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27 January 2015

Seamus Lefroy-Brooks
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Dear Mr Lefroy-Brooks

**P2005878: Royal Free Hospital: Pears Building: Basement Impact Assessment**

Thank you for the comments raised in your independent review of Basement Impact Assessment for Planning Application 2014/6845/P for the above project. We set out below our responses, cross-referred to your report, and provide further information to supplement that originally provided.

The design has recently been developed by the client's design team to RIBA Stage E. As such we are now able to draw on further information for the scheme. The information provided at Stage E, which takes the form of Employer's Requirements, sets out technical parameters with which the contractor has to comply. The contractor will develop the final design of the structure and the construction methodology during the next stage of design. It should be noted that the contractor may propose alternative forms of structure and construction methodologies as the design develops, but the Royal Free Charity will stipulate that they must remain within the established parameters. BDP structural engineers will maintain a quality monitoring role for the client for the remainder of the project to review and comment on the contractor's proposals against the requirements set out in the Employer's Requirements.

## 3.2 The Audit Process

### 3.2.1 Qualifications / Credential of authors

Alan Watson is a 'CEng' who specialises in ground engineering. He has worked for Soil Consultants for over 29 years and his CV, demonstrating his experience in ground engineering, is included in Appendix 7.

### 3.2.3 Description of Works

Appendix 1 is an excerpt from Employer's Requirements Doc No SPC(20)S101 Rev 1 prepared by BDP and provides a description of the permanent works for the sub-structure. This is developed to RIBA Stage E level. The contractor will be required to work to the parameters set out in this document enforced through the Employer's Requirements.

Appendix 2 is an excerpt from Employer's Requirements Doc No SPC(20)S101 Rev 1 prepared by BDP and provides a suggested methodology again developed to RIBA Stage E. The contractor will be required to develop a detailed methodology which will ensure that any impact on all adjacent buildings remain negligible.

Appendix 3 includes Stage E drawings (16)SP100 Rev E and (20)SP101 Rev H which were issued as part of the Employer's Requirements and provides the sub-structure drawings.

These appendices demonstrate that we are adhering to the recommendations made in the two BIA reports; namely that the temporary and permanent works will be adequately designed and implemented within acceptable parameters

taking account of the geology and hydrogeology of the site and surrounding areas; the drainage strategy implements mitigation measures which lead to the discharge to the sewer post development being less than pre-development (refer to 3.2.7 below).

**3.2.4 Investigation of Issues**

Appendix 4 is an excerpt from Employer's Requirements Doc No SPC(20)S101 Rev 1 prepared by BDP and includes a commentary on ground movements and a "Note on Movements Associated with Excavation" Revision 0, January 2015 prepared by Geotechnical Consulting Group. This study extends to neighbouring buildings - the LINAC bunker and St. Stephen's Church. Figure 2 in the report shows the relationship of St. Stephen's Church to the proposed development. Data in CIRIA report C580 (Gaba et al, 2003) indicates that horizontal and vertical movements reduce to zero within a distance of four times the excavation depth from the line of the wall. The nearest point on St. Stephen's Church is around 24m from the 4m deep excavation and over 40m from the 7m deep excavation. The report concludes that damage to the church should not exceed damage category 0 (negligible) with hairline cracks of less than about 0.1mm - refer to Figure 3 of the report for details. This complies with the guidance set out in paragraph 2.31 of Camden Planning Guidance 4 (Basements).

**3.2.6 Assessment Methodology**

Refer to Appendix 4 for the "Note on Movements Associated with Excavation". Ground heave has been modelled using the computer programme PDISP which is appropriate for this application.

**3.2.7 Mitigation**

Information on the surface water drainage strategy incorporating drawing (52)CP100 Rev A is included in Appendix 6, a ground movement study is included in Appendix 4, requirements for condition surveys and vibration surveys are outlined in Appendix 5. These mitigation measured form part of the Royal Free Charity's Employer's Requirements for the contractor to ensure that they are adhered to for the duration of the build programme.

**3.2.8 Monitoring**

Appendix 5 contains particular requirements for vibration monitoring and condition surveys of neighbouring building with which the contractor is to comply. These include monitoring of both St. Stephen's Church and Hampstead Hill School. A vibration specialist, appointed by the Royal Free Charity, has set 'alarm' threshold levels of vibration for the hospital as an advance warning of exceeding acceptable vibration limits. The contractor will work with a vibration specialist to establish similar thresholds for adjacent buildings which will mitigate any damage to them. In the event that the threshold vibration levels are approached, the contractor will immediately halt operations, review the reasons for excessive vibrations and modify approach to suit.

**3.2.9 Residual Impacts after Mitigation**

The design has been developed to incorporate mitigation measures. The ground movement study demonstrates that the impact on St Stephen's Church is negligible. The vibration and monitoring surveys planned for St. Stephen's Church and other neighbouring buildings will only serve to better this situation. Similarly our design shows the discharge to the sewer post development being less than pre-development. Therefore the residual impact of sewer flooding is also negligible.

## 4. Assessment of Acceptability of Residual Impacts

**4.1 Proposed Construction methodology**

The construction methodology will be developed by the contractor during the next stage of design. BDP has set out the technical parameters with which the contractor will have to comply in developing this methodology in the Employer's Requirements. BDP will retain a quality monitoring role for the Royal Free Charity as the project progresses and will review and comment on the appropriateness of proposed methodologies.

**4.2 Soundness of Evidence Presented**

Appendix 6 includes a description of the surface water drainage strategy and the associated surface water drainage drawing. The current proposed discharge rate is based on the measured and assumed impermeable areas draining to the existing public sewer network as taken from the topographic survey. It does not assume that the whole site is

impermeable but does consider that some of the 'permeable' site areas are underlain by existing structures which are positively drained and can therefore be classed as impermeable. The calculated existing run-off rate has then been reduced by 50% in accordance with planning requirements.

The proposed development can be considered to be 100% impermeable which will result in a small increase in hardstanding area over existing. However, the surface water discharge restrictions outlined above will provide a betterment to the existing regime and reduce volumes and rates of surface water runoff.

**4.3 Reasonableness of Assessments**

Refer to Appendix 3 for sub-structure drawings for the permanent case. Temporary works information will be prepared by the contractor in the next stage. The Employer's Requirements set out clearly the need for the contractor to mitigate any impact on neighbouring buildings. The contractor will therefore develop the temporary works within the technical parameters set out in the Employer's Requirements document.

**4.4 Robustness of Conclusions and proposed Mitigation Measures**

Refer to 3.2.7 above

We trust this letter and enclosed appendices provide you with the information you need.
Yours sincerely

Michelle McDowell MBE FREng
Chair, Civil and Structural Engineering
**BDP**

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- Appendix 1: excerpt from Employer's Requirements Doc No SPC(20)S101 Rev 1, sub-structure permanent works
- Appendix 2: excerpt from Employer's Requirements Doc No SPC(20)S101 Rev 1, suggested methodology
- Appendix 3: Sub-structure drawings (16)SP100 Rev E and (20)SP101 Rev H
- Appendix 4: excerpt from Employer's Requirements Doc No SPC(20)S101 Rev 1 on ground movements and a "Note on Movements Associated with Excavation" Revision 0, January 2015 prepared by Geotechnical Consulting Group.
- Appendix 5: excerpt from Employer's Requirements Doc No SPC(20)S101 Rev 1 outlining requirements for condition surveys and vibration surveys
- Appendix 6: excerpt from Employer's Requirements Doc No SPC(20)S101 Rev 1, surface water drainage strategy and drawing (52)CP100 Rev A
- Appendix 7: CV for Alan Watson of Soil Consultants