Dear James Remmington,

re: 2016/6742/T 31 Heath Hurst Road FRONT GARDEN: 1x Ash, 1x Sycamore, 1x Viburnum - Fell

Please accept and consider my objection to this Notice of Intent.

It is proposing to fell trees/shrubs which it blames for a sudden and considerable degree of subsidence, and states that "other possible causal factors have been discounted", with no evidence of any attempt to do this, and ignoring the signs of the actual possible causes.

It is my contention that the house is subsiding as a result of silt erosion from the underlying soil, likely to have been exacerbated by constrained groundwater diverted under the house by the recently dug foundations of the rear and side extension of number 33 Heath Hurst Road - the twin of this pair of semi-detached buildings.

There are several signs that this is so.

1) It is stated that tree roots were found under the bay window. Normally tree roots don't go under a dry house. This is a sign that there is water below the house and two culprits are likely:
   i) Ground water flowing within the 'Made Ground' below the house - which will also be 'Head', the layer of silt and sand found over the underlying soil from the Bagshot Sands and Claygate Beds of upper Hampstead, deposited there by solifluction (see https://www.newcivilengineer.com/soliflucted-clay/998851.article) during the last Ice Age, and also within the underlying soil which is Band D of the London Clay Formation (see description of its layers below). These layers can be less than a foot wide with sand partings containing water running through too, in some cases in Hampstead, under pressure. It is for this reason that Hampstead is the source of four of London's rivers. This water flow may or may not normally be continuous - there is huge variability across Hampstead - but its signs are present.
   ii) The drains: the only comment being that no *significant* defects were identified. No mention of the mains water or waste water drains owned by Thames Water outside the property has been made and one can assume Thames Water has not been asked to comment or to survey these drains.

   If the culprit is the drains then the tree roots have been caused to grow un-naturally by the water from the drains. The solution is to find the leak and fix it. In Hampstead mains water pipes and waste water drains are frequently breaking as their foundations are undermined by soil erosion, so frequent inspection is required. While Thames Water will fix cracked pipes and broken joints of the mains water supply, they do not check or repair broken sewer pipes unless required to.

2) It is stated in the Crawco Preliminary Report of 06.09.16 that clay shrinkage is responsible for the damage. In the Factual Report this shows that silty and very silty clay were found. Since silt particles are less than 0.425 mm across the proportion of silt is not determinable from this - only sand - but one isolated borehole in this laminated geology cannot determine this. No mention of silt is made in this report.

   In the Factual Report however it is stated that silt was found at 0.4m in Drain Run 2 MH1 to RWG1 Surface Water drain. This could indicate that silt is being washed out of the surrounding soil into the free/open volume of the drain if there are any cracks - we only know there is no *significant* damage.

3) While tree roots can cause volume changes in clay soils, several factors have to add up:

i) Vegetation-related ground movement has to be shown to be seasonal i.e. it goes down when the leaves are on the trees and goes up in winter. It can also vary according to rainfall. No movement studies have yet been presented.

ii) The degree of subsidence has to be related to the degree of soil desiccation hence a period of extremely dry weather would be expected to precipitate the movement.

Fact: The arboriculturalist gives no approximate ages of the trees, merely "Younger than property", but one can safely assume that the trees in the front garden, the street trees and the trees to the rear of the property - even in the garden of 23 Hampstead Hill Gardens - are all more than 20 years old, some considerably older even if not pre-existing the house built around 1900.

I contend that these trees are old enough to have proved that they have not caused subsidence during past episodes of drought much worse than the few months of reduced rain in the last 2 years.

Fact: The Met Office states (http://www.metoffice.gov.uk/climate/uk/interesting/2012-drought):

England and Wales drought 2010 to 2012

Much of central, eastern and southern England and Wales experienced a prolonged period of below average rainfall from 2010 to early 2012

The drought was due to a sequence of dry months from winter 2009/10 to March 2012, particularly in the spring, autumn and winter seasons. For England and Wales, this was one of the ten most significant droughts of one to two years duration in the last 100 years. Across southern England, the two-year period April 2010 to March 2012 was the equal-driest such two year period in records from 1910, shared with April 1995 to March 1997.

