2 'Just because sound levels can reach 100db (or whatever) does not mean that a noise floor, say 40db below this is at all acceptable. At a rock concert the levels of sound are consistently high and mask much of the noise - however, EVERY piece of film music must start and end cleanly with silence (and a pure ring out from the space at the end). Many film cues have the orchestra playing very very quietly to create the right texture and feel for the cue. So every tiny noise is picked up. Sometimes we have to redo takes because the noise from the page turns is too loud and distracting'.

This is the view of a regular end-user of the studios and an expert in this field.

2.8 CJ go on to argue that because the applicant at 11 Rosslyn Hill cannot hear the music coming from the studios it would follow that the noise from the construction works would not be audible within the Studios because the sound insulation measures in the studios would work both ways, and '*Measures will have been put in place to protect recording studios and hall from noise from emergency vehicle sirens and alike'.* This argument is fatally flawed. The ambient noise levels (which are quite high) experienced by the occupiers of 11 Rosslyn Hill would mask any escape of noise from the studios also the noise levels within the studios are so low that even the slightest noise (see above) can be picked up and can ruin a recording. It is known by users of the facility that sirens on emergency vehicles and low frequency noise from trains can be heard in the studios. Below are two quotes from Gavin Greenaway's email – both very pertinent:

1. *The lack of sound heard outside the studio and the acoustic shielding built into the Hall does not mean that extraneous low frequency (LF) sound will not get in. Acoustic instruments in fact generate very little acoustic energy below 50 hertz, so the chances of them being heard outside a ice traffic noise are low. However building plant and anything mechanical directly* in *contact with the ground generates substantial LF energy, many magnitudes greater than an acoustic instrument. This sound can plainly be heard inside the Hall when an orchestra's truck is idling next to the building. (I haven't checked this as the source, but I have heard the noise occasionally in the studio).*

   The use of averaged noise figures is totally inadequate to deal with the LF threat from the building works.

   3. The Hall IS susceptible to siren noise. At least once per session we have to redo a take due to sirens. We all accept that we are working in a converted church, not a studio built from the ground up.
   Once at Abbey Road studio 1 recording was interrupted by a low hum. We thought at first it was a helicopter hovering over the building, but it turned out to be tree surgeons working in close proximity to the roof. It took 20 minutes to find the cause (the tree surgeons had come on the wrong day) and we were not able to record during that time.

2.9 The CJ letter concludes that *'with the existing level of sound protection of the studios there will be some protection against construction noise.'* The key word in this sentence is **some.**

2.10 The CJ letter attempts to dismiss the suggestion that ground borne noise might be an issue. Vanguardia do not agree with this suggestion especially due to the proximity of the proposed construction works.

Existing Noise Levels around the Site

2.11 Table 1 presents a summary of the existing noise levels around the site and includes two additional locations (A and B) used to determine noise levels around the studios. These additional locations have been included because the first two CJ reports failed to identify the studios as a noise sensitive receptor.

2.12 Below Table 1 is a commentary on the recorded levels. Table 1 provides Daytime (0700-2300) 16hour levels and Night-time (2300-0700) 8hour levels with two notes explaining how the L_{Amax} and $L_{A90,15min}$ levels have been obtained. The commentary however seems to draw on 10hr (0800-1800) levels which are not shown in Table 1. This is quite confusing and there is no explanation as to how these figures have been calculated. It then goes on to provide expected noise levels at noisiest facades of the Air Studios which are different again without any explanation as to how these levels have been obtained.

Proposed Criteria

2.13 CJ criticise the proposed criteria that Vanguardia have suggested in relation to construction noise and vibration because the report does not distinguish between times when the studios are recording and times they are not. In fact the hours of operation of the studios are not specified because their operation is on a 24/7 basis. CJ state: *' In order to protect the amenity of residents the working hours would need to be restricted to between 8am and 6pm Monday to Friday and 8am to 1pm Saturdays. Therefore clearly outside these times the studios could not have any noise disturbance.'* The sentiment in this statement is confused – and the meaning is not clear. CJ go on to explain how there are accepted practices where times are allotted to quiet and noisy times saying e.g. if no recording takes place before 11am more noisy work could be undertaken at that time. As previously described there are no fixed hours of operation for the studios, it is a 24/7 operation with studio spaces sometimes booked for weeks at a time. The criteria proposed by Vanguardia would need to be complied with at all times that the studios were in use.

2.14 It is suggested by CJ that Vanguardia have misinterpreted the LA_{max} criteria within DS10 relating to the Threshold of Significant Impacts of re-radiated underground sources. Vanguardia recommended the use of the 25dB $L_{Amax,s}$ threshold in favour of the higher 30dB $L_{Amax,s}$ threshold because of the very large volume of the main recording studio at Air Studios. It has a volume equivalent to some auditoria and most other recording studios are quite small in comparison. It was also noted that the existing ambient noise levels in the recording space are so low that to protect it the lower noise limit should be applied. Vanguardia have erred on the side of caution in order to protect an extremely noise sensitive location. CJ also make the point that the criteria in DS 10 do not relate to temporary construction noise. It is understood that this project is likely to last for more than a year.

2.15 CJ claim that continuous flight auguring will be used on the site (not impact driven) and that this method would mean that there would not be any impulsive noise or any significant vibration generated. Continuous flight auguring can however produce relatively high noise levels particularly when the augur encounters obstructions underground – there may be a need to augur through. High noise levels can also be generated when the augur is cleaned to remove adhering spoil – this may take place several times during a working shift. It is also quite common to experience a 'roar' from the power pack. This can be a significant source of noise.

Discussion of Air Studios protection from noise

2.16 CJ make an assumption that recording in Air Studios are not affected by the external background noise levels. This section should be read accounting for the comments received from Gavin Greenaway on this topic:

10. The studios (the Hall specifically) ARE susceptible to background noise. If you turn up the speakers very high, you will hear the low drone of London. The consistent nature, and relatively low level, of this noise means that it can be mitigated with equalisation or post-processing.

This means that any calculations made by CJ which assume that the Air Studios façade is sufficiently robust to completely prevent the noise break-in of external background noise are incorrect.

2.17 This section of the CJ letter discusses the possible noise break-in to the Studios from the construction noise and concludes that using the stated mitigation and based on the noise information obtained to date their assessment is indicative that construction activities that take place more than 10m from the studios would not impact upon recordings. It acknowledges that special arrangements would have to be put into place for the noisier activities closer to the studio. All of this will be included in a Construction Management Plan.

Construction Management Plan

2.18 CJ are critical of Vanguardia for assuming that the 'Outline Construction Logistics Plan' was indeed a Construction Management Plan (CMP). It must be said that it is normal practice to submit a Construction Management Plan to support a planning application for a large project. Being that the Outline Construction Logistics Plan was the only document on the Planning Portal it was not unreasonable for Vanguardia to assume that this document was in fact the submitted CMP.

2.19 CJ propose a number of measures designed to be considered in the CMP. These are summarised below:

i. Restricted Site Operation Hours
ii. Restricted hours for noisier work
iii. BPM
iv. Noise and Vibration Limits to be determined at the site boundary
v. Noise Monitoring at the site boundary
vi. Regular reports

2.20 It has already been explained why restricted site operation and restricted hours for noisier work are not practical due the 24/7 nature of the business of Air Studios and the highly noise sensitive nature of the recording spaces. Naturally BPM is a given, not least to protect the amenity of the other residents of the area.

2.21 In view of the confidence expressed by CJ that the construction activities that may take place more than 10m from the studios would not impact upon the recordings there appears to be no reason for the restricted hours for noisier work to be necessary.

2.22 Whilst there may be very limited scope to programme 'noisy' work (or work within 10m of the studios) to take place when the studios are not in use, it is probable that this time would be outside normal working hours so any 'noisy' work would not be allowed due to the restrictions imposed by L B Camden put in place to protect the other adjacent noise sensitive properties in the area.

2.23 Vanguardia agree that whilst noise and vibration limits determined and monitored at the site boundary would be appropriate to protect the neighbouring noise sensitive receptors they are not suitable for the protection of Air Studios.

2.24 Vanguardia suggests that a synchronised method of noise monitoring inside and outside the building that correlates the internal and external levels would be more appropriate. In the event of the agreed internal noise limit inside the studio being exceeded which is caused by the construction taking place outside then the construction should immediately cease and not recommence until either the recording studios are not in use or an alternative (less noisy) method can be agreed. The levels not to be exceeded are stated in the Vanguardia report Table 4.1.

Plant Noise

2.25 The additional noise survey location (location B) is now included to address the omission of a suitable measurement location in the previous reports by CJ. This has resulted in a revised (lower) background noise level used in the plant noise assessment calculations.

2.26 There is still no justification for the use of a limit set at not more than 5dB above background. The plant noise data previously submitted indicates that tonality will be present yet no adjustments appear to have been made.

APPENDIX A – Response from Gavin Greenaway

Gavin Greenaway is a renowned music composer and conductor and a regular user of Air Studios. Reproduced below is an extract from an email received.

From: Gavin Greenaway
Sent: 27 September 2015 16:26
To: Jessica Learmond-Criqui
Subject: Re: air noise report

Hi Jessica,

Thanks for this. There are a number of incorrect assumptions in the report which Air need to counter, for instance:

1.The lack of sound heard outside the studio and the acoustic shielding built into the Hall does not mean that extraneous low frequency (LF) sound will not get in. Acoustic instruments in fact generate very little acoustic energy below 50 hertz, so the chances of them being heard outside a ice traffic noise are low. However building plant and anything mechanical directly in contact with the ground generates substantial LF energy, many magnitudes greater than an acoustic instrument. This sound can plainly be heard inside the Hall when an orchestra's truck is idling next to the building. (I haven't checked this as the source, but I have heard the noise occasionally in the studio).

The use of averaged noise figures is totally inadequate to deal with the LF threat from the building works.

2. Just because sound levels can reach 100db (or whatever) does not mean that a noise floor, say 40db below this is at all acceptable. At a rock concert the levels of sound are consistently high and mask much of the noise - however, EVERY piece of film music must start and end cleanly with silence (and a pure ring out from the space at the end). Many film cues have the orchestra playing very very quietly to create the right texture and feel for the cue. So every tiny noise is picked up. Sometimes we have to redo takes because the noise from the page turns is too loud and distracting.

3. The Hall IS susceptible to siren noise. At least once per session we have to redo a take due to sirens. We all accept that we are working in a converted church, not a studio built from the ground up.

Once at Abbey Road studio 1 recording was interrupted by a low hum. We thought at first it was a helicopter hovering over the building, but it turned out to be tree surgeons working in close proximity to the roof. It took 20 minutes to find the cause (the tree surgeons had come on the wrong day) and we were not able to record during that time.
4. I have never heard of any noise from studio 1 in the Hall causing any stoppage to a recording I was part of.

5. The noise from the lights is measurable but not at all significant in recordings.

6. The air con system is designed so that when the 'red light' is on (i.e. we are recording) the ventilation fans do not run, and no noise is caused. Since the red light is not on during rehearsals, the quality of air and its temperature is very acceptable with this system.

