



SOW 6700 for Agreement to install a root barrier for Crawford and Company

Date

January 5, 2024

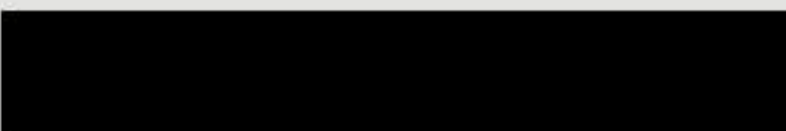
Services Performed By:

Optera Structural Solutions
The Barn, Oxburgh, Fosse Way,
Stretton on Dunsmore. CV23 9JF
tel: 02476 553776 fax: 08447 746370

Services Performed For:

Crawford and Company
First Floor, Cassiobury House,
11-19 Station Road,
Watford, WD17 1AP

POLICY HOLDER:



POLICY HOLDER ADDRESS:



CLIENT REFERENCE:

SU2005303

OUR REFERENCE:

6700

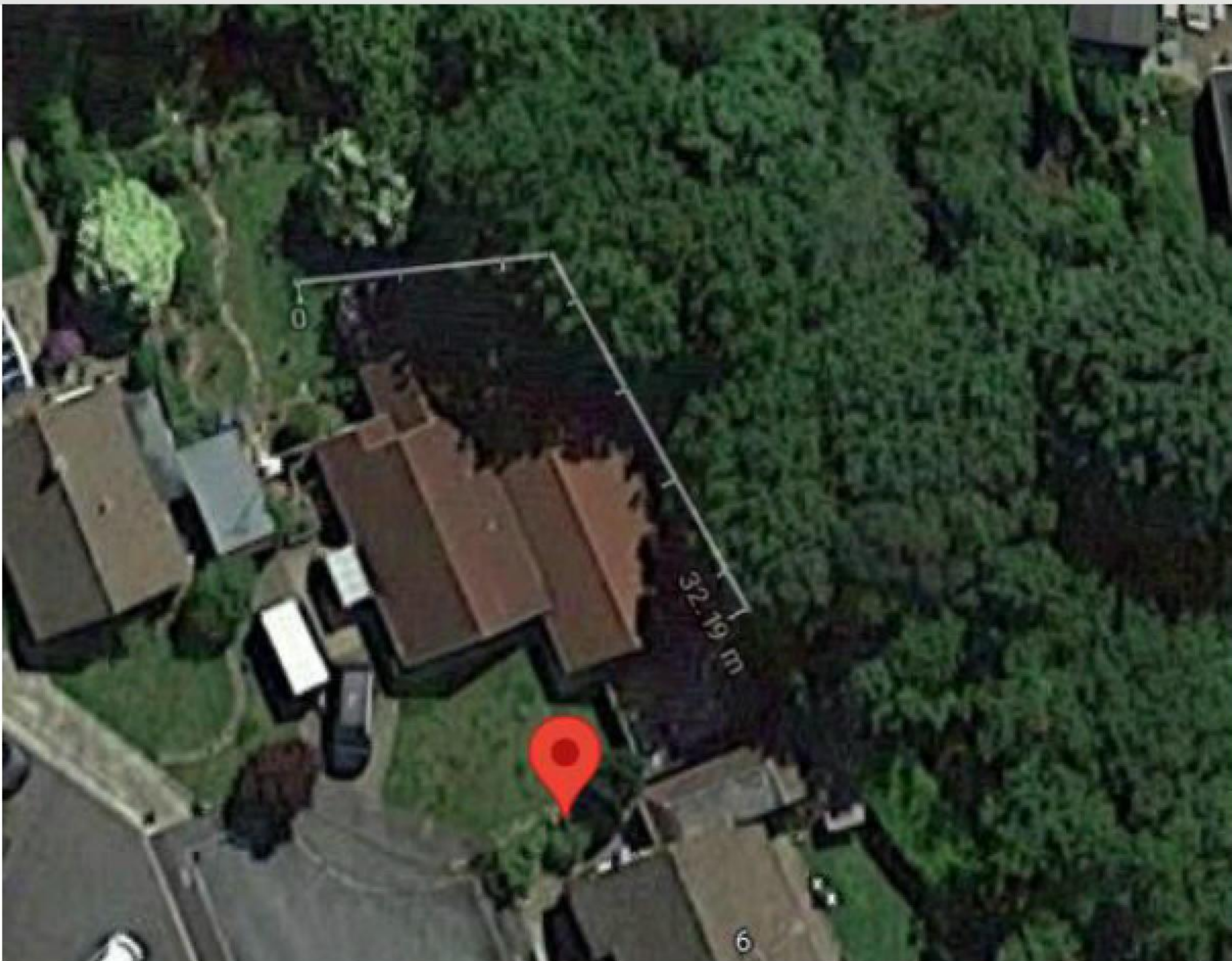
ANTICIPATED START DATE:

