PARTIAL REPORT FOR MARKETTING PURPOSES - SOME PHOTOGRAPHS AND OTHER SECTIONS REMOVED FOR CLIENT PRIVACY /CONFIDENTIALITY ETC

S J Johnson Associates Ltd
Chartered Structural Engineers
Carlton House, Battledown Drive
Cheltenham, Gloucestershire
GL52 6RX
M: 07475 644468
W: www.rapidcalcs.com

STRUCTURAL APPRAISAL / REPORT IN CONNECTION WITH REPORTED POSSIBLE SUBSIDENCE DEFECTS

[redacted]

GLOUCESTER

20-05-[redacted]

PRELIMINARIES

Recent cracking has been advised at the property leading the owner to instruct a report to determine the likely causative factors. To assist the desk study / preparation for this survey / report, an earlier structural engineers report dated 2005 was supplied, along with current proposals for a form of chemical injection under pinning.

As with the earlier 2005 report descriptions within this report consider the building as oriented when looking from the front unless noted otherwise.

The partially intrusive survey upon which this report is based was undertaken on the morning of Friday May 15th [redacted], from approximately 09:30 to 13:30PM. Conditions where clear and dry throughout the survey as they had been for the previous few days. Temperatures were typical for the time of year circa 15-18 degrees. The survey was primarily undertaken to consider localised cracking in the south gable and RH 1st floor room that has been advised as manifesting over the last eighteen months. Particular attention was also given to the two front gables owing to comments in the earlier report and the current prescription to underpin them.

SYNOPSIS

Having completed the desk study, the following items where considered possibly relevant and of interest with regard to causation.

1.0 FRONT WALL - INTERNAL & EXTERNAL (FW)
2.0 NORTH AND REAR WALLS - EXTERNAL (NR)
3.0 INTERNAL WALLS FRONT BEDROOM (RH-BRM)
4.0 SOUTH GABLE EXTERNAL – (SG)
5.0 TRIAL PIT (TP)
6.0 TREES (T)
7.0 DRAINAGE (DR)
8.0 DAMP READINGS (D)

The findings for each item will be briefly discussed below, making reference to the similarly numbered photographic record contained at the end of this report. Conclusions will be stated thereafter.

This report and its findings follow one partially intrusive survey visit, where opening up was limited to the RH gable footing and the RH bed room floor as pictured.

Following the summary findings, a brief commentary is provided for each area of interest investigated during the survey. Following that is the photographic record with captions where appropriate / significant. These provide a brief description with the photograph of the defect observed.

It is noted that this property exhibits wear and tear and many minor decorative cracks that one would normally associate with a property of this age (circa 1890's). This report however will focus on cracks in the area requested and that are considered structurally significant to the issue at hand. The descriptions used in this report used to describe the severity of the cracking will be the standard descriptions provided by Tomlinson, Driscoll and Burland repeated on the following page. It is further noted and should be appreciated that the crack width is only a part measure of the degree

and significance of any damage and this will be elaborated on as required.

Table 2.3 Classification of visible damage to walls with particular reference to ease of repair of plaster and brickwork or masonry (after Tomlinson, Driscoll, and Burland[2.18])

Category of damage	*Degree of damage*	*Description of typical damage*[1] *(ease of repair is underlined)*	*Approximate crack width*[2] mm
		Hairline cracks of less than about 0.1 mm width are classed as negligible	≯0.1
1	Very slight	*Fine cracks which can easily be treated during normal decoration.* Perhaps isolated slight fracturing in building. Cracks rarely visible in external brickwork	≯1.0
2	Slight	*Cracks easily filled. Redecoration probably required. Recurrent cracks can be masked by suitable linings.* Cracks not necessarily visible externally; *some external repointing may be required to ensure weather-tightness.* Doors and windows may stick slightly	≯5.0
3	Moderate	*The cracks require some opening up and can be patched by a mason. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.* Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired	5 to 15 (or a number of cracks ≯3.0)
4	Severe	*Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.* Window and door frames distorted, floor sloping noticeably.[3] Walls leaning[3] or bulging noticeably, some loss of bearing in beams. Service pipes disrupted	15 to 25 but also depends on number of cracks
5	Very severe	*This requires a major repair job involving partial or complete rebuilding.* Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability	usually >25 but depends on number of cracks

1 It must be emphasized that in assessing the degree of damage account must be taken of the location in the building or structure where it occurs, and also of the function of the building or structure.
2 Crack width is one factor in assessing degree of damage and should not be used on its own as direct measure of it.
3 Local deviations of slope, from the horizontal or vertical, of more than 1/100 will normally be clearly visible. Overall deviations in excess of 1/150 are undesirable.