7. "If no recording takes place before 11am". Yes, it is possible that Air could tell its clients that no session could start before 11 to be guaranteed no pile driving, but the other noisy things going on without control would continue randomly. Acoustic barriers will do nothing to stop the LF noise.

8. Bottom p.5 "a representative internal location (possibly where the nearest microphones may be located". This shows a lack of understanding of disruptive sound as it relates to recordings, in my view. If a 50hz generator hum is present anywhere in a room, you will hear it in the whole room. There is no microphone placement which won't pick it up, and the level will will not depend so much on proximity as the shape of the room and whether you measure at a node or null point.

9. Noise monitoring at the site boundary is not going to tell us the actual disruptive noise inside the Hall.

10. The studios (the Hall specifically) ARE susceptible to background noise. If you turn up the speakers very high, you will hear the low drone of London. The consistent nature, and relatively low level, of this noise means that it can be mitigated with equalisation or post-processing.

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Appendix 13

Cole Jarman Letter to Camden Council dated 2nd March 2016

Cole Jarman

Mr T Croft
Thomas Croft Architect
9 Ivebury Court
325 Latimer Road
London W10 6RA

2nd March 2016
Ref: 16-0692 L04-0

Dear Thomas

Application Reference - 11 Rosslyn Hill
Civil Engineering Dynamics Ltd report ref AKS/3400/R1/iL dated 1st February 2016
"Structural and Ground Dynamics"

I refer to the above report. You have asked that we comment with respect to two matters raised in the report not covered in our earlier correspondence. These are:

a) The potential effect of use of the new TV room upon recording at the studio

b) The effects of underground train noise upon the studios.

Previously noise and vibration matters have been commented upon by Vanguardia on behalf of the studio. It should be noted that they did not raise these matters in their reports, from which one might reasonably conclude they did not consider them matters of merit worth raising as reasons for objection to the application. That is a conclusion I would concur with, my reasons outlined below:

The Potential Effect of use of the New TV Room upon Recording at the Studio

In paragraph 8.32 of the report it is stated:

"Depending upon the type of sound system used in the Home Cinema Basement room and were they to mounted on the adjacent new interface basement wall (see fig 8.10), it may be necessary to mount any powerful loudspeaker (an electrodynamic shaker), in such a way to minimise structure-borne noise transmission of very loud events that exist in some movie tracks. Otherwise this has the potential to affect the un-isolated main Hall, particularly given the 24/7 nature of the studio usage. It may be used late at night at a time coincident with typical use of a home cinema. And when background levels are lower."

I note that that the concern relates only to structureborne noise, that arising from direct connection to the building structure. There is no concern with airborne noise, the sound as actually heard in the TV room. This is fairly obvious as the TV room would be separated from the recording studio by the lining constructions within the basement shell, the 300mm concrete inner wall, the secant piled wall and the studios own constructions which would offer very high levels of airborne sound insulation. The airborne sound levels themselves within the TV room would be at domestic levels.

Civil Engineering Dynamics speculate as to loudspeakers being directly fixed to the concrete shell walls. However, very clearly this cannot and will not happen. Under Camden Development Policy DP22 the scheme needs to achieve Level 4 Code for Sustainable Homes rating with 50% of the energy, Water and Material Credits. Consultants Price and Myers have undertaken a pre assessment demonstrating this will be achieved. To achieve level 4 as a minimum the thermal performance of the building has to be at least 19% above Building Regulations Part L requirements. In their Energy Strategy Report they state that the walls and floor of the building are to have U values of not more than 0.11 w/m^2K. This means that within the concrete shell of the basement there will be extensive thermal insulation of the walls, floor and ceiling, between the concrete shell and the internal finishes. As a consequence the loudspeaker supports can (and will) only be on to the internal finishes, as any direct connection to the concrete structure would cause "cold bridging" to the shell. Therefore the speculation on loudspeaker mounting will not apply. I would again reiterate that this would be a TV room with domestic sound levels, not those which would be made in a nightclub (or recording studio).

The Effects of Underground Train Noise upon the Studios

It is noted from the Civil Engineering Dynamics report that underground train noise is audible within the main studio. The noise levels recorded at ground level of 28.7dBA, apparently from the closer tunnel and 25.8dBA from the further tunnel represent noise levels above the criteria Vanguardia had proposed (25dBA) applicable to noise intrusion from construction works at 11 Rosslyn Hill.

They speculate that the new constructions at 11 Rosslyn Hill will increase the underground train noise in the main recording studio due to the piled foundations and connection between the studio building and the new constructions at 11 Rosslyn Hill.

The argument is however flawed. The primary mechanism of sound transfer dissipation is distance attenuation. The main recording studio is actually closer to the tube lines than the proposed TV room basement extension. Therefore the dominant sound transmission path to the main studio is through ground which will not be affected by the construction. That will remain unchanged.

As Alan Baxter make clear the studio buildings and the proposed TV room basement extension will remain structurally separate. The effect of the basement extension rather than amplifying train vibration will be to act as a partial vibration screen to the studio, as a consequence of the discontinuity in ground conditions it will create. This effect is covered in some detail in the attached page from "Transportation Noise Reference book" (Editor Paul Nelson), paragraph 16.6.4.

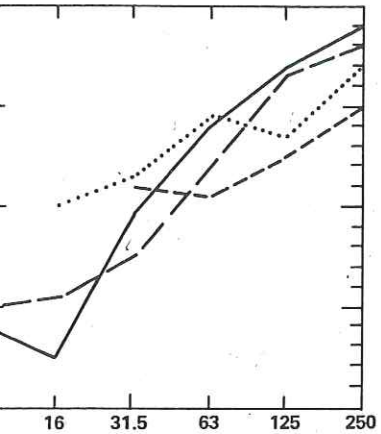
In this case however the screening benefit to main studio would not be perceived by the main studio because the dominant sound path from the train tunnels would continue to be the nearer direct path. With the other smaller studios they are on isolated bearings and so there is currently no noise impact. That will continue to be the case with the TV room basement constructions present.

The effects of this screening I refer to can actually be seen in the readings by Civil Engineering Dynamics, the noise levels from the further northern line tunnel being around 3dBA less than the nearer tunnel. That 3dB attenuation can expected to be mostly due to the closer tunnel acting as a noise screen to the second tunnel, the differences in distance between the two being unsubstantial, (and hence the additional distance attenuation).

Civil Engineering Dynamics also speculate as to the impact of other train lines. The nearest of those are some 100m to the north. The others are over 150m away to the south. They do not identify any impact of these upon the studios currently and so this would continue to be the case for the reasons identified above.

Yours sincerely

Neil Jarman

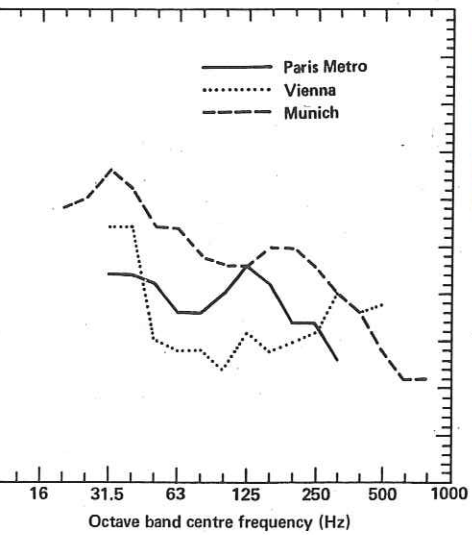


6.20 Difference in tunnel vibration levels between onal track and floating slab track (level without floating l with floating slab). ——, New York (NYCTA) continuous slab, support frequency $f_0 \approx 16$ Hz;[65] — —, Washington, DC) continuous concrete slab, $f_0 = 16$ Hz[33] – – – – –, Cologne us concrete trough containing a conventional tie/ballast 10 Hz;[66] . . . . ., Frankfurt discontinuous precast concrete $f_0 \approx 10$ Hz[67]

tunnels. However, below about 31.5 Hz the levels from lar tunnel are 0–10 dB lower.

ported reductions in groundborne noise and vibration from changes in the average tunnel wall thickness rom 5 to 18 dB per doubling of the wall thick-[9,70,71]

er research is needed to provide better estimates of the f tunnel wall thickness and of tunnel/soil interaction. n increased tunnel wall thicknesses imply increased tion costs, greater thickness designs may provide the oise reduction more inexpensively, more reliably, and maintenance requirements than, say, floated slab track ner walled tunnel.



21 Measured change in vibration with ballast mats[33] mat–level without mat).

16.6.4 Screening

Trenches (either open or backfilled with light-weight waterproof filler) or solid barriers (such as concrete-filled trenches) have seen only limited use as a method for controlling groundborne noise and vibration from rail systems. Both screening approaches provide an impedance mismatch in the soil so as to interrupt the wave propagation path.

In order to alleviate a groundborne noise problem at a TV studio in a building located about 2.5 m (8.2 ft) from the wall of a rapid transit tunnel, a trench was installed between the tunnel and the building. Measurements were taken before the work began, after excavation of all the soil between the tunnel and the building, to the depth of the bottom of the tunnel and after backfilling the trench to its final width of 20 cm (7.9 in). The basement floor of the building was about 2.3 m (7.5 ft) below the bottom of the tunnel (and trench). Noise reductions in the studio of 8 and 4 dB(A) were obtained before and after the trench was backfilled.[72] The dominant octave band in all cases was 63 Hz.

The results of a test conducted with steel sheet piles (9 m [30 ft] deep and 50 m [165 ft] long) driven in two rows near a Shinkansen aerial structure[73] yielded about 15 dB of reduction in the ground surface vertical acceleration level at 12 m (39 ft), about 4 dB at 20 m (66 ft) and 0 dB at 50 m (164 ft). The reduced effectiveness at larger distances may be due in part to flanking around the ends of the sheet piles.

In another test on the Shinkansen[73] concrete piles (40 cm [16 in] in diameter) were driven in a continuous line about 4 m (13 ft) from an existing (apparently at-grade) track. When driven to a depth of 5 m (16 ft), these piles resulted in a vibration reduction of about 10 dB at 7 m (23 ft). For piles driven to a depth of 3 m (10 ft), the reduction was only about 2 dB.

The Toronto Transit Commission[74] built a 'U'-shaped trench, whose side parallel to the track was 24 m (80 ft) long and whose ends (perpendicular to the track) were 10 m (34 ft) long. The trench was 4.3 m (14 ft) deep and filled with 10 cm (4 in) thick styrofoam. The side parallel to the track was 8 m (26 ft) from the at-grade track centreline. The typical reduction in the ground acceleration level at 9.8 m (32 ft) was 5 dB with reductions at some locations of up to 10 dB.