TBC

QUOTE VALUE:

PROJECT MANAGER:

Spencer Caizley



Aerial plan indicating proposed size and alignment of barrier

Report

Optera have been asked to refresh a previously supplied quote for the provision of a root barrier. The quote is based upon the previously supplied information with the only changing parameter being the updated level monitoring which shows considerable movement about the rear extension which has always been the focus of the claim. . The quote includes all activities relating to the installation of a copper impregnated bio-barrier. The works are subject to a detailed site inspection and are based upon our initial desktop assessment of the information supplied to us by the client. We understand that damage is primarily centred around the rear extension which forms the kitchen.

Property Details

The property is a single storey detached bungalow of traditional construction with assumed cavity brick walls surmounted by a pitched tiled roof. The property has been extended to the rear prior to the insureds occupation of the property in circa 1991 and the kitchen is situated within the rear extension. Alterations in 2018 included an extension to the right hand side on a piled raft foundation which remains unaffected by the recent movement.



Front elevation of property.

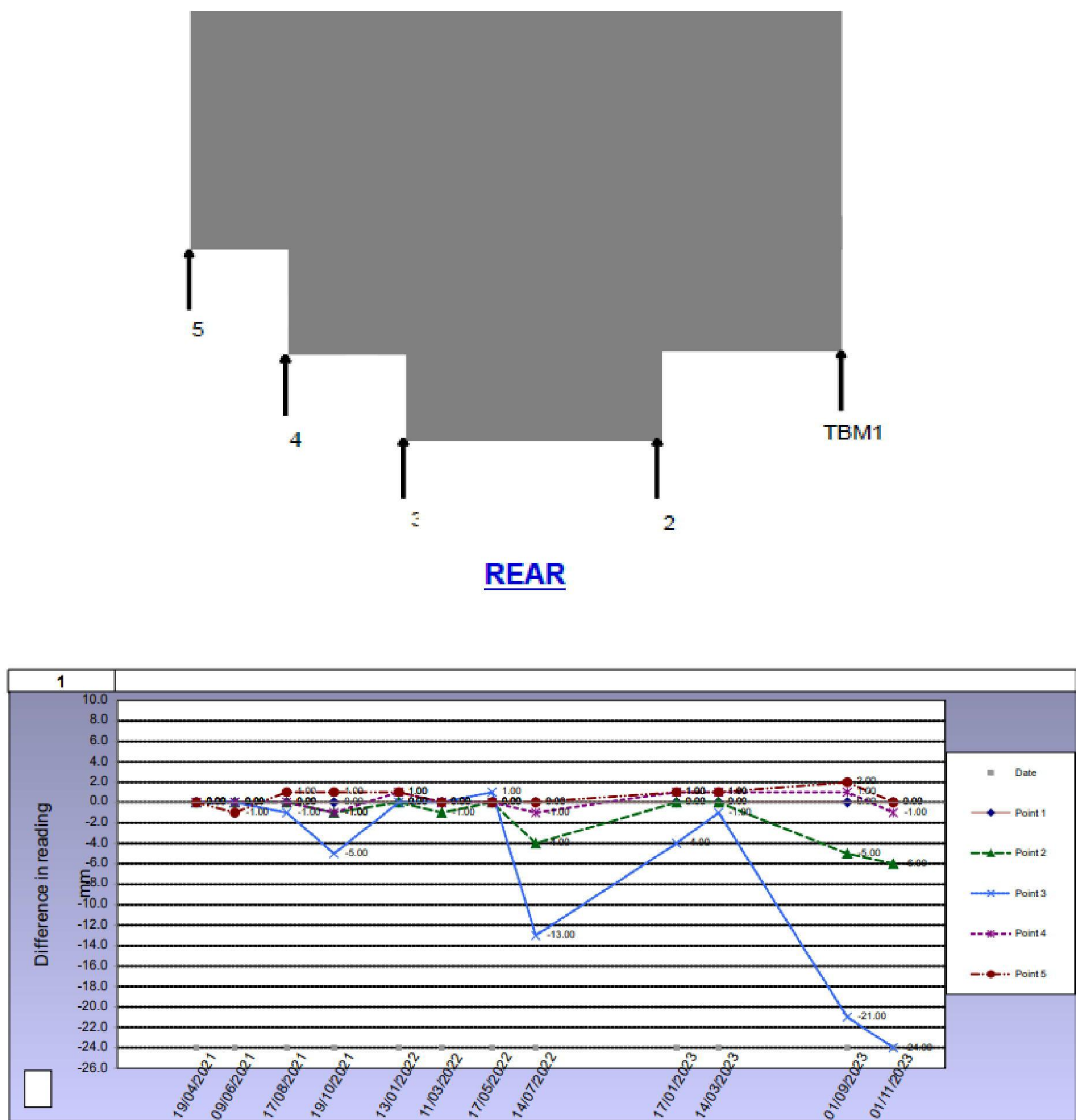
Site Investigation Results

The site investigations supplied to us by CET, dated 26/01/2021 indicate the property is founded on a 400mm thick, concrete strip footing, bearing on to a firm, orange, brown silty CLAY at 900mm below ground level. The exact depth is questionable as the SI appears to have taken an elevated decking as ground level and we suspect the footings are in fact on 600mm below ground level. Roots of live appearance were recovered from below the

footings to 2m BGL. These were subsequently identified under microscope as belonging to oak trees. The soils were tested in the laboratory and determined to be of changeable plasticity although elements were identified as intermediate to high, confirming the volumetric vulnerability of soils below the foundation.

Level monitoring Results

The level monitoring indicates a cyclical pattern of movement which shows both downwards movement during the drier summer months; when trees are in leaf and actively demanding moisture from the ground; and subsequent recovery and upward movement during the wetter winter months when the trees lose leaf and become dormant. Patterns of movement such as those observed at the risk address are consistent with clay shrinkage subsidence and are only consistent with the effects of shrinking and swelling of clay soils exacerbated by the presence of roots.