(CLASSIFICATION) OF VISIBLE DAMAGE TAKEN FROM TOMLINSON – FOUNDATION DESIGNER AND CONSTRUCTION REF [1]

SUMMARY CONCLUSIONS

With reference to the following sections, I conclude as follows;
Section 1 – Movement within the front wall and bays likely to be historic, however the RH bay is at risk of subsidence from foliage on the adjacent boundary if left to grow unabated.
Section 2 – North wall, no direct access, therefore no defects observable.
Section 3 – Cracking starting in the wc and adjacent 1st floor LH bedroom likely to be secondary to subsidence to that observed at the south gable discussed in section 4.
Section 4 – Cracking at the south gable wall likely due to dessication subsidence from what is thought to be a Plumb Cherry. Assessment of likely required underpinning depth relayed in body of report.
Section 5 – Bay footings extremely shallow as expected for such properties leaving them at risk of subsidence from seasonal movement on clay like shrinkable soils.
Section 6 – Further to issues on the south gable, it is felt that the rear kitchen annex is likely to be shortly at risk of subsidence from the Lawson Cypress trees. Assessment of likely required underpinning depth relayed in body of report.
Section 7 – Drainage requires attention / clearance as discussed, but not felt to be the source of the cracking in sections 3-4.
Section 8 – Damp readings generally good.

Without the controlled removal or pollarding of trees, It would appear necessary to underpin the south gable as an absolute minimum this based on current observable defects. Further uncontrolled growth of the trees discussed are likely to put the RH-front bay and rear kitchen annex at risk of future subsidence.

As it is likely that both bays are on similar depth footings it might be prudent to underpin both bays and the linking front wall between them.

Concerning the rear annex, controlled removal or pollarding of the Lawson Cypress is advised to avoid potentially immanent subsidence to this area.

It is noted that in addition to the primary masonry cracking that there are other possible subsidence related dilapidations manifesting. These being at the south gable ridge verge and the flashing over the RH – bay, photos SG-02 and FW-38 respectively. Access was not available to the roof space, however in quantifying any related damage I would recommend an inspection of the roof.

With regard to underpinning methods, detailed consideration needs to be given to the amount of clay present within the substrata. As injection methods, it is understood become impractical in clayey soils. Should this be found to be the case, traditional staged underpinning is recommended.

1.0 FRONT WALL AND ITS GABLES – INTERNAL AND EXTERNAL.
Records of leaning of the front and rear walls in the structural engineers report dated 2005, and the recent proposal to underpin both bays by [redacted], required a study of this area of the property. Investigations did demonstrate some leaning, most significantly 3.1 degrees across the right hand bay **(Photos FW-11-12)** There was also evidence of local vertical lean in the full height walls of some 1.3 degrees and 0.7 degrees **(Photo's 25 and 26 respectively)**, and also of at the front of the bays of 0.4 degrees and 2.1 degrees **(Photo's 24 and 27 respectively)**. This leaning can be clearly seen and measured, with wider observations leading me to believe that this is old and not active at this time, also not currently of a magnitude to be of concern. This opinion being based on the rule of thumb that lean is only of concern when it exceeds one sixth of the wall thickness over the walls height. Observations from the side do not appear to show such full height projection. Therefore measured local vertical leaning is more likely to be attributable to building tolerance. However the lean across the RH-bay is most likely attributable to historic settlement occurring shortly after its construction most likely due to shallow foundations.

As above recorded leaning / movement is considered historic and not currently active, with cracking current only **(VERY SLIGHT) – Photo FW-06** being representative of current cracking within the bays. This situation though may change if nearby planting issues are not addressed as described later.

2.0 EXTERNAL NORTH GABLE AND REAR WALLS.
The North wall was not easily accessible, and had to be observed at distance by leaning over the party fence **(Ref photo NR-01)**. It was not therefore possible to observe any specific defects. However damp measurements discussed later appear to show past remediation works here which included provision of a concrete ground floor slab in this area have been successful.

Concerning the rear walls, **(Ref photo's NR2-3)** no other defects other than those attributable to wear and tear synonymous with a property of this age were observed.

3.0 INTERNAL WALLS FRONT BEDROOM.
Ref Photo **RH-BRM-01**, Loss of 1st floor diaphragm was investigated with six joists exposed as pictured. All appeared robust as they entered the wall, with no signs of rot observable.

