The Heath & Hampstead Society

The Society examines all Notices of Intent relating to Hampstead and Hampstead Heath Fringes, and assesses them for their impact on conservation and on the local environment.

**To London Borough of Camden**

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| **Planning Ref:** | 2019/5710/T |
| **Address:** | Camden Arts Centre |
| **Case Officer:** | Tom Little |
| **Date**: | 5th December 2019 |

This is an objection to this Notice of Intent to fell trees here.

**Geological Factors**

Camden Arts Centre (CAC) sits up above Finchley Road on a fairly steep slope into ground that is described in the report as 'Made Ground' but is in fact 'Head'.[1] This is a fundamental misunderstanding of those who interpreted the data. The data was in any case gathered in an inappropriate manner: hand augers were used (and were unable to pass beyond 1.4 metres in Trial Pit 2) - a low tech method which is not recommended for testing complex and laminated soils.

Underneath the Head beneath the CAC is Unit D of the London Clay Formation[2], just south south-west of its boundary with its relatively more permeable neighbour Unit E the Claygate Beds. This boundary runs parallel and immediately south of Lindfield Gardens, with the spring line - where the perched water table at the bottom of the Claygate Beds emerges - roughly along the rear gardens on this southern side. Residents here report springs emerging from their rear gardens and lawns during wetter periods - one year a spring may be in one garden, the next in a neighbour's, illustrating the laminated form of the ground here and changes in water emergence and flow along the spring line under differing rainfall and ground water surging conditions.

Due to its underlying geology and topography - a hill like a layer cake of increasing permeability towards the top, Hampstead is the source of four of London's rivers. Since no part of Hampstead is on a layer beneath Unit D of the London Clay Formation, and as such has a range of groundwater flow through it from very rapid (seen at the bottom of wells tapping the perched water at the bottoms of the Bagshot Beds and the Claygate Beds layers) to intermittent seepage of at least a small amount of groundwater, it is arguable that a persistent moisture deficit[3][4] is unlikely to occur here.

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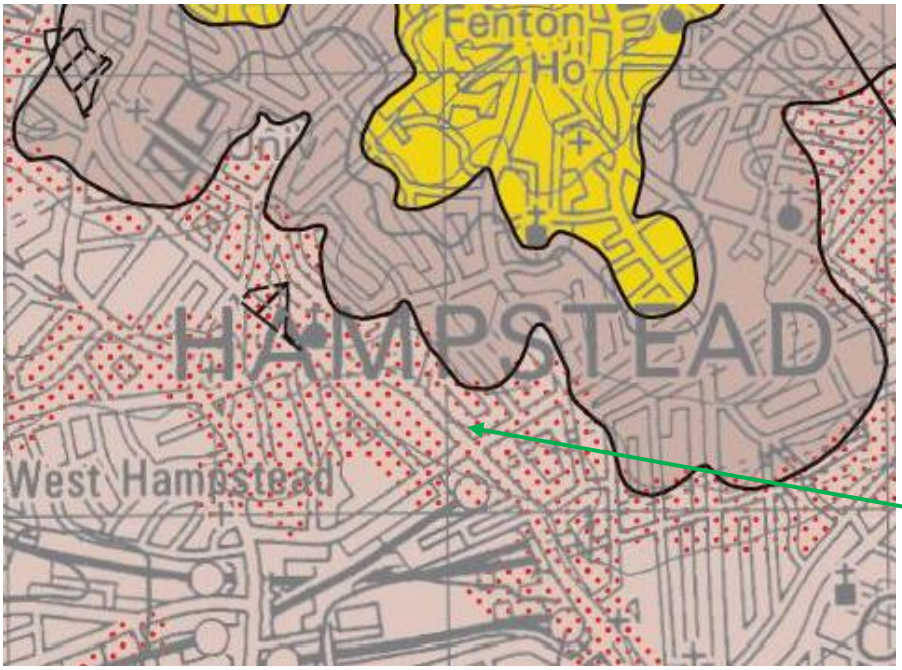
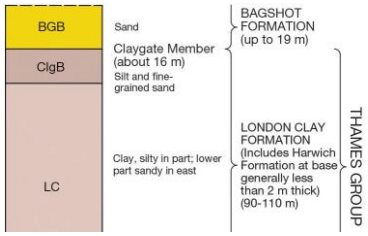
[1] From *Geology of London: Special Memoir for 1:50 000 Geological sheets 256 (North London)* etc Ellison RA (2004) p69-70:
**'Head**
Head is defined as material that has moved downslope by solifluction (mass movement under periglacial conditions). It formed principally beyond the ice limit during the glacial stages of the Pleistocene, when mass wasting was accelerated because of the arctic climate and lack of vegetation. When snow melted in the spring, debris of frost-weathered material formed a slurry, which gradually flowed downhill to form a poorly bedded deposit of variable character.'