Why did this house not subside then, if this is vegetation-related subsidence?

Fact: Hampstead is fortunate to have a local weather station that can help identify the rainfall: http://nw3weather.co.uk/ This also compares rainfall with that of 30-year averages.

The historic weather of 2010 - http://nw3weather.co.uk/wxdataday.php?year=2010
2011 - http://nw3weather.co.uk/wxdataday.php?year=2011 etc

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	9.0	27.0	4.9	4.6	31.7	8.5	3.8	21.0	11.7	25.4	4.9	8.0
Total	56.1 (102%)	99.3 (248%)	33.4 (76%)	21.5 (44%)	68.8 (135%)	22.2 (40%)	15.1 (36%)	98.5 (186%)	42.6 (75%)	77.4 (119%)	32.4 (58%)	26.7 (48%)
Count	22	25	14	8	9	7	12	18	8	16	12	14
Cumu-lative	56.1 (102%)	155.4 (164%)	188.8 (136%)	210.3 (112%)	279.1 (117%)	301.3 (102%)	316.4 (94%)	414.9 (107%)	457.5 (103%)	534.9 (105%)	567.3 (100%)	594.0 (95%)

Rainfall for every available day of 2010 along with monthly summary: lowest, highest, total, count (values > 0), and the cumulative value for the year to the month's end.
Figures in brackets refer to departure from average conditions.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	16.1	12.3	4.4	1.4	14.5	14.7	13.7	14.6	21.7	3.6	13.4	9.1
Total	73.0 (133%)	44.2 (110%)	11.1 (25%)	1.8 (4%)	24.1 (47%)	87.6 (159%)	53.2 (127%)	73.0 (138%)	42.1 (74%)	15.5 (24%)	25.2 (45%)	56.2 (100%)
Count	19	16	7	3	9	19	13	17	16	10	9	21
Cumu-lative	73.0 (133%)	117.2 (123%)	128.3 (92%)	130.1 (69%)	154.2 (65%)	241.8 (82%)	295.0 (88%)	368.0 (95%)	410.1 (92%)	425.6 (83%)	450.8 (80%)	507.0 (81%)

Rainfall for every available day of 2011 along with monthly summary: lowest, highest, total, count (values > 0), and the cumulative value for the year to the month's end.
Figures in brackets refer to departure from average conditions.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	10.6	8.0	11.2	16.9	16.4	25.7	19.8	15.8	21.8	15.6	17.3	21.7
Total	42.8 (78%)	20.5 (51%)	21.6 (49%)	100.4 (205%)	44.6 (87%)	117.7 (214%)	89.0 (212%)	31.7 (60%)	43.4 (76%)	89.0 (137%)	75.1 (134%)	101.4 (181%)
Count	12	8	4	22	12	21	17	16	8	25	15	18
Cumu-lative	42.8 (78%)	63.3 (67%)	84.9 (61%)	185.3 (99%)	229.9 (96%)	347.6 (118%)	436.6 (130%)	468.3 (120%)	511.7 (115%)	600.7 (118%)	675.8 (119%)	777.2 (125%)

Rainfall for every available day of 2012 along with monthly summary: lowest, highest, total, count (values > 0), and the cumulative value for the year to the month's end.
Figures in brackets refer to departure from average conditions.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	8.0	12.9	12.5	10.2	14.7	4.2	12.2	19.2	32.0	15.2	11.6	15.2
Total	47.0 (85%)	37.1 (93%)	54.2 (123%)	31.7 (65%)	49.1 (96%)	15.6 (28%)	36.2 (86%)	51.3 (97%)	61.3 (108%)	92.0 (142%)	55.6 (99%)	91.0 (162%)
Count	17	13	15	10	14	11	10	11	15	19	18	15
Cumu-lative	47.0 (85%)	84.1 (89%)	138.3 (99%)	170.0 (90%)	219.1 (92%)	234.7 (80%)	270.9 (81%)	322.2 (83%)	383.5 (86%)	475.5 (93%)	531.1 (94%)	622.1 (100%)