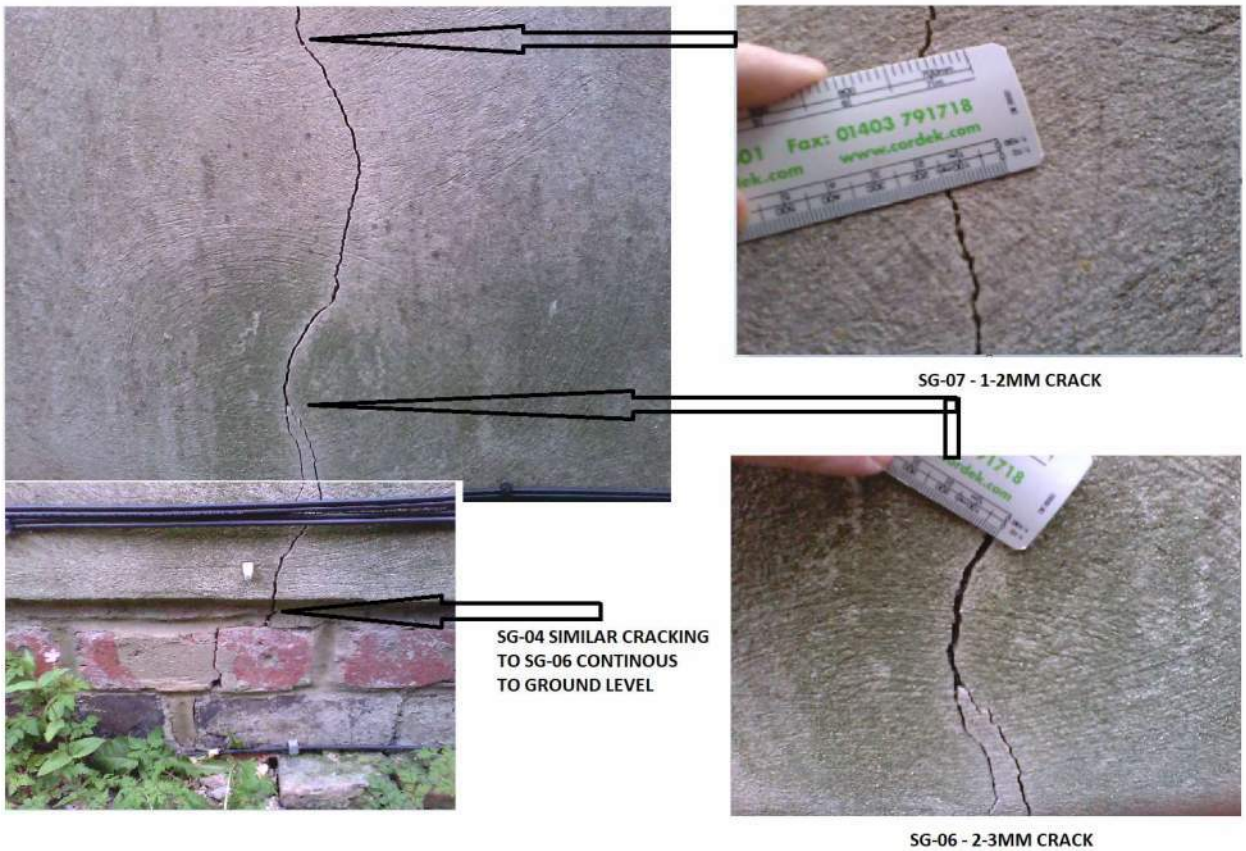
Ref Photo's RH-BRM-02-03 a crack has manifested under the RH side of the window looking outwards. The crack propagates from skirting board level to a current maximum aperture of some 4mm – classification therefore currently **(SLIGHT)**. **Ref Photo FW-38**, the action of the internal cracking being reflected in part in the more ductile lime mortared outside face. Current symptoms being, a rotation of the Sill and a possibly related tear in the flashing.

Ref Photos RH-BRM-04-11, a significant length of cracking has manifested in recent times. Commencing in the adjacent WC **Photo(04)**, then tracking through the landing **photos(05-06)**, re-emerging in the RH Bedroom and tracking up currently from the light switch area to ceiling level. Cracking widens to 6mm here, and to a similar **(MODERATE)** severity in the landing area. After reaching the bedroom ceiling ref **photos (07-11)** the crack appears to continue as a shear crack synonymous of the ceiling sliding relative to the walls, this cracking continuing in a clockwise manner around the ceiling, around the gables chimney breast and terminating in the front wall above the cracking at the window discussed above, **Ref Photo's RH-BRM-02-03.**

Based on the observations above, it is my view that the movement and cracking discussed here at this time is attributable to subsidence settlement at the southern gable, which will be discussed next.

4.0 SOUTH GABLE EXTERNAL

Ref Photos SG-04-07, collated below over the wider view of **SG03** for clarity, it can be seen that a crack has manifested, appearing from external ground level currently **(SLIGHT)** at 3mm, narrowing to 1-2mm as it progresses up the gable wall.



It is my view at this time, that this cracking is the result of settlement due to dessication subsidence caused by the foliage at the boundary, most likely with primacy attributable to the plumb cherry detailed later.