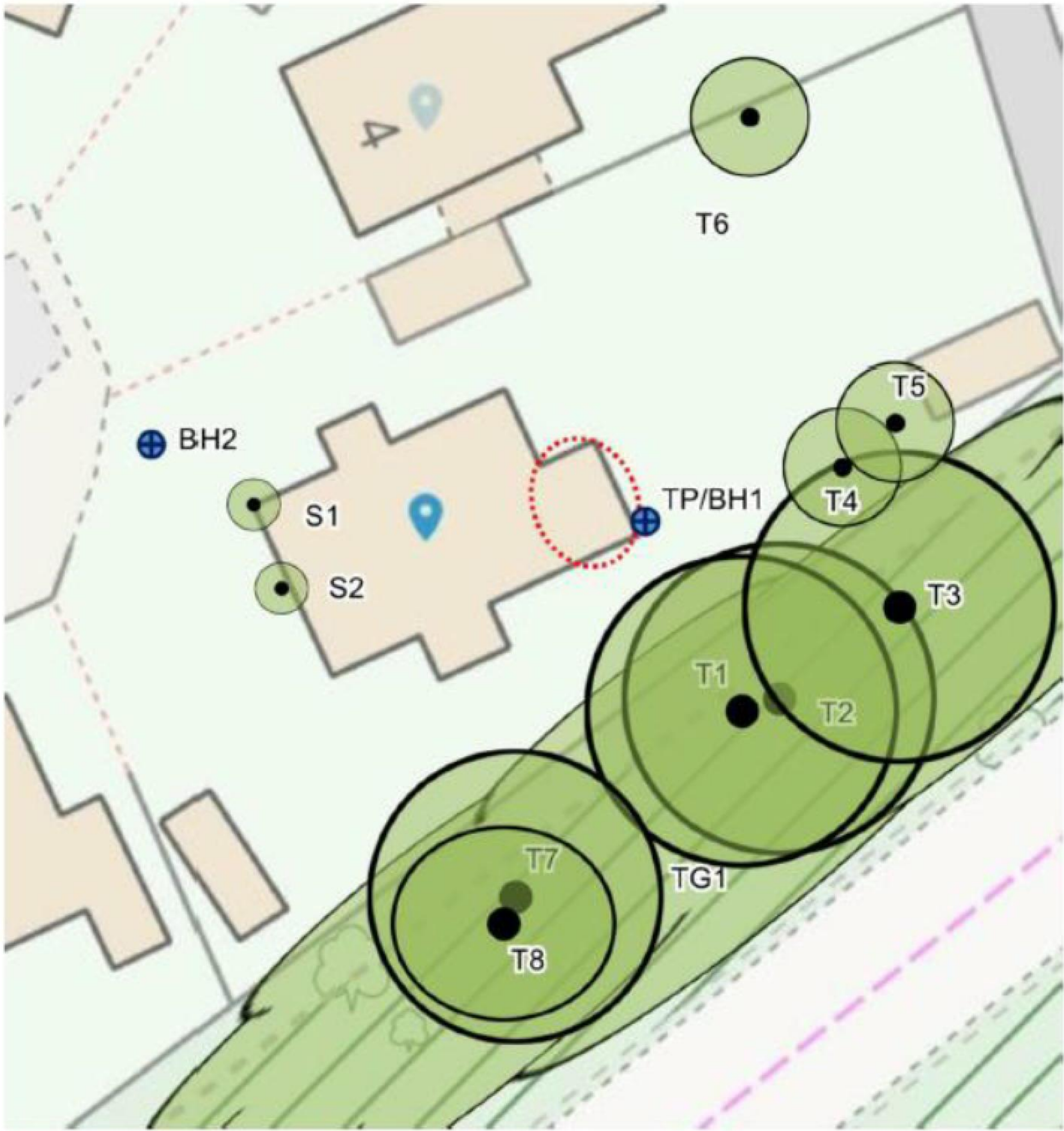


Our concern remains that the level monitoring seems to use a datum on the front of the property and we note movement is widespread across the rear. Whilst there is potentially more influence at the back, there remains considerable vegetation at the front and if the datum is moving, this will dampen the true readings witnessed at the property.

Arboricultural Recommendations

The arborists report recommends T1, T2 and T3 be removed to mitigate the current issues. We understand that attempts to carry out the mitigation have been unsuccessful and insurers are looking at alternative methods of abating the nuisance. The trees in question form a much bigger group of trees and the trees in question, whilst owned by the local town council, are protected with TPOs.

Whilst roots were identified as oak, the density of planting may mean that adjacent trees share root systems and felling those implicated may not have the desired effect of abating further moisture extraction. The piled extension, whilst close, remains unaffected due to the depth of the footings, but equally does nothing to prevent root ingress to the area of concern. The site plan overleaf indicates the size and position of the trees, relative to the affected extension.



Arborists Site plan

Tree Root barriers Explained in Brief

The current issues arise from the presence of tree roots which have grown into the clay soils directly below the foundation of the property. To abate the nuisance, it is prudent to either fell the tree in question or sever the roots between the tree and the property and provide protection against further growth.

Optera install a copper impregnated geotextile barrier. This is typically installed with a small excavator measuring no more than 2m in width. A trench is formed with the excavator and the arisings stored to one side of the trench. The barrier is typically formed in 5m lengths. Once the first 5m of the trench is excavated, we will bund the leading edge with sheet piles and line the trench with the copper impregnated bio-barrier, before backfilling with 20mm angular stone as we are so close to the property. . The backfilled spoil will be placed in a stockpile at the front of the driveway and collected by grab lorry.