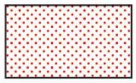
[2] From *Geology of London: Special Memoir for 1:50 000 Geological sheets 256 (North London)* etc Ellison RA (2004) p47:
**'Unit D**
This unit, 30 to 45 m thick, consists of interbedded, bioturbated and glauconitic sandy clayey silt to sandy silt, in beds up to 5 m thick. Bed boundaries are mostly diffuse and transitional because of the biturbation. 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% of the succession; these beds thicken westwards as the clay beds become thinner.'

[3] This is where rewetting in winter does not fully replace all the moisture lost during the summer. It is unlikely beneath the buildings and gardens of Hampstead in the way that this occurs with dry winters for lower units of the London Clay Formation where silt and sand - hence groundwater - is generally in smaller quantities within the clay, such as at the Building Research Establishment, Chattenden, Kent where studies on vegetation-related clay movement was undertaken.

[4] Driscoll, R. (1983) The influence of vegetation on the swelling & shrinking of clay soils in Britain. *Geotechnique*, **33**, 93-105.



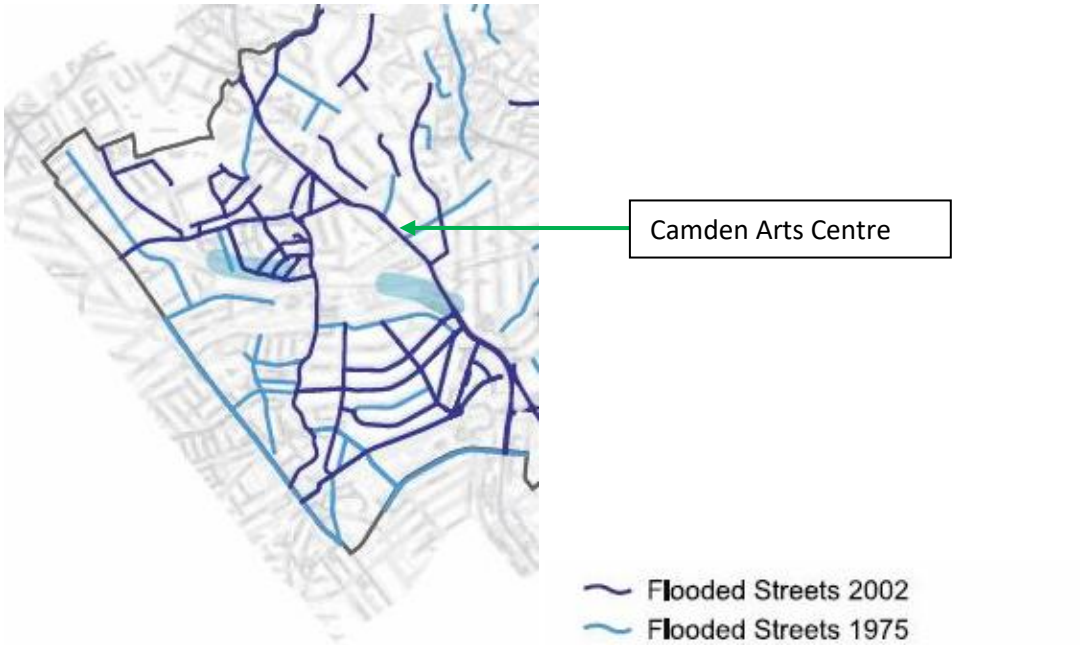
Head propensity

The Head propensity is based on the geotechnical properties of the London Clay. The areas denoted are most likely to be covered by Quaternary head deposits as interpreted from digital slope analysis and confirmed by borehole data. These are not mapped deposits and not verified by fieldwork.

Key:

Taken from: **British Geological Survey 1:50 000 England & Wales Sheet 256 North London**
http://www.largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001750

The majority of groundwater emerging at ground level from spring lines and seepage surfaces of perched water tables is channelled into drains. However much of the water going down this hill will be within the Head layer, along the superficial aquifer below this Head layer and some within units D and E flowing towards the course of the eastern branch of the East Westbourne River - which incidentally goes under the CAC - eroding silt as it goes (see ARUP's map below). I believe this to be the primary cause of underlying and on-going subsidence here. As with many many buildings in Hampstead, silt erosion has been developing for decades (or even centuries), increasing during storm days with surging groundwater until finally beyond the point of stability when cracking finally occurs. Then, as the years and the storms go by, more and more erosion produces further crack opening and subsidence that is cumulative until remedial action is taken. Camden's Flood Map (see next page) demonstrates that not only groundwater flows downhill beneath CAC, but that surface run-off also goes in this direction down Arkwright Road as well as Frognal.