Some general guidelines for trench and soil barrier design are given by Barkan,[29] Richard *et al.*,[75] Haupt[76] and Dolling.[77] The primary concern is to provide a trench of sufficient depth to attenuate the primary wave type causing the vibration at the receiver location. Thus, for Rayleigh (surface) waves, the trench depth should be in the order of the Rayleigh wavelength at the dominant frequency. In typical soils, the Rayleigh wavespeed is in the order of 200 m/s (660 ft/s) and the dominant frequency from train vibrations is about 50 Hz. Thus, the Rayleigh wavelength is about 4 m (13 ft).

16.6.5 Building isolation

Insertion of isolation pads in buildings under foundation piles, at column bases or crowns, and at other structural connections can assist in protecting selected buildings or areas within buildings from noise and vibrations. Lead–asbestos pads have found considerable use in isolating large buildings from railroad and subway-induced noise and vibration in New York City since about 1915. More recently (in the 1960s) these pads were used in the construction of Montreal's Queen Elizabeth Hotel and New York's Avery Fisher Hall (formerly the Philharmonic Hall) and appear to result in significant vibration isolation, in the order of 10 dB.[78]

Elastomeric bearing pads have been used in building foundations in the United Kingdom for the purpose of noise and vibration isolation from rail systems since 1964.[79] The general

Appendix 14

Alan Baxter Associates Letter to Camden Council dated 14th March 2016

Alan Baxter
INTEGRATED · DESIGN

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BY SCANNED LETTER VIA E-MAIL

Our Ref: 1693/11/MC/jmc

Tom Croft
Thomas Croft Architects
9 Ivebury Court
325 Latimer Road
London
W10 6RA

14 March 2016

Dear Tom

11 Rosslyn Hill – Civil Engineering Dynamics

You have asked for our comments in relation to the report recently received from Civil Engineering Dynamics (CED).

CED set out their issues in paragraph 2.4. They refer to noise and vibration during construction and to the long term impacts. The construction issues have been dealt with at length in the Cole Jarman reports and we have dealt with the structural damage and structural movement issues in our work, which has been accepted by CRH. In summary there is no structural damage, as clearly set out in our reports. This deals with CED's points 2.4.2, 2.4.3 and 2.4.4 and leaves 2.4.1; ground borne noise and vibration from underground railway tunnels. I am surprised that CED are raising this, especially as the tunnels are deep and remote from the site, but I am able to offer some comments on the situation based on our experience of the design of buildings containing or adjacent to vibration sensitive equipment much closer to LUL assets than Lyndhurst Hall. Cole Jarman should be able to confirm these.

We have worked on several projects where underground railway noise and vibration has had to be considered, including a very large basement for the London Clinic, very close to the Metropolitan and Circle line tunnels and a basement at St Martins-in-the-Fields close to and above the Northern line (see attached details).

It is not credible that significant energy could somehow be reflected or reradiated into the structure of Lyndhurst Hall from the proposed new structures at number 11.

2/...

ABA STRUCTURAL & CIVIL ENGINEERING URBAN DESIGN MASTERPLANNING TRANSPORT & MOVEMENT CONSERVATION SUSTAINABILITY

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Alan Baxter Ltd is a limited company registered in England and Wales, number 06600598. Registered office as above.

The vibrations from the Northern line, which have been measured by CED, are very small indeed and the direct noise path through the ground to Lyndhurst Hall that causes these is much shorter than any reflected noise path would be. The longer reflected noise paths (if indeed reflected noise is a factor, which we believe not to be the case) mean that more energy would be dissipated. Also, the new concrete sub structures are very much stiffer than the clay in which they sit, so they will absorb energy from the ground much more than reflect it. The nature and arrangement of the piled walls with gaps between circular piles, is not like a solid plane wall in terms of reflection. The configuration will result in dissipation and absorption of the noise. CED state that the basement structures may provide a more efficient transmission of ground borne noise and vibration. We do not agree that this is a possibility, based on the configuration and disposition of the new structures and the longer sound path in the ground to them, than the direct sound path to the Hall. The attached marked up sketch illustrates this.

It is significant to note in CED's fig 7.2 that the noise from the further Northern line tunnel is much less than that measured for the nearer tunnel. The noise path from the further tunnel is 1.2 times longer than the noise path from the nearer tunnel, and the noise strength is approximately half. From the sketch I have produced, the noise paths (if there is any reflected noise) from the nearer underground tunnel via the new basements to Lyndhurst Hall are more than double the length (2.1 and 2.2 times) and as noted, the new basement structures will absorb most if not all of the noise.

The BS references CED quote are about piles concentrating loads into the buildings founded on them and not into adjacent buildings.

The Royal Free will be subject to similar minor underground noise and vibration, but from what we are able to establish, they are not taking any special measures in their new development proposals which include a new basement and with piled foundations and housing sensitive medical equipment.

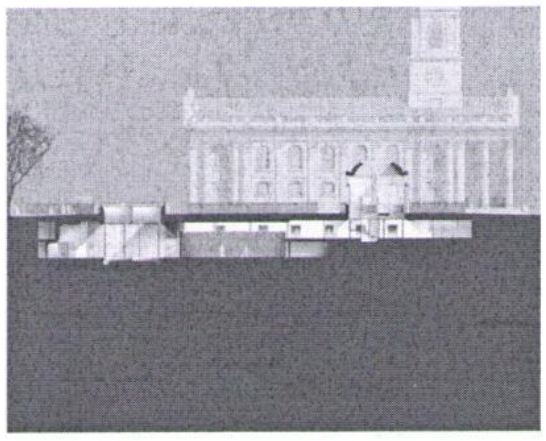
Nothing that our clients are proposing will change this once their project is complete and they have dealt with the issues that need to be considered during construction, as far as I am aware.

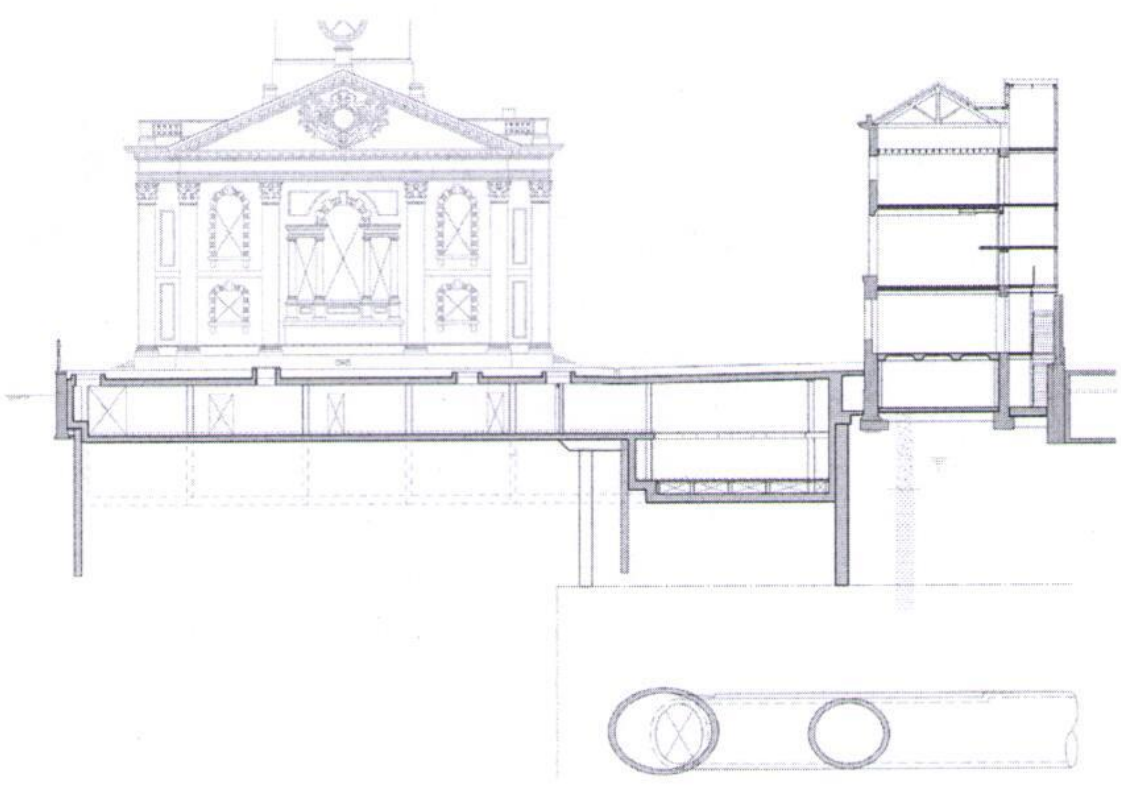
Yours sincerely

Michael Coombs
for Alan Baxter Ltd

St Martin-in-the-Fields, London

St-Martin-in-the-Fields is a landmark building of world renown, combining worship, education and social care within one of the nation's most splendid ecclesiastical settings. We have acted as engineers on a major extension of the listed Grade I church that has included the careful removal of existing vaults and the construction of a new double basement structure beneath the church yard between two sensitive buildings. The new basement has been constructed on a highly constrained site over the Northern line and between listed buildings requiring careful consideration of ground movements and sequencing.
Client: St Martin-in-the-Fields





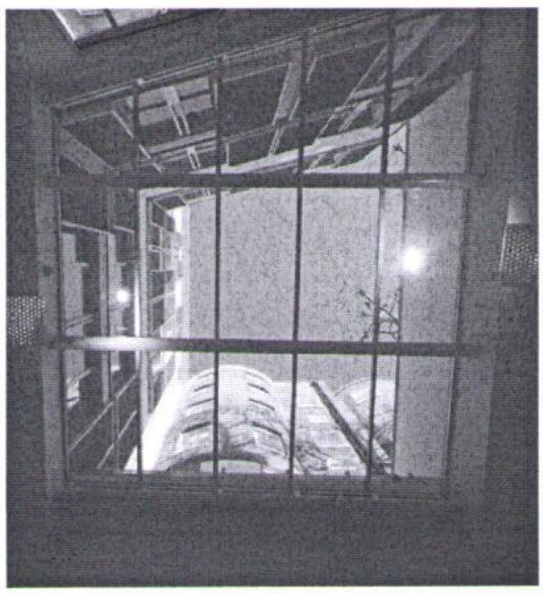
THE NEW BASEMENT IS USED FOR FUNCTIONS AND PERFORMANCES

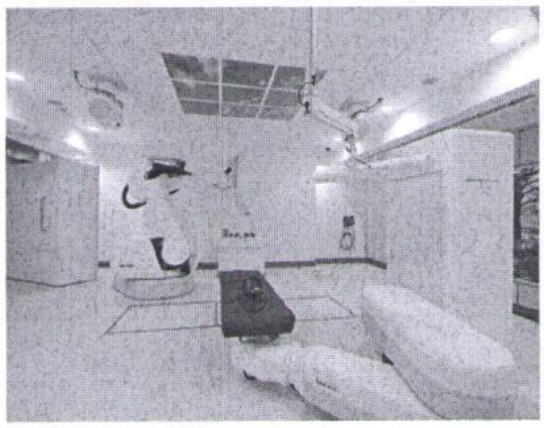
NO SPECIAL MEASURES WERE INCORPORATED TO DEAL WITH GROUND BORNE NOISE FROM THE NORTHERN LINE.