Rainfall for every available day of 2013 along with monthly summary: lowest, highest, total, count (values > 0), and the cumulative value for the year to the month's end.
Figures in brackets refer to departure from average conditions.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	16.8	8.5	8.6	6.2	14.5	5.6	11.7	38.5	29.3	40.7	29.8	10.7
Total	141.5 (257%)	78.9 (197%)	22.9 (52%)	23.2 (47%)	70.3 (138%)	28.9 (53%)	47.1 (112%)	118.3 (223%)	42.6 (75%)	94.2 (145%)	106.1 (189%)	41.2 (74%)
Count	30	20	9	10	17	14	12	14	5	17	20	17
Cumu-lative	141.5 (257%)	220.4 (232%)	243.3 (175%)	266.5 (142%)	336.8 (141%)	365.7 (124%)	412.8 (123%)	531.1 (137%)	573.7 (129%)	667.9 (131%)	774.0 (137%)	815.2 (131%)

Rainfall for every available day of 2014 along with monthly summary: lowest, highest, total, count (values > 0), and the cumulative value for the year to the month's end.
Figures in brackets refer to departure from average conditions.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	15.8	6.5	6.3	5.2	14.4	4.1	31.9	17.5	26.1	13.1	7.9	6.1
Total	75.7 (138%)	44.3 (111%)	22.3 (51%)	19.5 (40%)	52.1 (102%)	9.4 (17%)	58.5 (139%)	77.9 (147%)	63.9 (112%)	51.9 (80%)	66.0 (118%)	52.2 (93%)
Count	23	15	10	8	14	6	16	17	11	9	19	24
Cumu-lative	75.7 (138%)	120.0 (126%)	142.3 (102%)	161.8 (86%)	213.9 (89%)	223.3 (76%)	281.8 (84%)	359.7 (92%)	423.6 (95%)	475.5 (93%)	541.5 (96%)	593.7 (95%)

Rainfall for every available day of 2015 along with monthly summary: lowest, highest, total, count (values > 0), and the cumulative value for the year to the month's end.
Figures in brackets refer to departure from average conditions.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	16.1	13.0	13.9	21.1	17.7	30.4	11.2	7.7	20.6	10.6	20.8	6.6
Total	71.3 (130%)	38.6 (97%)	63.3 (144%)	50.5 (103%)	43.4 (85%)	91.8 (167%)	22.3 (53%)	18.1 (34%)	38.7 (68%)	38.7 (60%)	82.4 (147%)	10.5 (19%)
Count	23	14	14	19	8	20	9	12	9	10	15	8
Cumu-lative	71.3 (130%)	109.9 (116%)	173.2 (125%)	223.7 (119%)	267.1 (112%)	358.9 (122%)	381.2 (113%)	399.3 (103%)	438.0 (98%)	476.7 (93%)	559.1 (99%)	569.6 (91%)

Rainfall for every available day of 2016 along with monthly summary: lowest, highest, total, count (values > 0), and the cumulative value for the year to the month's end.
Figures in brackets refer to departure from average conditions.

Fact: 2010, 2011 and 2012 had some very dry months, particularly 2011. It also shows that since then there have been no very significantly dry years. In 2016, while July to September 2016 were dry, June was wet with 91.8mm of precipitation (167% of the 30 year average). In 2015 there was a considerably drier period from March to June yet the subsidence did not emerge then.

4) What are the actual causes of the subsidence here? Two questions need raising:

i) Why do some houses have subsidence while others under identical or similar conditions do not?

ii) Why do unchanging trees not cause subsidence over a long period of many years of both dry and wet conditions, then suddenly 'cause' subsidence one year?

The answer to these questions is that there are other causes. The trees in this area - while causing a certain level of shrinkage and expansion due to a proportion of clay within the soil - have not done this sufficiently with the existing foundations to cause building subsidence.