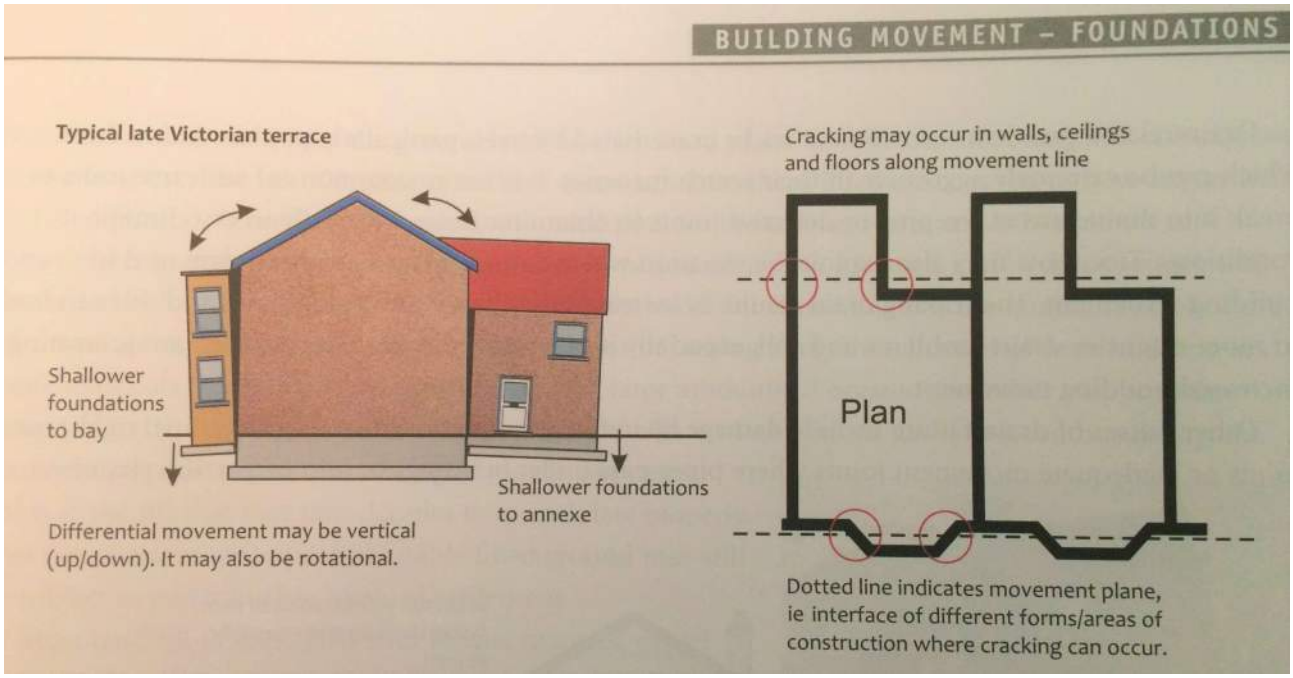
Other notable defects are a loss of mortar at the ridge/verge, which may also be attributable to this settlement – as shown in **photo SG-02.**

5.0 TRIAL PIT.

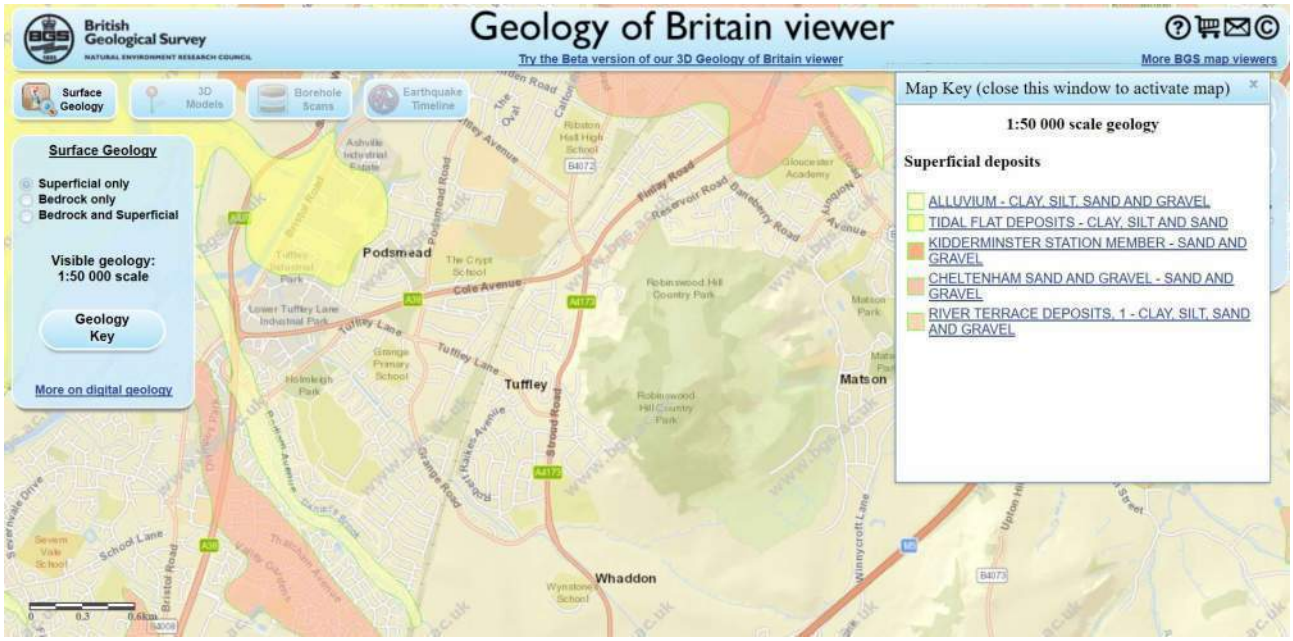
Ref photos TP-01-07, a trial pit was dug to formation which exposed the RH-bays footing depth as expected for this age of property at approximately 6.5 inches below external ground level. Such shallow footings are known to cause lean as discussed above and pictured below **Ref[2]**, findings remain as above.