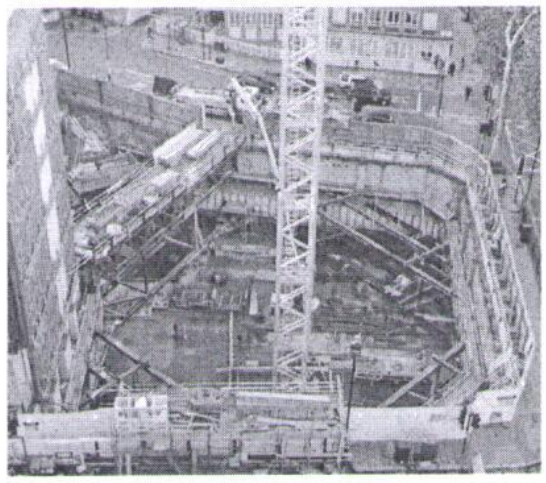
The London Clinic

A substantial building on Marylebone Road has been the imposing home of the London Clinic for 75 years. We have recently completed a major new cancer centre, which also acts as a new deliveries and servicing hub for the entire hospital. It is linked to the 1932 hospital by a new tunnel under Devonshire Place. This was a highly complex project for which we were responsible for civil and structural engineering design and highways and transport issues. The new building, for example, houses lined linear accelerator bunkers in a 15m deep basement. In addition, an adjoining listed Georgian town house has been restored and integrated into the scheme. The tremendous constraints of the site added to the challenge, with a major road artery, the Circle and Metropolitan underground line and extensive services just a few metres away.

Client: The London Clinic







THE NEW BASEMENT

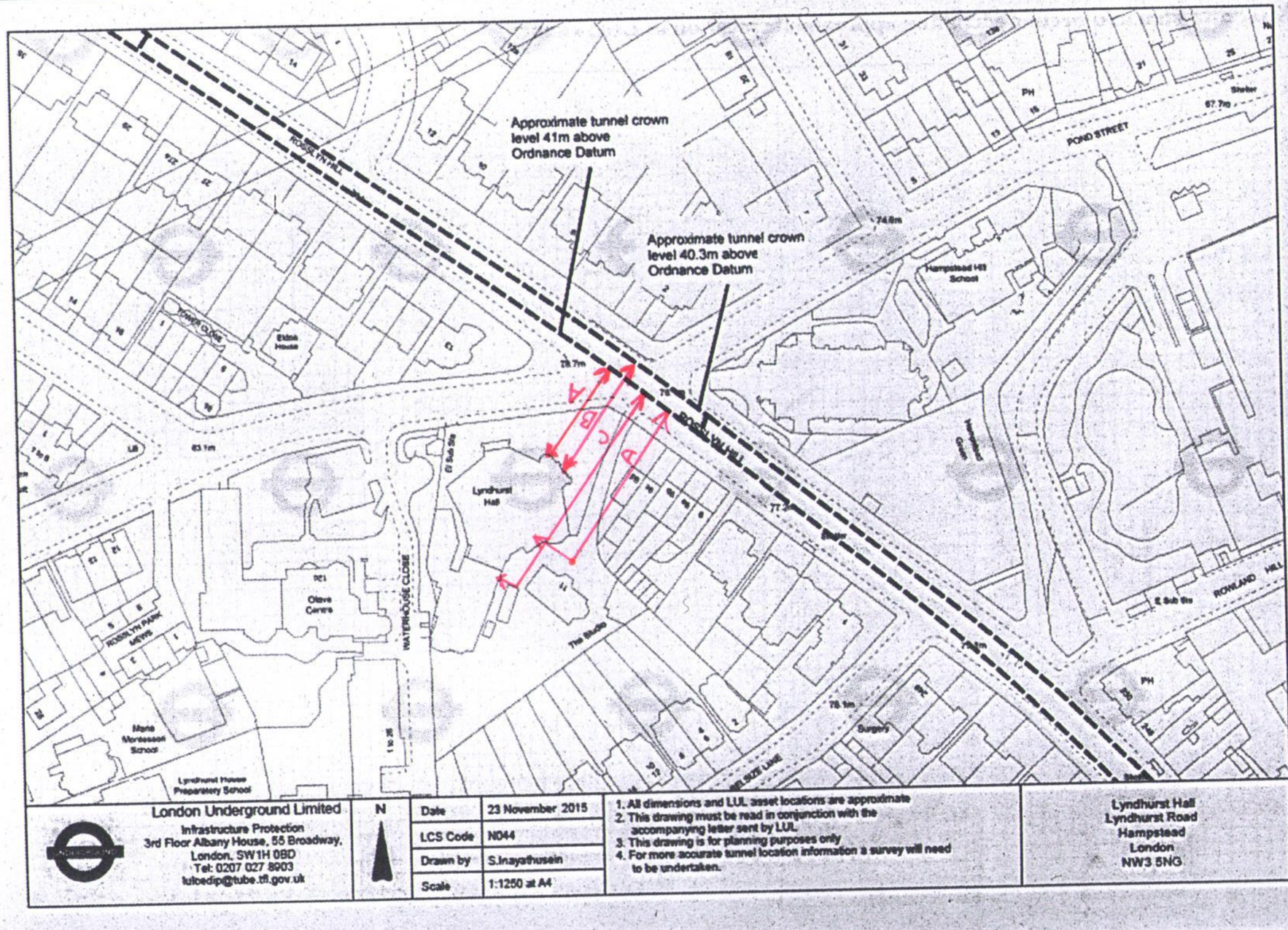
CONTAINS VIBRATION SENSITIVE MEDICAL EQUIPMENT BUT NO SPECIAL MEASURES WERE NEEDED TO DEAL WITH GROUND BORNE NOISE AND VIBRATION FROM THE UNDERGROUND LINES.

A = Direct Noise path from closer Tunnel to Lyndhurst Hall

B = Noise path from further Tunnel to Lyndhurst Hall B = 1.2 × A

C = Noise path via cinema Basement C = 2.2 × A

D = Noise path via Rear Basement D = 2.1 × A



Appendix 15

Email Correspondence from Environmental Health Officer to Planning Officer

Samantha Humphrey

From: Davis, Edward <Edward.Davis@camden.gov.uk>
Sent: 05 July 2016 08:36
To: Tulloch, Rob
Subject: 11 Rosslyn Hill 2015/2089/P (Air Studios, Lyndhurst Hall)

Hello Rob

In reference to the above application I do not wish to object to the application but on the basis of the information available to me and in depth assessment of technical data received. I recommend that any approval that might be granted be subject to the following conditions:

Prior to commencement of the development hereby approved, a demolition/construction management plan shall be submitted to and approved in writing by the Council. Details shall include control measures for site **acoustic screening**, pest control, dust, noise, **vibration control**, lighting, delivery locations, restriction of hours of work and all associated activities audible beyond the site boundary to 0800-1800hrs Mondays to Fridays and 0800 -1300hrs on Saturdays, advance notification to neighbours and other interested parties of proposed works and public display of contact details including accessible phone contact to persons responsible for the site works for the duration of the works. Approved details shall be implemented throughout the project period.
Reason: To ensure that the amenity of occupiers of surrounding premises is not adversely affected by **noise**, **vibration**, pest, dust, lighting or other emissions from the building site.

Given the sensitivity of the site to noise:
Prior to use of the development, details shall be submitted to and approved in writing by the Council, of the external noise level emitted from plant/ machinery/ equipment and mitigation measures as appropriate. The measures shall ensure that the external noise level emitted from plant, machinery/ equipment will be lower than the lowest existing background noise level by at least 10dBA, by 15dBA where the source is tonal, as assessed according to BS4142:2014 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at **maximum capacity**. Approved details shall be implemented prior to occupation of the development and thereafter be permanently retained.
Reason: To ensure that the amenity of occupiers of the development site/ surrounding premises is not adversely affected by noise from plant/mechanical installations/ equipment.

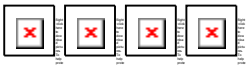
Prior to commencement of the development, details shall be submitted to and approved in writing by the Council, of building site vibration levels generated by the demolition/construction etc. together with appropriate mitigation measures where necessary. The vibration criteria to be met are: Vibration for occupiers 0.5mm.s-1and Structural vibration 3.0 mm.s- within the nearest vibration sensitive premises. The assessment method shall be as specified in BS 6472:2008. No part of the development shall commence until the approved details have been agreed. Approved details shall thereafter be permanently retained during the construction period.
Reason: To ensure that the amenity of occupiers of the surrounding premises is not adversely affected by ground- or airborne vibration.

Prior to commencement of the development, a noise assessment shall be submitted to the Council detailing proposed construction site noise levels and proposed site sound acoustic screening that will meet the following studio internal noise limit of 25dB LAmax,s

Construction noise break-in from the development shall achieve an internal noise level of NR15 in any recording studio room of the adjacent premises. These levels are to be permanently maintained during the construction period.

Edward Davis
Noise Officer
Regeneration and Planning
Culture and Environment
London Borough of Camden

Telephone: 02079744501
Mobile: 07967652382
Web: camden.gov.uk
Town Hall Extension (Culture and Environment)
Argyle Street
London WC1H 8EQ



Please consider the environment before printing this email.

Samantha Humphrey

From: Davis, Edward <Edward.Davis@camden.gov.uk>
Sent: 11 July 2016 13:27
To: Tulloch, Rob
Cc: Wallas, Vicky
Subject: RE: 11 Rosslyn Hill

Hello Rob,

I have carefully considered all the submitted documentation pertaining to noise and vibration. Firstly there has been a number of professional reports produced for and against the development and my current views are as follows:

The applicant has submitted what I consider to be a provisional CMP and acoustic assessment. The acoustic report did not seem to cover how noise mitigation would or could be carried out during the actual construction phase as this will be the time there would be a greater impact on the amenity.

There were claims that the main piling vehicles would be brought on site vis 7.5T vehicles but once I had made a site visit that has been questioned as the vehicular access to the site seems to be quite restrictive and unlikely such piling equipment could be delivered by such means. To date this question has not been fully answered but can be clarified within a revised CMP.

There have been objections from Air Studios which we have looked into quite intensely and although some valid points have been raised I feel to the most pat the applicant has worked to resolve most of the issues raised.

The grey area on the most part is what is being objected against is not quantifiable as we are looking at the perceived risk that may or may not occur during the construction phase. We have taken on-board the potential risk and are of the view this can again be conditions before any development commences.

The fact that clients of the studios may not like a construction site next door is not a consideration for refusal but if it can be competently shown the risk can be migrated against then the development should be granted on that basis.

From an environmental noise prospective it is important to preserve the current noise and vibration levels within the nearby studios so as not to have an adverse effect on the running of the business and once construction is complete there is very little evidence to show that there will be a negative impact from the actual use of the development. We have looked at the current operating levels and parameters of the studios and are happy that noise and vibration can be conditioned.