Hampstead buildings, roadways and services - including water - frequently undergo subsidence with potholes and even sinkholes appearing. Cases of subsidence where Camden street trees are blamed are more frequently encountered across the Claygate Beds and Band D of the London Clay Formation region i.e. MUCH LESS than where there is less silt in band B and C of the London Clay Formation. These are caused by erosion of the silt from the soil by the action of ground water. This produces a much more massive loss of volume than occurs from vegetation-related desiccation.

The second photograph in Appendix 2 of the Crawco Preliminary Report - of LA trees - also shows the large pot holes that have appeared in this roadway in the past. This is a strong indicator that silt erosion by groundwater action is very active here. In fact, these potholes are downhill of number 31 in a section of the road that has much fewer street trees - none on the eastern side. Indeed I believe that the street trees higher up near 31 HHRd could be helping to mitigate for this water action, and the situation would be worse without them.

Looking at the Ordnance Survey map of the area (see below) it can be seen that groundwater flows downhill at 90° to the contours and that it will already be being constrained by the railway cutting behind the southern side of Heath Hurst Road from the bend in it down to South End Road.

What has changed at 31 Heath Hurst Road?

In 2014 33 Heath Hurst Road gained planning permission to build a large rear and side extension, and this was built the following year. The much deeper foundations (those of 31 Heath Hurst Road were recorded as 0.425 metres deep when the borehole was dug) according to current building regulations will have had two effects:

i) Differential subsidence between the much deeper new foundations into stiffer clay/silt and the shallower existing foundations into superficial less stiff Made Ground and Head. Stepping of the new foundations to the old could have prevented cracking appearing in 33 Heath Hurst Road, however it may not have prevented cracking in 31 HHRd which presumably was not involved in any foundation work.
ii) The barrier now presented by the new foundations will have constrained ground water flow, causing it to have a more erosive action than usual on silt within the clay below the house.