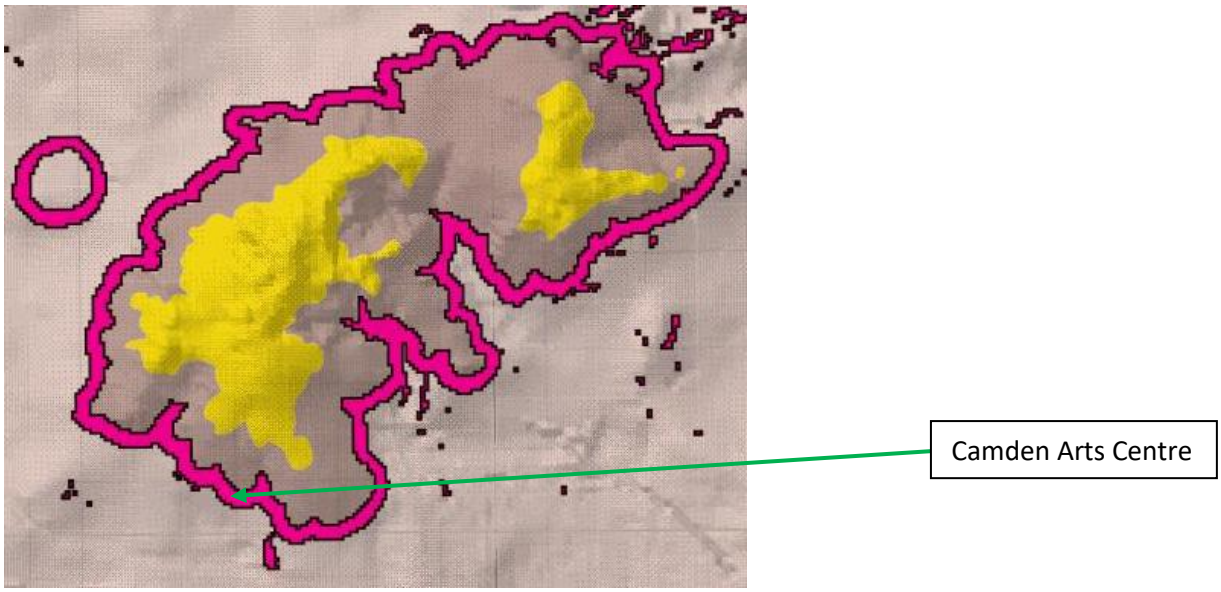



From **'Flood Map' Figure 15 of ARUP's Camden Geological, Hydrogeological and Hydrological Study.**

These two factors, both impacting on silt erosion have another indirect but actually more serious consequence. When silt erosion affects the foundations of drains and mains water supplies, these erode the silt from the clay beneath buildings and roadways much faster.

**Landslip and Slope Angle**

Another factors again here is that of landslip and the steepness of the slope as Arkwright Road joins the Finchley Road. It can be seen (below) that CAC is right on an area of greatest potential for slope instability, just at the point where there is a considerable amount of slip-lubricating groundwater. The history of this site indicates that landslip is likely to be occurring.




**Areas of greatest potential for slope instability**, from BGS North London Sheet 256
http://www.largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001750

**HISTORY**

The building was built on an area of landslide potential, just below the geological boundary between Claygate Beds and Band D of the London Clay Formation (see figure 17 of Arup's 'Camden Geological, Hydrogeological and Hydrological Study: Areas of landslide potential, taken from Forster A, Wildman G & Poulton C (2003) Landslide potential modelling of North London. British Geological Survey Internal Report, IR/03/122R).

The building was opened in 1897, survived World War II, despite hits by enemy incendiary bombs in 1940 and the blast from a V2 rocket in 1945. The library grew in size and was extended in the 1920s.

In the 1960s Finchley Road was widened along here, the slope down Arkwright Road having to be made steeper to join the Finchley Road and the garden of Camden Arts Centre held back, though with merely a small brick wall it seems. Elsewhere along Finchley Road there were worrying amount of landslip and trees were also used to help bind the hill together, such as north west of Frognal Lane.