Arisings from the excavation showed at first sandy clay **(Ref TP-02)**, becoming more consistent lumpy clay at approximately 300mm depth **(Ref TP-03 & 06)**. This was as expected, with British Geological Survey Mapping **Ref[3]**showing superficial deposits of clay, silts, sands and gravels as repeated below, with the bedrock map (not shown) relaying Lias and Mudstone at depth.

With this in mind, it posses the question if the clay content might affect the ability to utilise an injection under pinning system? It is recommended that if this route is to be considered that appropriate testing and review of soil type is undertaken, and confirmed as acceptable by the supplier.



Lean often caused by shallow bay footings – Ref [2] Understanding Building Defects by Marshall / Worthing / Heath.



Superficial geology – Ref BGS [3]

6.0 TREES

Tree species have been assessed from **photos T1, 2, 4 & 5** using the Woodland Trust App. **Ref[5]**

There are currently two specific trees identified by this survey, that by recognised assessment methods in this case (NHBC Chapter 4 – APP) **Ref[4]**, can be demonstrated of being capable of producing detrimental subsidence effects. Due to the extremely over grown nature of the foliage on the other side of the party fence line, there may be other species of significance.

LAWSON CYPRESS

Ref photos T1-3, at least 3no 8m tall - Lawson Cypress are present the first being at a 9m offset from the kitchen. Assuming high plasticity clays (until tests prove otherwise), these trees at their current height require a footing depth of 1.37m **(photo T3)** to avoid affect. It is likely with reference to Marshall / Worthing / Heath above, NHBC **Figure 6** [4] below and the elevation of these trees, that the kitchen annex is on the point of experiencing subsidence from these tress alone, not diminishing the effects of other planting on the neighbours side of the boundary.

Figure 6 Levels from which foundation depths are measured where trees or hedgerows are removed

Use the lower of:
a: foundation depth based on appropriate tree height (see Figure 8)
b: minimum foundation depth (see Table 8)

PLUMB CHERRY

Ref photos T4-6, at least 1no 4m tall – Plumb Cherry has been identified 2m away from the South Gable cracking discussed above in section 4 **Ref Photos SG-04-06.** Assuming high plasticity clays (until tests prove otherwise), this tree(s) at current height require a footing depth of 2.04m to avoid affect. Similar Orchard Cherry used in the NHBC App **(Ref photo T6),** as Plumb Cherry not in NHBC App Register.

It is likely, due to the current slight nature of cracking currently observed that clay plasticity might not be high. Therefore to limit the amount of underpinning, it is recommended to have a laboratory test this.

To conclude this section, it is apparent based on the findings that at least the RH-Bay and South Gable require under pinning for protection against subsidence from un controlled planting immediately adjacent on the other side of the party fence.

It is also likely (as formation not exposed by trial pitting) that the rear kitchen annex is becoming at risk of subsidence from the Lawson Cypress should they be allowed to increase in height.

7.0 DRAINS

From **photographic record DR1-5** it is apparent that the drains require some attention at least generally to remove foliage and ensure they are not blocked.
No signs of leaks were found during the visit, however the visit followed what has been a dry spell of many days.

It is apparent from Photo **DR-5** that the drain on the South Gable appears blocked and I would recommend that this is addressed. However with nearby cracks narrowing as they progress up this wall, as described and shown in section 4. It seems that the current issue is one of tree dessication and settlement rather than excess water and heave associated with leaking drains.

8.0 DAMP

As can be seen in section 8 of the photographic record, many readings for damp were taken in and around the property. Generally these showed good results - "GREEN – NORMAL -LVL 0-3 NO ACTION", indicating at the locations tested that the injection damp proofing appears to still be functioning well. It was notable however in the LH Front room where the replacement concrete ground floor slab has been previously added, that damp readings were not so good. **Ref photos D2-3** upon initial insertion of the probe - "RED – ACTION LVL 7-10" readings were recorded. However this quickly fell off to -"ORANGE-ATTENTION LVL 3-7" by the time the camera was ready – possibly indicating damp caused by inadequate air circulation rather than other sources.