We were happy to see the revised layout of the development put forward by the applicant given the concerns of excess noise and vibration but again there is lack of detail at this moment within the provisional CMP and acoustic information how construction noise and vibration will be controlled.

We have looked at all the points and are happy that the points of concern can be controlled by strict conditions given the sensitive nature of the locality and there is no real evidence to refuse under environmental grounds and hence strict conditions have been sent to planning to consider.

The main question that will need to be considered by the applicant is that the cost of the level of noise mitigation required may outweigh the actual cost of the development itself but that is not a consideration for me to refuse. So at this point I do not wish to object to the application but on the basis of the information available to me . I recommend that any approval that might be granted be subject to the following conditions:

Prior to commencement of the development hereby approved, a demolition/construction management plan shall be submitted to and approved in writing by the Council. Details shall include control measures for **construction site acoustic screening**, pest control, dust, noise, **vibration control**, lighting, delivery locations, restriction of hours of work and all associated activities audible beyond the site boundary to 0800-1800hrs Mondays to Fridays and 0800 - 1300hrs on Saturdays, advance notification to neighbours and other interested parties of proposed works and public display of contact details including accessible phone contact to persons responsible for the site works for the duration of the works. Approved details shall be implemented throughout the project period.
Reason: To ensure that the amenity of occupiers of surrounding premises is not adversely affected by **noise**, **vibration**, pest, dust, lighting or other emissions from the building site.

Given the sensitivity of the site to noise:
Prior to use of the development, details shall be submitted to and approved in writing by the Council, of the external noise level emitted from any plant/ machinery/ equipment and mitigation measures as appropriate. The measures shall ensure that the external noise level emitted from plant, machinery/ equipment will be lower than the lowest existing background noise level by at least 10dBA, by 15dBA where the source is tonal, as assessed according to BS4142:2014 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at **maximum capacity**. Approved details shall be implemented prior to occupation of the development and thereafter be permanently retained.
Reason: To ensure that the amenity of occupiers of the development site/ surrounding premises is not adversely affected by noise from plant/mechanical installations/ equipment.

Prior to commencement of the development, details shall be submitted to and approved in writing by the Council, of building site vibration levels generated by the demolition/construction etc. together with appropriate mitigation measures where necessary. The vibration criteria to be met are: Vibration for occupiers 0.5mm.s-1and Structural vibration 3.0 mm.s- within the nearest vibration sensitive premises. The assessment method shall be as specified in BS 6472:2008. No part of the development shall commence until the approved details have been agreed. Approved details shall thereafter be permanently retained during the construction period.
Reason: To ensure that the amenity of occupiers of the surrounding premises is not adversely affected by ground- or airborne vibration.

Prior to commencement of the development, a noise assessment shall be submitted to the Council detailing proposed construction site noise levels and proposed site sound acoustic screening that will meet the following studio internal noise limit of 25dB LAmax,s

Construction noise break-in from the development shall achieve an internal noise level of NR15 in any recording studio room of the adjacent premises. These levels are to be permanently maintained during the construction period.

If you have any queries please do not hesitate to contact me.

Regards

Edward Davis
Noise Officer

Telephone: 02079744501

From: Tulloch, Rob
Sent: 09 July 2016 08:53
To: Davis, Edward
Subject: RE: 11 Rosslyn Hill

Hi Edward,

No, I only got the recommended conditions.

Regards

Rob Tulloch
Senior Planning Officer
Regeneration and Planning

Telephone: 020 7974 2516

From: Davis, Edward
Sent: 08 July 2016 14:41
To: Tulloch, Rob
Subject: Re: 11 Rosslyn Hill

Hi Rob,

Did I not send you mine in the week?

Edward Davis

On 8 Jul 2016, at 12:56, Tulloch, Rob <Rob.Tulloch@camden.gov.uk> wrote:

> Hi Guys,
>
> I need to have my report done on Monday. Any chance I can get your obs?
>
> regards
>
> Rob Tulloch
> Senior Planning Officer
> Regeneration and Planning
>
> Telephone: 020 7974 2516

Appendix 16

Alan Baxter Associates Letter to Camden Council dated 7th August 2015

11 Rosslyn Hill, Hampstead

Structural Engineering note responding to reports prepared by Corbett and Tasker dated 27 May 2015 and Geotechnical and Environmental Associates report dated 4 June 2015

Contents

1.0 Introduction

Alan Baxter Ltd (ABA) are appointed by Mr and Mrs A Jeffreys, the owners of No. 11 Rosslyn Hill, to provide structural engineering input in relation to their proposal to form two new basement areas as extensions to their existing basement. ABA have provided advise on the best structural engineering practice for basement development to the Royal Borough of Kensington and Chelsea and Westminster City Council which has informed the development of their planning policies in relation to residential basements. We have also designed and advised on many basement developments throughout London. We act for the Crown Estate in respect of basement proposals put forward by their leaseholders. We have advised Crossrail on the impact of tunnelling works on all of the listed buildings along its route and have worked for many years on some of our nation's most important buildings. We have all of the requisite skills and experience to deliver this project technically. We have a reputation for the high standard for our engineering work. We have worked on numerous basement projects, many of far greater complexity than this without any problems.

Following the submission for the planning application for the extension Mr and Mrs Jeffreys' neighbour, Air Studios (Lyndhurst) Ltd have employed their own technical consultants to review the proposed scheme. These notes have been prepared in response to two reports received from Air Studios. These are:

A) Corbett and Tasker (C&T) report dated 27 May 2015 – (Appendix A)
B) Geotechnical and Environmental Associates (GEA) report dated 4 June 2015 – (Appendix B)

Following the receipt of C&T and GEA's reports we wrote to C&T requesting some of the information referred to in their report and suggesting a meeting at Lyndhurst Hall to discuss the issues raised. This request was refused. Copies of this correspondence are included in appendix C

These notes provide further information relating to the existing structural arrangement of Lyndhurst Hall and the impact of the proposed basements on the hall. Our responses to each of the points raised in the above reports are set out in sections 3 and 4.

2.0 Lyndhurst Hall

2.1 Historical development

Lyndhurst Hall was designed by the British architect, Alfred Waterhouse (1830 – 1905) best known for his designs of Manchester Town Hall (1868) and the Natural History Museum (1873). The Hall was built as the Rosslyn Grove congregational church in 1883. Waterhouse's original drawings for the hall (Appendix D) show that it is a substantial loadbearing masonry structure constructed adjacent to No.11 Rosslyn Hill which was already in existence at the time of the Church's construction. There was a small schoolroom at the rear of the Church Site attached to the main church hall. At first floor level above the school room was a lecture hall. Beneath the schoolroom was a partial basement. The 1894 ordnance survey map shows a small cottage, Lyndhurst Cottage, connected to the church. The cottage is not shown as part of Waterhouse's scheme but must have

been constructed either shortly after the church or as an addition to the church's construction contract.

In 1905 the school wing was extended by architects Spalding and Spalding. This involved the partial demolition of the end of Waterhouse's school room and the addition of a three storey extension. At some stage an additional storey has been added above Waterhouse's schoolroom and lecture hall. It is likely this is contemporary with Spalding and Spalding's extension.

Lyndhurst Hall was listed Grade II in 1974.

The church closed in 1978.

Between 1980 and 1984 there were various proposals to convert Lyndhurst cottage and the upper storey of the school room to residential use (Extracts of the drawings showing these proposals are included in appendix E).

In 1992 the building was converted to a recording studio to designs prepared by Heber Percy and Parker. The works included the creation of new facilities for the new acoustically isolated recording studio detailed on a new mezzanine above first floor level in the 1905 extension. A new lift shaft was also installed within the building where Lyndhurst Hall is linked to Lyndhurst Cottage (Appendix F).

2.2 Existing structure and condition

The geology on the site of Lyndhurst Hall comprises made ground over London Clay. The geological map for the area produced by the British Geological Survey indicates that the boundary of the Claygate beds, which form the top strata of the London Clay formation, passes to the west of No11 Rosslyn Hill and Lyndhurst Hall.

The course of the River Fleet runs from the Hampstead ponds on the Eastern side of the Royal Free Hospital approximately 400m to the East of the site. The River Tyburn runs approximately 400m to the south of the site. This is based on Camden's Geological, Hydrogeological and Hydrological study – guidance for sub-terranean development prepared by Arup dated November 2010. Figure 11 from this report shows watercourses in the Camden area (Appendix G). The Arup study is based on Nicholas Barton's book "The Lost Rivers of London".

Waterhouse's original church building comprises load bearing masonry walls supported on corbelled brick footings and built on mass concrete strips. Waterhouse was an experienced and accomplished Architect by the time he designed Lyndhurst Hall. He had already completed the Natural History Museum and Manchester Town Hall and his designs for the church are well considered. The underside of the concrete strip footings were set at a level that bears onto the London Clay. The roof to the Main Church Hall comprises iron trusses which span between six masonry piers in the corners of the hexagonal hall. The iron roof trusses support a timber lantern at

the centre of the roof. Beneath the roof structure are plaster roof finishes. This arrangement is typical of many church buildings built around this time where the ceiling finishes are supported on a secondary framework of timber members that span between the members of the main roof structure.

There are three wings connected to the volume of the Hall which are occupied by the balcony seating. The original church organ is positioned facing these balcony wings.

Waterhouse's design for the schoolroom and lecture hall was also in loadbearing masonry. The footings for this part of the building are also corbelled brick and mass concrete strip footings bearing onto the London Clay. The partial basement beneath the north-west side of the schoolroom building is also supported on brick and concrete footings into the clay at a lower level. The roof of the school room building originally comprised timber king post trusses spanning between the external walls. These king post trusses were removed when a storey was added to the building.

We have not been granted access to Lyndhurst Hall to review its condition internally, however based on our observations externally the building is in good condition for its age and type of construction.

2.3 Impact of proposed basement development on Lyndhurst Hall

It is important to note that the proposed basement on the Lyndhurst Hall side of 11 Rosslyn Hill is not a deep basement. The basement is to be built using a fully propped contiguous piled wall to minimise and control ground movements in recognition of the fact that this construction is to take place between two listed buildings.

Camden's guidance for the design of residential basements requires that the structural impact on adjoining buildings shall be less than damage category 2 in accordance with the Burland category of damage. This was confirmed in our BIA.

We assessed the damage in accordance with the guidance contained in CIRIA report 580 which provides conservative estimates of ground movements (i.e. it overestimates them). We looked at the buildings adjacent to the proposed basements and concluded the following:

Building	**Category of damage**
Single storey garages at rear of Rosslyn hill houses	Category 2 Slight
11 Rosslyn Hill	Category 2 Slight
Lyndhurst Hall	Category 1 Very Slight

However, since receiving the report from C&T we have undertaken further work to refine our initial assessment of predicted ground movements. Reference has been made to the technical paper prepared by Richard Ball and Nick Langdon of CGL Card Geotechnics regarding the Prediction of party wall movements using CIRIA report 580 (Appendix H). The report shows that predicted movements using the CIRIA guidance can be significantly reduced for contiguous piled walls in London Clay where construction controls such as hit and miss construction are put in place. The paper gives guidance based on more realistic predicted ground movements where such measures are put in place and where "rigorous monitoring methodologies [are used] set against rationally designed trigger limits". Careful control of the proposed construction sequence and monitoring

regime will be used on this project and a high degree of quality control will be in place throughout the construction process. On the basis of the guidance in the above technical paper the predicted damage category for the modern single storey buildings to the east of the site damage can be limited to category 1. The damage categories for both Lyndhurst Hall and 11 Rosslyn Hill can both be limited to damage category 0, i.e negligible. Our further assessment is included in Appendix I.