**Local basements affecting the ground**
Three significant ground excavations were undertaken that would have had an impact on CAC:

- 214 Finchley Road Spring Grove Nursing Home - built 1992 with basement.
- The large scale building over the road 321-339 Finchley Road and 52-62 (even) Lymington Road of 8 storeys including a double basement was give planning permission 1963.
- 341-351 Finchley Road, the JW3 project started in early 2012, demolishing and replacing the Mercedes Benz showrooms with a double basemented 4-storey building and a 10-storey residential tower.

No doubt these basements had an effect on the roadway foundations and ground in the area causing ground pressures to release when they were dug out and silt to wash into the dugout areas. Then when the sheet piling was inserted the groundwater was blocked, causing a bit of an underground lake behind. I haven't studied what happened to this water further downstream once it got out around these obstructions. As these two large buildings 6 to 10-storeys high were completed, their weight would have compressed the ground which seemed to affect the roadway of Finchley Road. Old photographs show subsidence of the roadways and pavements in places here. Considering the steepness of the hill here and the previous loss of the toe of the hill from cutting back with road widening, it is reasonable to presume that ground pressure changes and impact from piling would all have had an effect on the ground beneath the front garden of CAC, and hence the building it supports above.

**Further sources of vibration**
For the last 10 years there has been a significant increase in heavy construction lorries to, from and through Hampstead. Many of them would have come down Arkwright Road and considering the short time the lights are green for vehicles driving down here it is notorious for vehicles to accelerate then crash onto Finchley Road as it bottoms out before hightailing it left up to the north or west. I believe this is likely to add to vibration of the ground and increase the likelihood of lubricated shaking causing landslip in this area of high risk, reflected in the road condition here that can be seen over the years.

**Street View (for pictures see the end of this document)**
When looking at Street View - particularly the roadway at the junction of Arkwright Road and Finchley Road, more is revealed! Here the Arkwright Road roadway & the junction in June 2008 is in a terrible state and there are cracks in the boundary wall corner joints to Camden Arts Centre (CAC). There is a huge amount of patching and tarmac cracking and clearly when the Finchley Road junction was re-surfaced by Sept 2009, it was raised a bit, so cars coming down the steep slope of Arkwright Road scraped their exhaust systems as they bumped into the dip at the very bottom, then up onto the main road. This gradually got worse. May 2012 there was some digging up and repairing of the pavement around the CAC corner & up Arkwright Road; mains water?

Further views of this area: November 2015 cracking in the tarmac across the junction; June 2016 Arkwright Road even worse, including where it joins the junction which itself has now has been repaired. June 2017 Arkwright Road has now been tarmaced, but by February 2018 a drop can be seen at the bottom of Arkwright Road on both corners where vehicles turn into & off Finchley Road. October 2018 water is running down the CAC side of the carriageway and a patch of water lies on the pavement on Finchley Road. November 2018 the leaking water main has clearly got much worse with standing water at the bottom that has escaped through the Arkwright Road and Finchley Road tarmac 'seam' and there is more water onto Finchley Road. By May 2019 this has been fixed, Finchley Road tarmaced again and the junction box put back BUT, there is a patch of water back on the Finchley Road pavement outside CAC. It is well known that Thames Water don't fix leaks when they are small so a lot of water had a chance to cause further silt erosion and lubricated land slip until in 2017 the slip was particularly severe, and relatively sudden it would seem.

I think all this is reflected in Historical Street View of the junction here that demonstrates on-going subsidence of the roadway junction at the bottom of Arkwright Road and Finchley Road in places. Unfortunately with only 1-2 snap-shots taken each year, the months and months of leaking water down Arkwright Road and at the junction that occurred in many years are not always shown. Movement of the front garden down the hill with dropping of boundary wall sections and opening out of cracks and of joints in that direction can be seen.

**Drains and Mains**

It would seem to provide support for the theory that the groundwater known to flow down here has washed out the foundations below both roadways, water mains, drains and the CAC, has lubricating some landslip and been fracturing further mains and drains for years. CAC itself has some drains fractures probably emanating from landslip. From the drains report: 'MH1 upstream to RWP1 Run 1: Condition B - cracks and fractures observed at 1.3m, 2m and 2.1m; unserviceable.' The water mains problems just by the steep drop in Arkwright Road would seem to coincide with cracks evident under the first floor window of the Finchley Road flank wall in Sept 2017 onwards, that seem not to be there in July 2016 though the Street View shot is unclear.