Based on the readings taken to date it is likely that provision of adequate ventilation/circulation would address the damp issues discussed above. Upon discussing this the owner has advised that there is such a system that is utilised when the property is let.

By Steve Johnson CEng MIStructE Beng Hons
Reg No. 024460435
20-05-2020

References

1. Foundation Design and Construction - 5th Edition MJ Tomlinson 1986 ISBN 0-582-28642-5
2. Understanding Building Defects by Marshall / Worthing / Heath. ISBN 9-780728-205567
3. British Geological Survey Mapping http://mapapps.bgs.ac.uk/geologyofbritain/home.html
4. NHBC Chapter 4.2 Building near trees and NHBC Foundation depth calculator App.
5. Woodland Trust Tree Identification App.

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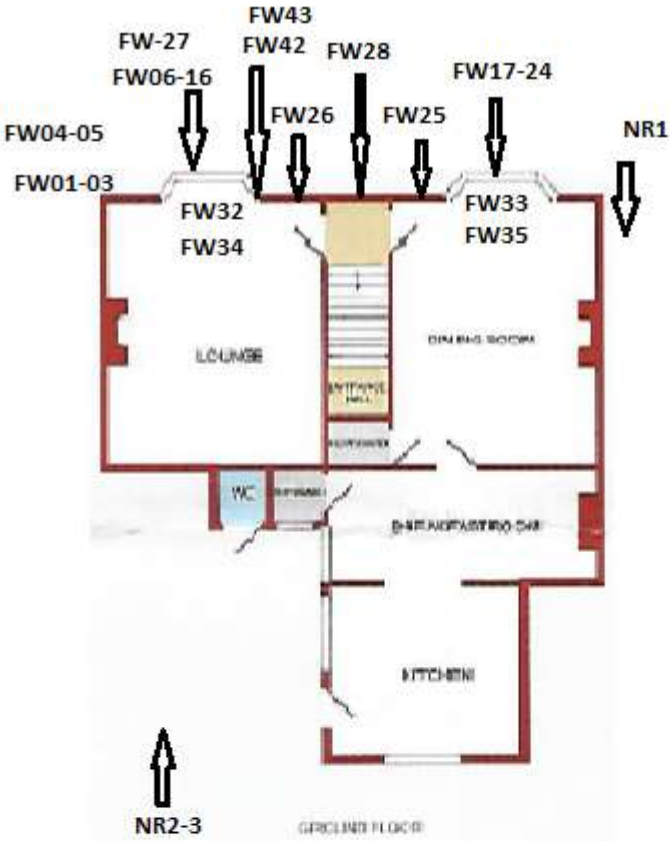
PHOTOGRAPHIC RECORD
(With caption commentary where appropriate)

SECTIONS

1.0 FRONT WALL - INTERNAL & EXTERNAL (FW)
2.0 NORTH AND REAR WALLS - EXTERNAL (NR)
3.0 INTERNAL WALLS FRONT BEDROOM (RH-BRM)
4.0 SOUTH GABLE EXTERNAL – (SG)
5.0 TRIAL PIT (TP)
6.0 TREES (T)
7.0 DRAINAGE (DR)
8.0 DAMP READINGS (D)

1.0 FRONT WALL - INTERNAL & EXTERNAL (FW)



WALL AND BAY PHOTO PLAN AS SHOWN

FW-12

3.0 INTERNAL WALLS FRONT BEDROOM (RH-BRM)

RIGHT HAND BEDROOM
PICTURE PLAN ALL
PHOTOS HAVE PREFIX
RHBR IN REPORT

RH-BRM-01 - JOIST ENDS EXPOSED ALL SIX INSPECTED SHOWING NO SIGNS OF DETERIORATION AT THE ENDS AS THEY ENTERED THE FRONT WALL, DIAPHRAGM APPEARS SATISFACTORILY FOR BUILDING CONSTRUCTION ERA.