3.0 Response to issues raised in Corbett and Tasker report

The following section of this report provides a response to each of the issues raised by C&T and provides our response to the points raised in **bold**. The relevant text from C&T's report is extracted in *italics* for ease of reference.

a) C&T statement contained in Section 2 i)
There is a vaulted roof structure over the main studio of Lyndhurst Hall which is around 27m at the highest point.

The roof structure over the hall is not vaulted as suggested by C&T. Waterhouse's original drawings clearly show the roof structure is iron trusses with timber purlins and rafters. The ceilings are suspended from this arrangement.

b) C&T statement contained in Section 2 ii)
The special nature of Lyndhurst Hall's construction make it particularly susceptible to damage from ground movement, however very limited consideration of this is demonstrated in the BIA. We understand from our Client that the Engineers for 11 Rosslyn Hill have not inspected or visited Lyndhurst Hall, and there are no studies of its construction or full assessment of the impact of the proposed basement construction on its structural fabric contained within the BIA.

Our study of the construction of Lyndhurst Hall described in section 2 of these notes and in the BIA shows that the construction of Lyndhurst Hall comprises loadbearing masonry walls that are founded on deep strip footings onto the London Clay. The walls are detailed with substantial buttresses on their external faces which means they are robust. They are constructed in lime mortar which means they are far more tolerant of building movements than modern forms of construction. The building is generally in good condition for its age and type of construction. Based on our findings we do not agree that the structure is "particularly susceptible to damage from ground movement". The building has demonstrated its ability to tolerate movements given its good condition after 130 years. Its nature and construction mean that it will not be adversely affected by the very minor movements predicted.

We have proposed visiting site with Air Studios technical advisors to discuss these matters however this request has been refused making further study of their building impossible at this stage.

c) C&T statement contained in Section 2 ii)
Clause 2.41 of Camden Planning Guidance 4 (CPG 4) specifically requires a Structural Stability Assessment for basement construction at or adjacent to listed buildings and it is clear to us from our review of the BIA that this has not been carried out.

We did undertake a structural stability assessment of both 11 Rosslyn Hill and Lyndhurst Hall when preparing the BIA, which informed the proposed scheme. We concluded that the form of construction of both buildings is such that there are no significant issues with the construction of the proposed basements.

Our assessment of the impact of the proposed basement construction on Lyndhurst Hall is provided in Appendix I and in section 2 of this note. The anticipated impact on Lyndhurst Hall and 11 Rosslyn Hall falls well within the requirements defined in Camden's planning policy.

d) C&T statement contained in Section 2 ii)
No drawings of Lyndhurst Hall are provided in the BIA and there are no section drawings showing the new basement's relationship with the structure of Lyndhurst Hall.
We have sketched out some approximate sections through Lyndhurst Hall and the proposed basements which begin to investigate and demonstrate the effects of the basement construction on the Hall, as well as highlight some potential issues that the Hall's presence may have on the setting out, design and construction of the basements.

Drawings are provided showing the structural arrangement of Lyndhurst Hall and sections are attached (Appendix J) showing the relationship of the proposed basements to the Hall.

C&T's section SKA shows a section through the cinema basement where it is adjacent to the hall. Their SKB shows the swimming pool basement which is near to one of the wings to the main church hall. Both of these sketches suggest that the footings of Lyndhurst Hall may have been underpinned in the past. The original plans for the building clearly show that the footings were originally constructed on mass concrete strip footings. This is consistent with the findings of the trial pit investigation included in the BIA. The suggestion that the concrete is underpinning is not correct and the sketch sections are misleading.

e) C&T statement contained in Section 2 iii)

Contained within the BIA is a crack assessment using the Burland scale, related to the length of Lyndhurst Hall, following a process set out in a CIRIA technical guide; however, no consideration has been given to ground movements, horizontal or vertical, on the stability or cracking of the triple height vaulted roof structure of Lyndhurst Hall main studio. See figure 2 below for an approximate assessment we have sketched out based on the limited information to hand.
It is well known that the Burland damage assessment procedure cannot be used on its own as a direct measure of damage to property yet this is the only approach used in the BIA.

As described in section 2 the roof structure of the Lyndhurst Hall main studio is not a "vaulted roof structure" as C&T suggest but an iron and timber roof construction with suspended finishes hung beneath it. Furthermore the closest masonry pier supporting this roof structure is around 14m from the proposed excavation. The ground movements predicted at this distance are very small and will have negligable impact on the walls supporting the trussed roof over the main church hall.

C&T sketch (figure 2) indicates an "approximate deflection profile due to settlement of the ground". The profile drawn would be consistent with an unpropped excavation. This is not what is proposed and is misleading. For the section of basement indicated in C&T's Figure 2 a 'top down' construction methodology is proposed. This involves casting the roof slab before carrying out the excavation and acts as a very stiff prop to the top of the retaining wall throughout the construction process. The deflection profile shown is therefore incorrect.

f) C&T statement contained in Section 2 iv)
A single trial pit has been dug to expose the foundations of Lyndhurst Hall, the results of which have been extrapolated across the entire building by the engineers compiling the BIA, based on the assumption that it represents the footings to the entire building. The trial pit however is unlikely to be typical. Neither is it clear from the BIA as to where the trial pit was made, as the sketches and drawings provided are contradictory. It is understood from our client that Lyndhurst Hall was partially underpinned during its conversion in the early 1990s and in some areas beneath the building there are basements, resulting in the foundations being of variable depth.

The trial pit has been undertaken in the location where the proposed basement is adjacent to the hall and the record drawings provide further supporting information which support the assumptions made regarding the footing depths of the hall. The approach taken in investigating the foundations of the hall are not unusual and it is not sensible or necessary to undertake investigations to confirm every detail of the existing buildings foundations. The information obtained combined with the record information regarding the existing building gives a good level of confidence in relation to the footing arrangements of Lyndhurst Hall where these are required to understand the impact of the proposed basement construction.

We have marked the location of the trial pit on the plan in Appendix J so that there is no uncertainty with regards to the location of the pit.

Based on the drawings submitted by Heber Percy and Parker for the conversion of Lyndhurst Hall into a recording studio, the only works that are shown that may have required underpinning were the installation of a new lift pit which is located in the link building between Lyndhurst Hall and Lyndhurst cottage. This is on the opposite side of the hall to No 11 Rosslyn Hall. There is a existing basement which was part of Waterhouse's original building. This is also on the opposite side of the hall to No11 Rosslyn Hill and is clearly shown on the original drawings. Clearly the foundations for the basement walls are set much deeper into the London Clay than the other walls of the building. However, this does not introduce uncertainty about the levels of the foundations of the building in the way that C&T suggest.

g) C&T statement contained in Section 2 iv)
The foundation construction of Lyndhurst Hall will strongly influence the proposed adjacent basement design and construction and requires more extensive consideration in the BIA. Where the foundations are shallower they may not prevent perched groundwater flows through the made ground layer over the London Clay beneath our Client's building, as assumed in the BIA, and where there are underground features this needs to be considered properly in the design, construction and location of the new basement. See figure 3 below for a detailed section showing the existing foundations and the proposed basement, deduced from the information provided, which suggests that the basement is too close to Lyndhurst Hall.

The depth of the existing foundations for Waterhouse's original design of Lyndhurst Hall are shown on the record drawings in Appendix D. We have used this information and the findings from the trial pit investigation undertaken against the 1905 extension to the hall to plot the foundation depths of Lyndhurst hall adjacent to the areas of proposed basement. This is shown in the drawings in appendix J. The level of the footings in each of the sections produced is consistent with the building being founded into the London Clay. It is inconceivable that an architect of the calibre of Alfred Waterhouse would have founded the Church on the made ground which overlies the clay. In addition, the building is clearly founded on a sound bearing strata given its condition after 130 years. On this basis Lyndhurst Hall must act as a cut off to perched ground water as described in the BIA.

The section produced by C&T in their figure 3 is incorrect. Based on the record drawings and the physical investigations on site included in the BIA there will be no clash between the proposed construction and the existing footings of the hall. The correct relationships are shown in Appendix J.

h) C&T statement contained in Section 2 v)
Appendix J of the BIA contains some very basic calculations for a 600mm diameter contiguous piled wall with a 10kN/m2 surcharge load behind the wall; however the section of proposed basement containing the cinema, which abuts our clients foundations and southern boundary wall, is constructed using piles of 450mm diameter and the surcharge load behind this wall will be the bearing force underneath the foundations, significantly higher than the 10kN/m2 allowed for. Therefore the structural calculations of the basement provided do not appear to consider the actual loads being imparted to the soil by our clients building, nor does it seem that there is a justification in the selection of 450mm diameter piles for the cinema basement and neither was consideration of the deflection noted in the calculations, either immediate or in the long term due to creep, that the walls may experience due to the load on them.

The typical retaining wall calculation contained in the BIA is for the retaining wall to the swimming pool basement. It is not a requirement of the planning process to include calculations for all elements of the proposed development. This is undertaken during the detailed design stage. However, a calculation for the piled retaining wall is included in Appendix K in response to the comments made by C&T. Detailed calculations considering long term effects are not necessary or appropriate for planning stage.

C&T statement contained in Section 2 vi)

i) C&T statement contained in Section 2 vi)

The most sensitive time during the construction of the basement will be the installation of the piled walls, followed by excavation of the soil; it should be noted that the movements experienced by the surrounding ground and structures they support are predominantly dependent on the quality of workmanship and the construction methodologies deployed by the contractor. Generally speaking the most damaging type of movement is horizontal movement and one way this is controlled is through ensuring the wall is sufficiently stiff and adequately propped.

A high stiffness propping system will be used in combination with high levels of site control to control workmanship and construction methodology.

j) C&T statement contained in Section 2 vi)

The BIA has very little information on the details of workmanship to be deployed during the basement construction, mentioning only that the walls will be propped, but not giving detail on how this will be done or explaining how movement of the ground and our clients' structure will be monitored. Therefore the BIA offers little protection in this regard to our Client.

The end section of the swimming pool basement shown in Section A-A in Appendix K is to be constructed using top down construction. This is explained in the construction sequence included in the BIA.

The sequence drawings in the BIA also show the initial proposals for the layout of the propping to the cinema basement area.