**Trees?**

What is the evidence for the subsidence being contributed to by trees? The Plasticity Index and the Liquid Limits are hardly very remarkable and there is the consideration that these tests were performed on complex ground using low-tech methods to extract it which would be expected to skew the results. Root suction usually must be able to dry out a significant thickness of soil below the foundations to be capable of causing building damage. Since Unit D of the London Clay Formation is virtually at the level of the bottom of the foundations and there will hence be a small if patchy aquifer lying at this level, the thickness of soil capable of being dried out is essentially non-existent. The soil sample suctions are in any case variable, contributing to the sense that the ground is complex. It is essential to demonstrate when claiming vegetation-related that there is soil desiccation. Desiccation has not even been mentioned, is often inferred from the shear vane tests, but here I would suggest the shear vane readings do not confirm high shear strength - they merely confirm variation. In any case in an area of complex laminated soil this invalidates their ability to be a proxy for desiccation [5].

I consider there is no evidence that the trees are or even could be a significant cause of the subsidence. Movement monitoring has not been performed or its results presented which might indicate what the cause might be. If the cracking were to be tree-related then crack closure and ground recovery would have to be demonstrated in winter.

The question of a dry summer - June 2018 was particularly dry - rears its head as the national newspapers clamour to tell us about the flood of subsidence claims that will appear. These self-fulfilling prophecies annoy me intensely every time they happen; April and October of 2017, September and October of 2018, January, April and May of 2019 were also dry, and why did this building not crack up in 1976, 1985, 1990, 1992, 1995, 1996, 2003 and 2006: individual surge years characterised by more than 50,000 subsidence claims. What has also been apparent though is that the weather in recent years has brought record levels of storms with very high rainfall: ideal conditions for silt erosion by groundwater action. Those whose homes are within the Claygate Beds in Hampstead and whose lower floors flood during periods of high rainfall had seven in the summer of 2017, the worse for 24 years.

Removing trees here will not stop subsidence even if it were to play a small additional part, but there is always the chance that this would hasten silt erosion and land slip.

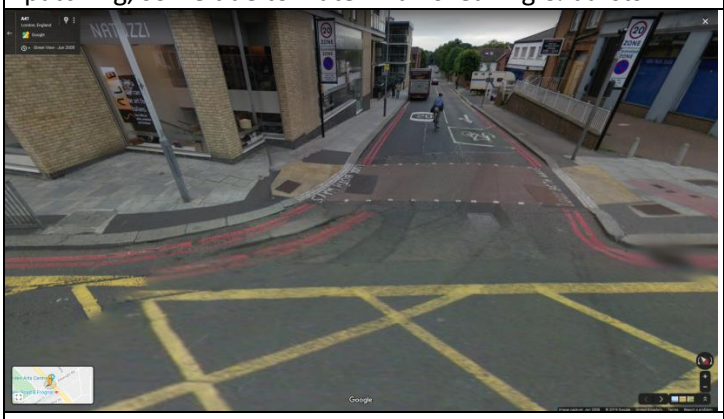
It is my opinion that the recommendation for these trees to be removed is at least premature and most probably an inappropriate remedy for the subsidence damage.

Dr Vicki Harding
Society Tree Officer, Heath & Hampstead Society

[5] FACTORS AFFECTING THE INTERPRETATION OF THE IN-SITU SHEAR VANE TEST A thesis submitted to the University of Surrey for the degree of Doctor of Philosophy in the Department of Civil Engineering by Caesar Mowbray Merrifield (1980)

May 2008 Poor roadway state at junction with frequent patching, some due to water mains leaking & bursts


June 2008 Subsidence pre-JW3 corner opposite



June 2008 Subsidence junction outside Natuzzi opposite

June 2008 Poor junction state, subsidence & frequent patching, some due to water mains leaking & bursts

Sept 2009 new tarmac Finchley Road junction


June 2012 patched junction but dip - exhaust scrapes - adding to vibration

July 2012 Dip at junction - exhaust scrapes increasing

May 2014 Dip at junction deteriorating


Oct 2015 surface water run-off down Arkwright Rd into drains with silt


Nov 2015 Cracking across Finchley Road's new tarmac suggesting on-going erosion and subsidence of the area

June 2016 Continuing subsidence + service repairs

June 2017 Dip filled & new tarmac bottom of Arkwright Rd

Feb 2018 New tarmac Finchley Road

Oct 2018 Pavement and roadway water

Nov 2018 Burst water main - many occur here and at other places along this section of Finchley Road, not picked up by snap-shot Street View

May 2019 Road mended, water still appearing on pavement

June 2008


May 2012


Sept 2017

Nov 2019