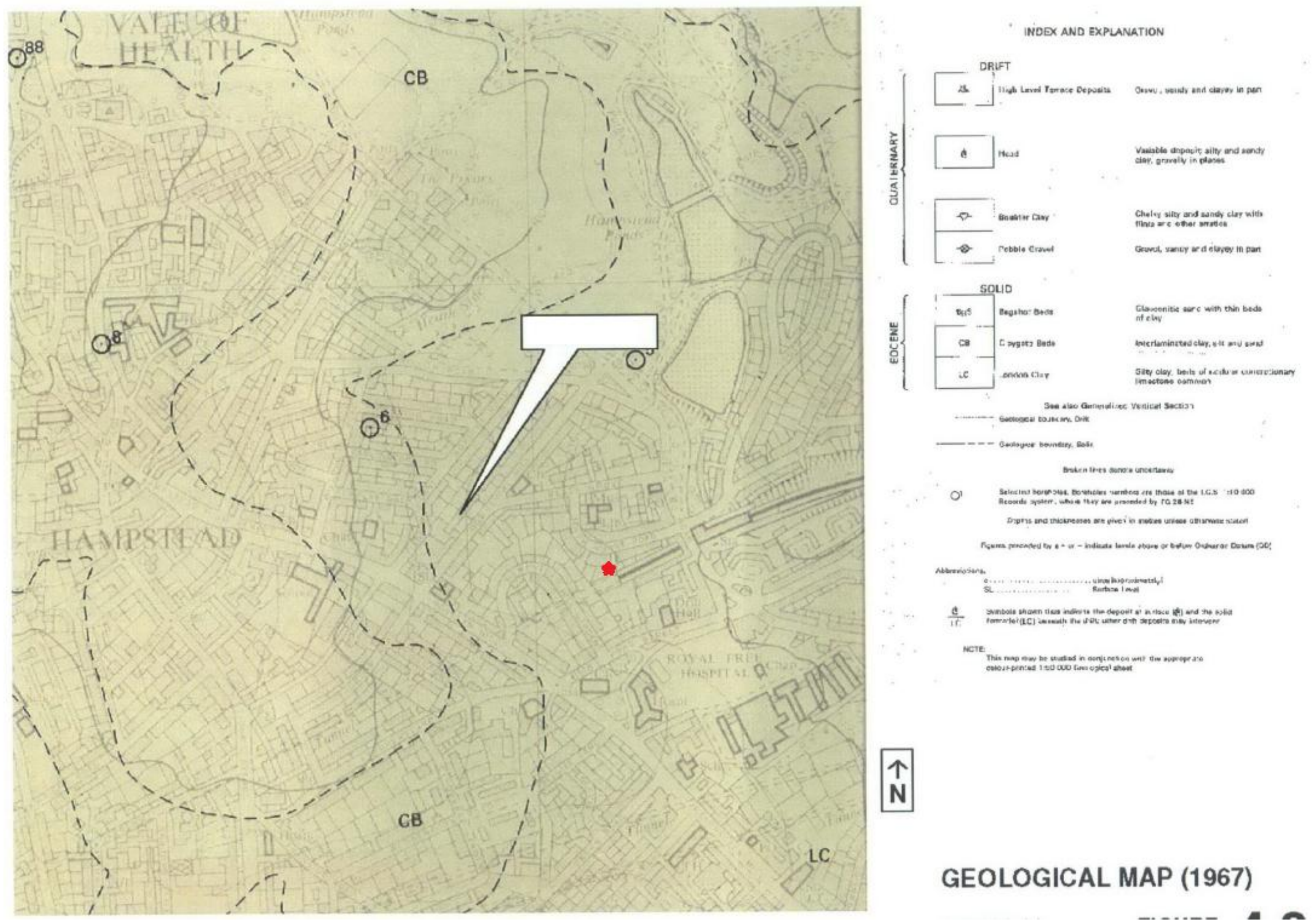
SUMMARY

- No evidence has been provided to demonstrate that vegetation-related movement is occurring.
- No evidence has been sought that Thames Water mains/drains or MH1 to RWG1 Surface Water drain might be responsible for un-natural tree root growth and the presence of roots under the house.
- All other possible causes of subsidence have not been considered.
- The underlying geology and hydrogeology are known to cause subsidence from silt erosion in this area and there are signs present in the roadway here.
- There are possible small signs that silt IS being eroded out - into the drains, where this could be possible, but may have not been reported as it is not considered significant.

- The timing of the subsidence is completely unrelated to historical weather records, or to tree-related work.
- The timing IS related to the extension build next door indicating that this could have exacerbated the existing groundwater erosive action, and warrants investigation for differential subsidence which has not so far been done.

Please refuse this Notice of Intent. I can understand that it may be considered these three trees do not warrant TPOs, however they are doing a grand job of beautifying the street in the small space available, and importantly are helping in their small way to reduced the problems of water here.

Dr Vicki Harding
Tree Officer, Heath & Hampstead Society



BGS Geological Survey map 1967 (taken from another application while my BGS map is out on loan). Dotted line on the eastern boundary of the Claygate Beds (CB) is the supposed Spring line between the Claygate beds and Band D of the London Clay Formation. 31 Heath Hurst Road is a red star, showing it to be just downstream of this spring line. The narrowness of the contour lines upstream to 31 HHRd indicate the steepness of slopes in this area.

From Ordnance Survey map 2009

LONDON CLAY FORMATION 47

Unit D

This unit, 30 to 45 m thick, consists of interbedded bioturbated and glauconitic sandy clayey silt to sandy silt, in beds up to 5 m thick. Bed boundaries are mostly diffuse and transitional because of the bioturbation. Layers of septarian nodules occur at a number of levels and phosphatic concretions are present, mostly in the more clayey beds. Silt- and sand-dominated beds with a variable proportion of glauconite grains generally make up less than 10 per cent of the succession; these beds thicken westwards as the clay beds become thinner.

Palaeontology

Unit D London Clay Formation from 'Geology of London' MA Woods et al British Geological Survey (2004).