4.0 SOUTH GABLE EXTERNAL – (SG)

SG-07 CRACK SHOWN IN PHOTO SG-03 CIRCA 1-2mm HIGHER LEVEL

5.0 TRIAL PIT (TP)

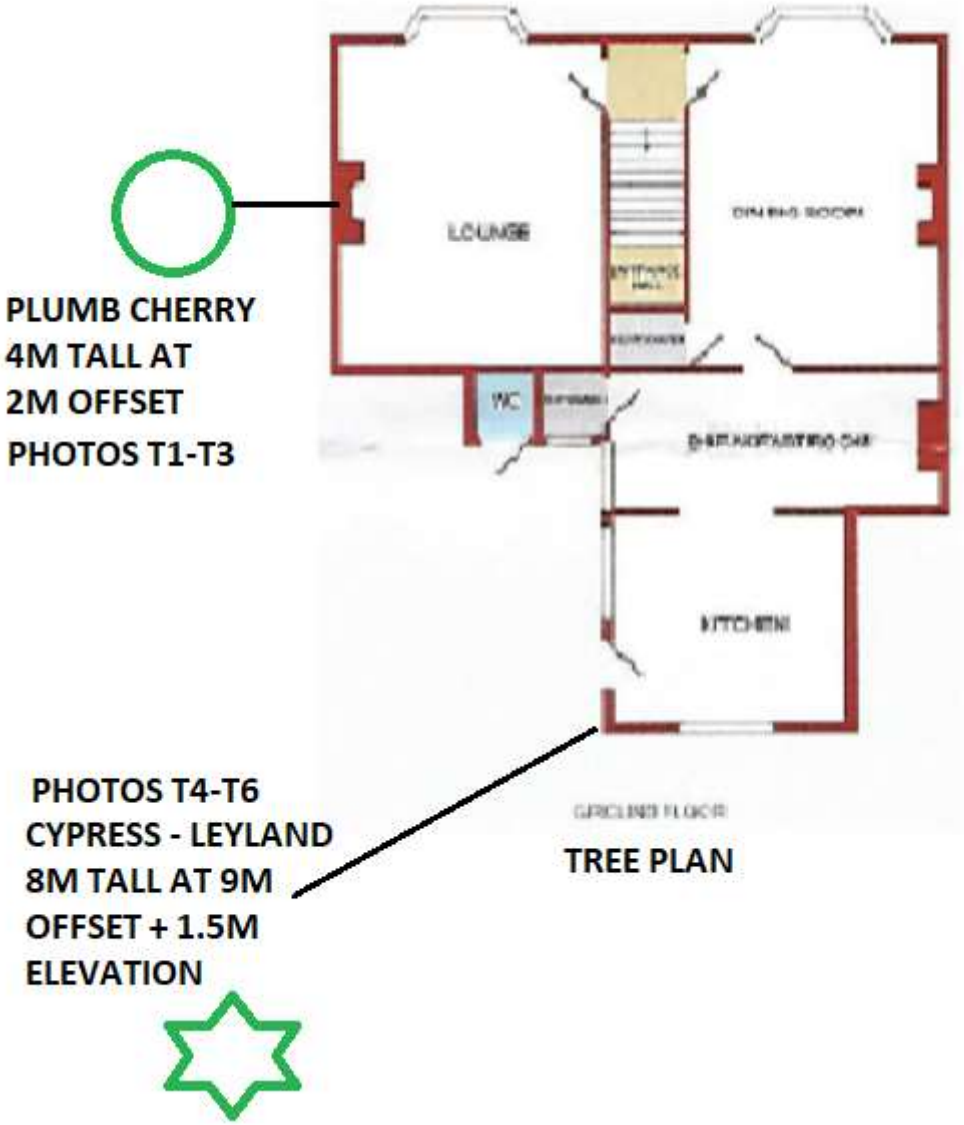
TRIAL PIT PHOTOS

PLAN TP1-7

TP-03 MORE LUMPIER CONSISTANT CLAY AT APPROX 300mm

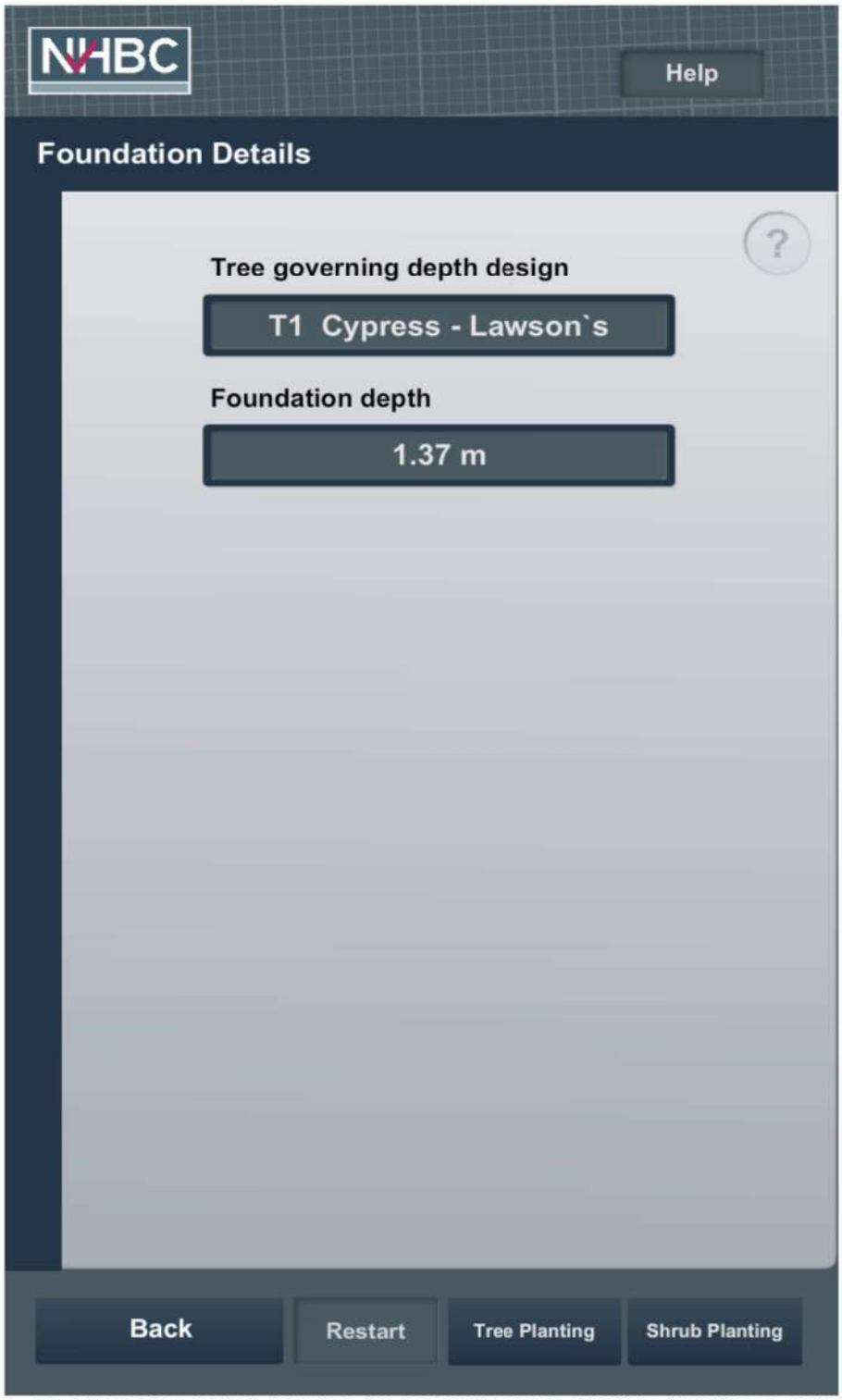
TP-4 FOOTING FLARES OUT AT APPROX 7 INCHES - SCREW DRIVER INSERTED BELOW DEFINING FORMATION AT 8 INCHES

6.0 TREES (T)


PLUMB CHERRY
4M TALL AT
2M OFFSET
PHOTOS T1-T3
LOUNGE
WC
KITCHEN
PHOTOS T4-T6
CYPRESS - LEYLAND
8M TALL AT 9M
OFFSET + 1.5M
ELEVATION
TREE PLAN

T1 - LAWSON CYPRESS TO REAR CURRENTLY 8M TALL NEAREST AT 9M OFFSET AT +1.5M ELEVATION INCREASE

T2 - LAWSON CYPRESS - FRUITS FOR TREE ID