The process is then repeated until all of the barrier is installed. The top 200mm will be filled with compacted type 1 MOT stone so as not leave any trip hazards but further reinstatement works will be necessary in the form of tarmac to the drive and potentially a concrete path down the side of the house. At the rear, where the barrier is formed through the grass area, the trench will be topped up with topsoil and grass seed applied to promote re-growth.

Any excess spoil will be cleared from site along with the plant, welfare, and protections. The area will be left tidy on completion.

The location of the barrier is targeted at the roots between the tree and the foundations, and the act of excavation will sever them, causing the roots under the foundation to wither and die. The absence of water demand from the clay below the footings will allow it to rehydrate and swell. Whilst a period of recovery is anticipated, repairs can be typically undertaken shortly after the installation is complete. We note from the photos supplied that there is a raised decking to the rear which appears to wrap around the rear right hand corner. It is unclear if this needs to be taken down and reinstated to facilitate the works, but it is assumed that any enabling works in this regard will be undertaken by others. Equally, we cannot assess the gap down the right hand side of the property but assume it is more than 2.5m for the purpose of the quote and that any removal and reinstatement of fences to facilitate the works will be undertaken by others. We can provide a quote for any additional enabling and reinstatement once a site visit is conducted, should insures wish to pursue the works.

Method Statement

It is assumed for the purpose of the quote that the site will be secured by others and any hard landscaping lifted and set aside for reinstatement on conclusion of our works. The quote is based on soft ground excavation and any additional hard break out will be charged over and above the works proposed.

The proposed works will comprise the following:

- Set up site, including compound area to be agreed with the client. This will be boarded, protected and secured with site fencing.
- The barrier will be marked out on the ground and the area CAT scanned prior to mechanical excavation. Any detected services are to be hand excavated and exposed prior to machine excavation.
- A trench, 300mm wide will be formed to a depth 3.5m , 1500mm past the last detected root in the information we have been supplied.

- Once the first 5m of trench has been formed, we will bund the leading edge of the excavation with sheet piles and line the trench with the copper impregnated bio-barrier.
- The trench will be filled with as dug arisings to within 200mm of the surface and opalced and compacted in layers using a specialist compactor attachment to the excavator.
- The next section of trench will be formed, and the process repeated, until all of the barrier has been excavated and installed.
- Once the barrier is installed and complete, we will top up any excavations to the surface with compacted clean graded topsoil and seed the trench line to promote grass growth.
- All fencing, welfare and plant will be off hired and cleared from site and the area left tidy on completion.

Proposed Plan of Works for 6700

START DATE: TBC

COMPLETION DATE: 3 weeks after commencement.

Assumptions

- It is assumed that the excavations will be undertaken in virginal ground with no allowance for trench support or additional protections.
- It is assumed that the trench will be formed through clay soil which is readily excavated with the plant prescribed and no additional mechanical breaking is necessary.
- No allowance has been made for diversion of removal and reinstatement of existing utilities.
- No allowance has been made for the removal or reinstatement of hard landscaping, fencing, gates and access apparatus or plants and shrubs which may be affected by the works. Should our clients require this service, we can provide additional costs accordingly.

Carbon savings and green credentials

The installation of a copper impregnated geotextile fabric is the most carbon neutral option available to the insurance repair marketplace. The average tree absorbs 21 kg of CO₂ per annum based upon a mature species. Felling trees releases carbon and replanting saplings takes many tens if not hundreds of years to offset the effect of felling the original species.

Traditional engineering solutions consume vast quantities of carbon, both in their execution with plant, spoil to landfill and the vehicle movements to and from site. In addition, the manufacture of concrete generates in the region of 72kg of CO₂ per ton and contributes 8% of all man made carbon output in the world today.