As is usual, the details of the proposed monitoring arrangements will be agreed as part of the party wall agreement on the project as the detailed design is developed. Details of the proposed methodology are described in the BIA and later in this report.

k) C&T statement contained in Section 2 vi)

It should also be noted that extended construction periods increase the risk of ground movements. Groundworks and basement construction is notoriously risky and frequently takes longer than anticipated; it is noted that there may be Archaeology present in the neighbouring site which increases the risk of an extended construction period to the one currently planned

The possibility of finding archaeology during the construction of a basement development exists in any project undertaken in a city centre site such as this. This is not a valid reason for preventing development. If there is archaeology present it will be in the fill above the clay i.e. at a shallow depth and will not pose risks to the adjoining structure as C&T suggest.

l) C&T statement contained in Section 2 vi)

The proposed basement drawings describing the cinema show this to be located extremely close to our Clients' building; further study may show this to be too close – the proximity will make it practically very difficult to construct as can be seen from the sketch in figure 4 below, as the extents of the concrete underpinning to Lyndhurst Hall has not been investigated in the BIA.

The sketch included in Figure 4 in C&T's report is incorrect and misleading. It neglects to show the mass concrete strip footings to the wall of Lyndhurst Hall which were a feature of the original construction. This has been verified by the physical investigations.

m) C&T statement contained in Section 2 vi)

It is understood that the method used to predict ground movements in the BIA are based on limited empirical data and is uncorroborated by numerical analysis; they are indicative only and therefore it should be noted that there is a risk that actual movements may be higher.

The method used to predict ground movements in the BIA is as described in CIRIA report 580. This is a recognised, well established and industry standard means of predicting ground movements for basement construction. The CIRIA approach provides a conservative prediction of ground movements as described in section 2 (i.e. an overestimate of the movements).

n) C&T statement contained in Section 2 vii)

George and Martin both recall that when the new basement and lift pit were constructed there was a very significant flow of ground water – of sufficient flow and quantity for them to attribute this, rightly or wrongly, to the River Fleet. We understand that the specified basement tanking was insufficient to counter the water pressure and so a pressurized grouting procedure was then used around the new basement area, which also proved ineffective to withstand the flow of water. The solution finally adopted was to construct a well with a pump to actively dewater the ground. Through consultation with Air Studio's Technical Director Tim Vine-Lott we understand the well to be approximately 1200mm diameter with a depth of around 5.5m below ground floor level, and to be effectively 'de-watering' the area local to Lyndhurst Hall. Permanent pumps were fitted to the well, pumping out the water to effect this de-watering. These pumps are still in operation today and we understand from Tim that the pumps are rated at 9 litres/second. We have been informed by George that the initial exploratory holes carried out to inform the basement design at Lyndhurst Hall did not pick up the water flow that was later experienced and that the excavation works may have been carried out during a period of heavy rainfall.

The course of the river Fleet is approximately 400m to the east of the site as described in section 2.

As noted previously the only excavations of this nature for which the Studio have obtained planning permission is the construction of a new lift pit on the opposite side of the hall to 11 Rosslyn Hill. We note that the earlier 1979 drawings produced for the conversion of Lyndhurst Hall into residential use show the main surface water drainage carrying the rainwater from the roof of the hall. This drain is shown running directly adjacent to the area where Air Studios later constructed their lift pit. It is possible this may have been the source of the water described. In any event, the lift pit is on the west, i.e. opposite side of Lyndhurst Hall from the proposed basement. The BIA describes the foundations of the hall acting as a cut off to perched ground water due to the footings bearing into the London Clay. This is consistent with the boreholes and numerous window samples taken across the site to record the levels of the existing ground water. We can see that, because the substructure of Lyndhurst Hall acts as a cut off to ground water flowing over the top of the London Clay, ground water may exist on the west side of Lyndhurst Hall and could flow into the lift shaft which is on the upslope side of the hall.

We have requested further details regarding the installation and works described by Air Studio however they have refused to provide this.

o) C&T statement contained in Section 2 vii)
This factual account contradicts the ground water flow drawing presented in the BIA for 11 Rosslyn Hill, which indicates that water flows would be around Lyndhurst Hall, principally to the North rather than through or under the building. From the account above, which is corroborated in contemporary written journal accounts of the construction, it is clear that the hydrological characteristics of this area are more complicated and potentially more damaging than currently assumed and a more detailed study is required to fully understand the implications of the proposed basements on the adjacent listed buildings of 11 Rosslyn Hill and Lyndhurst Hall, which should include, for example, an identification of the source of this water and measurement of its flow rate.

We are very aware of the groundwater issues in Camden. In some areas in the north of the borough we have found some very complex groundwater flows with groundwater coming out on the surface. Here the situation is not complex and we have carried out a thorough site investigation and water level monitoring which is all reflected in the BIA.

4.0 Response to issues raised in Geotechnical and Environmental Associates report

The issues defined by GEA in their report are divided into two sections: Ground movements and Groundwater flow. Taking these in turn using the numbering in GEA's report:

Ground Movements

1) GEA refer to the need to undertake a structural assessment of Lyndhurst Hall.

Refer to response to the same issue raised in C&T report. In summary, we have undertaken a detailed desktop study of the hall and its history. This has been supplemented with visual observations and physical investigations to develop an understanding of the structure and condition of Lyndhurst Hall. We have been prevented from taking this assessment further since Air Studios will not meet with us and have not granted access to their building. Nevertheless we are satisfied that our assessment is sufficient to enable us to be sure that the basement design as we have proposed it is of a high standard and is appropriate.

2) *GEA suggest that a detailed stage by stage plan of the excavation sequence should be provided.*

A sequence of construction has been provided in the BIA for the proposed basement construction. The sequence defines the strategy and principles for the construction methodology which will be developed in more detail as the design develops. The level of detail requested is in excess of what is appropriate for planning stage.

3) *GEA suggest that consideration has not been given to the temporary stability of Lyndhurst Hall whilst the piling mat is installed.*

We cannot understand the issue being raised by GEA. The external walls of Lyndhurst Hall are thick loadbearing masonry founded well below the level of the proposed piling mat. The piles proposed do not require large scale rigs to install them and the modest piling mat that will be required will be set at the level of the existing ground. On this basis we cannot understand GEA's comment.

4) *GEA stated that further information should be gathered in relation to the foundations of Lyndhurst Hall.*

Further information from our desk study is included in the appendices in the form of record drawings showing the size and depth of the footings of the hall.

5) *GEA suggest more detailed retaining wall calculations should be undertaken.*

The calculation included in the BIA did not relate to the specific retaining wall referred to by GEA. A further calculation is included in Appendix K. The detailed analysis described by GEA is a detailed design issue and goes beyond the level of calculation appropriate at planning stage.

6) *GEA propose that the analysis described in 5) above should be used to define the propping stiffness category used in CIRIA report 580.*

Irrespective of the output of any analysis the proposal for the works at 11 Rosslyn Hill is to use a 'high stiffness' propping system for all elements of the basement construction. Where a top down construction sequence is proposed this will be provided by the permanent slabs. Where temporary propping is used the arrangement of the propping system and number of levels of propping will be determined to provide stiff restraint to the retaining walls during all stages of the installation sequence. It would not be appropriate to use low stiffness propping adjacent to listed buildings in the manner that GEA appear to be suggesting.

7) *GEA propose yet more detailed analysis at planning stage to inform the propping stiffness to be used.*

As described in 6) above a high stiffness propping system must be used for these works. Detailed calculations are unnecessary since it would not be appropriate to use propping which does not achieve this.

8) *GEA refer to the proposal described in the BIA to undertake monitoring of Lyndhurst Hall and the other listed buildings on the site during the works. GEA suggest further detail should be provided on the specific monitoring proposals that should be employed.*

The detailed monitoring proposals will be subject to agreement under the party wall act. The detail of the monitoring and movement 'trigger levels' at which predetermined actions will need to be undertaken by the contractor are to be agreed between the party wall surveyors in due course. However in principle, we confirm that the external elevations of the hall and piled retaining walls will be monitored for movement in all directions throughout the basement construction. Trigger levels will be set against which the movements will be monitored. These will be chosen to limit the movements to not exceed those we have predicted.

9) *GEA refer to the need for a construction management plan to be prepared for the construction of the new basements.*

An outline construction logistics plan was submitted as part of the submission.

Section 8.5 of Camden Planning Guidance 6 (CPG6) states:

"Usually Camden will secure construction management plans through a Section 106 Agreement, although sometimes for less complicated schemes they may be secured by using a condition attached to planning permission."

We expect that the requirement for the final construction management plan will be a condition attached to the planning consent for the scheme.

Groundwater Flow

GEA describe the ground water on the site as being as shallow as 0.5m below ground level and suggest this has not been considered in the piling design.

GEA do not appear to have understood the principles of the site hydrology described in the BIA. Based on the site record drawings for the building and the site investigations, Lyndhurst Hall is a founded on continuous strip foundations bearing onto the London Clay strata. The foundations along the boundary with 11 Rosslyn Hill are some 2.35m below ground level in London Clay i.e. below the level of the water that GEA have stated. This confirms the foundations of the hall act as a cut off as the London Clay is not permeable. Perched water was only found above the London clay where it flows around the edge of Lyndhurst Hall. The areas of the No11 Rosslyn Hill garden behind the hall do not have ground water at the level described by GEA.

The swimming pool basement on the south side of No. 11 Rosslyn Hill is not within the zone where the groundwater is cut off by Lyndhurst Hall and here a secant piled wall is proposed.

Conclusion

C&T's report claims that insufficient work has been undertaken to understand structural engineering nature of Lyndhurst Hall. We have offered to meet with them on site to discuss these matters but this offer has been refused. Our desk study shows that the Hall was designed by an accomplished Architect as a robust and loadbearing masonry structure supported onto the underlying London Clay. Our assessment of the impact of the proposed development on the Hall is that the damage will be negligible based on the Burland categories of damage using the industry standard assessment described in CIRIA report 580 taking into account the guidance provided by Ball et al in their paper "Prediction of party wall movements using CIRIA report 580". Based on our understanding of the structural arrangement and condition of the hall the effect of the proposals on the adjacent hall will be negligible. C&T have questioned the arrangement of the foundations of the existing hall presented in the BIA by drawing the arrangement incorrectly. We have produced further sections showing the proposed arrangement, and a further calculation is provided relating to the cinema basement adjacent to the hall. The proposed sequence of construction is included in the BIA. C&T have suggested inappropriate levels of detail should have been provided at planning stage. Such detail will follow when the detailed design work is undertaken and will be subject to agreement under the party wall act. C&T also make reference to the river Fleet being beneath Lyndhurst Hall. The recognised course of the Fleet is around 400m to the east of the site. They have made a passing reference to an anecdotal account of Air Studios having constructed their own basement in the early 1990's where problems with ground water were encountered however there is no record of a planning application being granted for such a basement on the Camden planning archive. We have requested further detail of this but Air Studios have refused to provide this.

We have obtained record drawings showing that Air Studios installed a lift shaft on the opposite side of the Hall from No. 11 Rosslyn Hill. Lyndhurst Hall acts as a cut off to ground water flowing over the top of the London Clay. However, we can see that ground water may exist above the clay on the west side of the Hall, where the lift shaft was built, which was on the upslope side of the Hall.