T3 – REQUIRED FOOTING DEPTH BY NHBC FOUNDATION DEPTH CALCULATOR APP – ASSUMMING high PLASTICITY - IGNORING ELEVATION INCREASE***

7.0 DRAINAGE (DR)

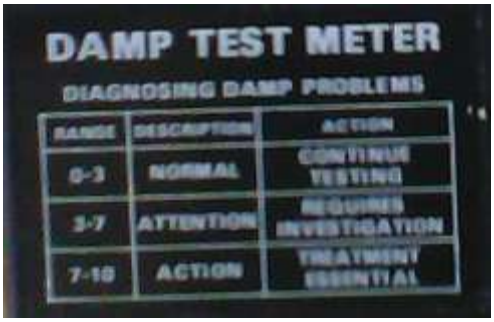
DRAINAGE PHOTOS
DR1-5

DR-5 - DRAIN ON SOUTHERN GABLE IMEDIATLEY ADJACENT TO PLUMB CHERRY, SHOWN TO BE BLOCKED UPON REMOVAL OF GRATE ETC

8.0 DAMP READINGS (D)

DAMP METER READS
PHOTO D1 TO D6

GREEN – NORMAL – 0-3
YELLOW – ATTENTION – 3-7
RED – ACTION - 7-10



DAMP TEST METER

DIAGNOSING DAMP PROBLEMS

RANGE	DESCRIPTION	ACTION
0-3	NORMAL	CONTINUE TESTING
3-7	ATTENTION	REQUIRES INVESTIGATION
7-10	ACTION	TREATMENT ESSENTIAL

D2 - LH BAY - INTERNAL RH CORNER