From Opteras own investigations and research, we estimate:

- The average underpinning scheme omits 12 tons of CO₂
- The average piled raft scheme omits 44 tons of CO₂
- PU injection treatment omits 3 tons of CO₂
- By contrast, a 10m root barrier omits just 1 ton of CO₂

Not only is the root barrier installation both less disruptive and much quicker to install then traditional engineered techniques, but it offers carbon savings of between 88 and 97%. And is still 66.667% more carbon friendly than the closest innovative competitor.

Warranty Details

All Optera whole life scheme designed barriers are issued with a 10 year company warranty, the details of which are seen below:



Warranty Note

Building Repair Warranty

Contractor	Optera Ltd.
Warranty Reference Number	xxxx
Supplier Registered Office Address	Seven Stars House, 1 Wheeler Road, Coventry, England, CV3 4LB
Supplier Company Number	07468088
Supplier Job Reference Number	xxxx
Commencement Date	xxxx
Expiry Date	xxxx
Homeowner's Name	xxxx
Location of Works	xxxxx
Description of works undertaken and Warranted the "Works"	Works completed pertaining to Optera's Statement of Work. Dated xxxxx

Signed for and on behalf of Optera Ltd:-

Name:	Spencer Caizley
Sign:	Spencer Caizley
Position:	Director
Date:	xxxxx

Warranty

The Contractor warrants that for a period of 10 years from the date of completion of the Works detailed above, the Works undertaken and/or the materials installed shall be free from defect. In the event of a failure, proven to be due to faulty workmanship by the Contractor, or materials supplied and installed by the Contractor, the Contractor will make or cause to be made, all repairs necessary to enable performance in accordance with this warranty

Any dispute as to whether any defect or failure is attributable to faulty or sub-standard workmanship or materials shall be referred to an arbitrator, who should be a suitably qualified and experienced Chartered Engineer, or Chartered Surveyor (i.e. a chartered civil, or structural engineer (MICE/IStructE), or a chartered building surveyor (RICS))

This warranty is specific to the location and Works as detailed above and is subject to the following qualifications and conditions:

Qualifications

The Homeowner acknowledges that the Contractor shall not be responsible for remediation of any of, or any combination of the following causes:

1. The cost of routine maintenance, overhaul or modifications or loss or damage arising therefrom, or for which compensation/recourse is provided by legislation such as the Consumer Credit Act 1974;
2. Any wilful acts or wilful omissions of the Homeowner or persons acting on their behalf
3. Any loss of use, any consequential or economic loss of any kind or description whatsoever including, but not limited to loss, costs, damages, expenses or penalties for any reason;
4. Any damage caused by war risks, sonic booms or nuclear radiations;
5. Any damage or defect caused by wear and tear, sunlight, normal deterioration, neglect in maintenance, any change in colour, texture, opacity or discolouration or staining or superficial deterioration or marring of finishings or surface appearance or aging process;
6. Any claims first notified outside the period of this warranty or any claims for any defects that the Homeowner should reasonably have been aware of any defects for which the Homeowner receives a discount/reduction in the cost of the Works;
7. The use of the Works for any purpose other than that for which they were originally intended and as stated in this document;
8. Any claim, loss or damage caused by or consequent upon a peril that can be insured under a Household or Commercial Buildings or Property Owners Insurance policy whether insured or not, other than in respect of subsidence, heave or landslip as a direct result of defective workmanship or materials in the Works herein warranted;
9. Placement, erection or construction of anything on or through the Works without the written permission of the contractor;
10. Any costs, losses, expenses or damages for death, bodily injury, disease, illness or injury to mental health;

11. Any abnormal use of the Works or the imposition of any load greater than that for which the Works were designed in whole or in part, structural alterations, repairs, modifications to the Works during the period of this warranty unless agreed in writing by the Contractor;
12. Any claim, loss, destruction or damage caused by pollution or contamination;
13. Any claim involving cosmetic cracking or blemishes that do not affect the performance of the Works;
14. Any claim, loss, destruction or damage due to defective design;
15. Any issues caused by the materials after expiry of the manufacturers product guarantee.