GEA have suggested that more detailed analysis should have been undertaken of the retaining wall design in the BIA. However, the reasoning they provide for undertaking this detailed design at this stage is to determine the stiffness of the propping system to be used in the basement construction. This is unnecessary since it is proposed to use a high stiffness propping system irrespective of the outcome of more detailed analysis. GEA also seem to have misunderstood the groundwater regime found on the site. They suggest that there is a perched water table on top of the clay in the location of the basement adjacent to Lyndhurst Hall which is 0.5m below ground level. This is incorrect as the adjacent hall which is supported on the clay acts as a cut off and prevents the flow of groundwater, which is generally in a southeasterly direction, into this area of the site. The BIA explains the approach to the actual ground conditions found on the site and secant piled walls (which prevent water flowing into the basement excavation in the temporary case) are proposed where perched water exists on top of the clay which is for the basement area remote from the Lyndhurst Hall.

5.0 Appendices

5.1 Appendix A: Corbett and Tasker report
5.2 Appendix B: Geotechnical and Environmental Associates report
5.3 Appendix C: Copies of correspondence between ABA and C&T
5.4 Appendix D: Original Alfred Waterhouse drawings for Lyndhurst Hall, 1883
5.5 Appendix E: Extracts of proposals for conversion of Lyndhurst Hall and Cottage to residential use (1980 to 1984)
5.6 Appendix F: Extracts of proposals for conversion of Lyndhurst hall to recording studios (1989 to 1992)
5.7 Appendix G: Extract from Camden's Geological, Hydrogeological and Hydrological study – showing alignment of the rivers Fleet and Tyburn.
5.8 Appendix H: Technical paper: Prediction of party wall movements using CIRIA report 580.
5.9 Appendix I: Updated assessment of predicted ground movements and damage assessment for adjacent buildings based on CIRIA report 580 and technical paper.
5.10 Appendix J: Plan and sections showing relationship between Lyndhurst Hall and proposed basement extensions.
5.11 Appendix K: Calculation for basement retaining wall adjacent to Lyndhurst hall.

Appendix A: Corbett and Tasker report

CORBETT & TASKER
structural engineering

AIR STUDIOS

INITIAL APPRAISAL OF THE IMPACTS ON LYNDHURST HALL OF THE PROPOSED BASEMENT CONSTRUCTION AT 11 ROSSLYN HILL, NW3

Prepared for
Richard Boote

Project no.
1580

Date
27 May 2015

CORBETT & TASKER
structural engineering

Revision History

Revision	Date	Purpose / Status	Document Ref.	Comments
-	27.05.2015	For comment/Preliminary	1580/R01	First Draft
A	05.06.2015	Final	1580/R01	Incorporating GEA review
B	18.06.2015	Final	1580/R01	Incorporating additional information on ground water pumping

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1. Background

Corbett and Tasker Ltd. are appointed by Air Studios (Lyndhurst) Ltd. to provide a technical review of their neighbours' Planning Application for 11 Rosslyn Hill, which includes the construction of two new basements in the London Borough of Camden.

Our Client is concerned that the construction of the proposed basements, which are in close proximity to the structural fabric of Lyndhurst Hall, will have an adverse effect on the structure of Lyndhurst Hall, and has queried the accuracy and completeness of the Basement Impact Assessment (BIA) submitted in support of the Planning Application; he has instructed us to carry out a technical review accordingly. The majority of this review will focus on the BIA submitted as part of the Application, with particular regard to the basement's impact on our Client's property. A specialist review by Geotechnical and Environmental Associates (GEA) Ltd. has been commissioned into the ground water and ground movement assessments contained within the BIA, which is appended to this report.

Air Studios is a renowned recording studio and our Client is also concerned that the construction noise and vibration of the works at the adjacent property, which in some locations is directly adjacent to the foundations and side wall of Lyndhurst Hall, may well result in the recording studios being unable to operate for the duration of the construction project, which is planned to take place over many months. It is not practical to sound proof the main hall of the recording studio due to the special nature of the structure. It is thought that ground borne vibration will be the most damaging aspect of the proposed construction works. A separate report on this is being prepared by specialist acoustic engineers Vanguardia Consulting.

This report has been prepared for the sole use of our Client in support of his objection to the planning application for the basement construction at 11 Rosslyn Hill; reliance cannot be placed on it by third parties or for any other projects than which it is intended. It is written to highlight shortcomings in the BIA prepared for the above planning application.

2. Initial review of BIA

i) Brief description of the structural fabric of Lyndhurst Hall

Lyndhurst Hall was constructed in the Romanesque style and designed by the renowned Victorian architect Alfred Waterhouse in 1883-4 as a chapel. It is listed and in the past all alterations to the historic fabric have been carefully reviewed and agreed with English Heritage. The structure appears to be a combination of load-bearing masonry and steel framing, with both timber and concrete floors, and the foundations are corbelled brick; in some areas the foundations are supported on mass concrete strips footings, possibly the result of underpinning. There is a vaulted roof structure over the main studio of Lyndhurst Hall which is around 27m at the highest point, supported on masonry walls inlaid with carefully preserved and fragile stained glass windows.

Figure 1: Image of main studio of Lyndhurst Hall (Heber-Percy and Parker Architects)

The structure underwent extensive alterations and renovations in the early 1990s when it was converted to its present use as a prestigious recording studio for Air Studios.

ii) Sensitive nature of the construction of Lyndhurst Hall

The special nature of Lyndhurst Hall's construction make it particularly susceptible to damage from ground movement, however very limited consideration of this is demonstrated in the BIA. We understand from our Client that the Engineers for 11 Rosslyn Hill have not inspected or visited Lyndhurst Hall, and there are no studies of its construction or full assessment of the impact of the proposed basement construction on its structural fabric contained within the BIA.

Clause 2.41 of Camden Planning Guidance 4 (CPG 4) specifically requires a Structural Stability Assessment for basement construction at or adjacent to listed buildings and it is clear to us from our review of the BIA that this has not been carried out. No drawings of Lyndhurst Hall are provided in the BIA and there are no section drawings showing the new basement's relationship with the structure of Lyndhurst Hall.

We have sketched out some approximate sections through Lyndhurst Hall and the proposed basements which begin to investigate and demonstrate the effects of the basement construction on the Hall, as well as highlight some potential issues that the Hall's presence may have on the setting out, design and construction of the basements. These are included in Appendix A of this report.

iii) Structural damage assessment

Contained within the BIA is a crack assessment using the Burland scale, related to the length of Lyndhurst Hall, following a process set out in a CIRIA technical guide; however, no consideration has been given to ground movements, horizontal or vertical, on the stability or cracking of the triple height vaulted roof structure of Lyndhurst Hall main studio. See figure 2 below for an approximate assessment we have sketched out based on the limited information to hand.

It is well known that the Burland damage assessment procedure cannot be used on its own as a direct measure of damage to property yet this is the only approach used in the BIA.

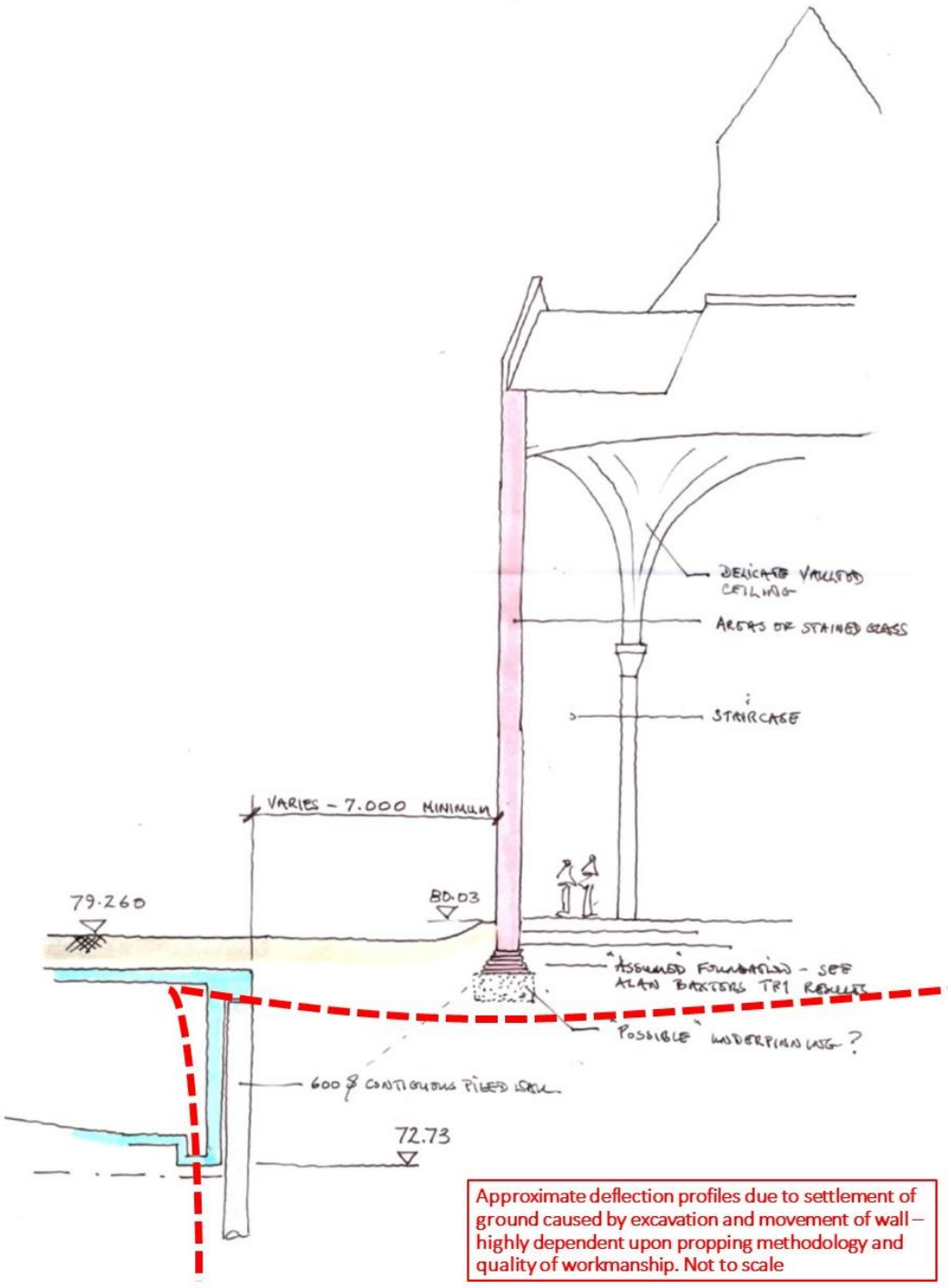

Figure 2: Approximate ground movement due to installation of underground swimming pool adjacent to the vaulted main studio of Lyndhurst Hall