Conditions

- A. The Homeowner shall notify the Contractor in writing of any defect within 21 days of discovery and give the Contractor reasonable opportunity to inspect the alleged defect and the area affected. During such an inspection, the Contractor shall be permitted to take such notes, photographs and/or samples as he deems necessary
- B. In the event of a failure attributable to workmanship, the Contractor's sole responsibility shall be limited to the costs of making good such repairs as necessary to enable the Works to perform as originally warranted.
- C. Any work carried out to rectify any failure or deterioration covered by this warranty shall not extend the duration of this warranty.
- D. If an alleged failure or deterioration is proven to not be the responsibility of the Contractor, then all costs associated with the investigation of such failure shall be borne by the Homeowner.
- E. This warranty does not become valid or enforceable until such time as payment in full for the Works has been received by the Contractor.

Completion Criteria

Contractor shall have fulfilled its obligations when:

- Contractor accomplishes the Contractor activities described within this SOW
- The Policy Holder is in agreement that works have been carried out as per the agreed specification to an acceptable standard.
- Agreement that works have been carried out as per the agreed specification to an acceptable standard by the appropriate Engineer
- Site has been vacated and all plant and materials removed.

Project Variation Procedure

The following process will be followed if a change to this SOW or a Variation of works is required:

- A project variation request will be submitted to Crawford and Company. The variation must describe the change, the rationale for the change, and the effect the change will have on the project.
- The designated Technical Manager for OPTERA will review the proposed change and determine whether to submit the request to the other party.
- If variation works are agreed, works will be booked in at the request of the Crawford and Company engineer and OPTERA will seek formal approval via Crawford and Company.
- Upon completion of the variation works, these will be invoiced separately to the initial authorized project.

Intervention Explained

How do Copper Root Barriers 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 vegetation, 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.

A crack due to differential foundation movement occurring after a tree has reached maturity, there being no cracks up to that time, means it is probable that an exceptionally long dry spell has also had an influence. But cracks will recover when ground moisture contents recover and will not recur to any greater width in future. BRE Cracking in Buildings. The intention of the Bioroot shield is to mitigate against this periodically damaging

effect. The solution adopted in this case seeks to decrease water uptake by the trees thereby lessening subsidence risk by conserving soil moisture and reducing clay subsoil shrinkage. This aim is to achieve an impairment to root growth by the focused introduction of a proprietary Bioroot-shield that offers all the benefits of being both flexible and permeable. In addition it works as a biological repellent.

The Copper signal barrier details a cooper foil securely bonded between porous geotextile, releasing copper ions and forming copper carbonate (verdigris) that signals an adverse reaction to roots deflecting them away from the barrier. The presence of copper does not constitute an eco-system burden or impact on groundwater.



This solution is multipurpose and ideally suited to the current application. Traditional impervious barriers divert rather stop roots and may block moisture movement. Also, roots getting under such barriers can grow back to the surface. Therefore, the use of this permeable barrier stops roots either by engaging and constricting them or by chemically inhibiting them.

The benefits of such a shield are its dual protection both physical and biological. The multi layered sheets can be welded together whilst retaining its flexible qualities, i.e. can be cut and effectively resealed to fit round services and foundations, inert with a 50 year service life expectancy. Equally the solution inhibits root growth on the barrier face which is often problematic with conventional barriers where increased moisture levels can cause root growth to become more prolific on the face of a traditional barrier. Research has shown that the use of the recommended style of copper based screening has greatly reduced the effects of root growth when compared to other traditional physical barrier installations

Following the installation of the shield the trench will be backfilled and compacted mechanically with 20mm single sized stone.. Alternatively dependent upon site conditions backfill using lean mix concrete will utilised on the structure side of the shield. On occasions some natural settlement is anticipated following completion. In all instances the project envisages a return visit to the property to effect any required maintenance of the surface of the reinstatement routinely programmed within 6 months following completion of the installation.

Specification of Barrier.					
Barrier Type	length	Max Root Depth	Minimum depth to be achieved with barrier	Distance between tree / Vegetation and barrier	shortest distance between barrier and foundation
Copper	32	20.m	3.5m	2m	8m