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Ground Investigation & Basement Impact Assessment – Non-Technical Summary

CLIENT	Mrs Appleton c/o 5D Architects and Vincent and Rymill
SITE ADDRESS	16 Rosecroft Avenue, Hampstead, London, NW3 7QB
REPORT REFERENCE	GWPR2630/GIR/November 2018
ENGINEER	Harry Brock BSc. (Hons) MSc Trevor Vincent Bsc C.Eng M.I Struct E.
SITE DESCRIPTION	The site comprised a three-storey semi-detached brick built residential dwelling with roof accommodation, set in a southerly/south-westerly slope. A lower floor ground floor garage was noted beneath the front of the site, with a sloping concrete driveway. A paved front garden with steps, was noted to front the property, the ground level of the property was ~2.0m higher than Rosecroft Avenue. The driveway at the front of the property was at 107.45m AOD and sloped upwards away from the property, to 108.87m AOD where it joins Rosecroft Avenue. The front doorway accessed via raised via steps at a level of 109.46m AOD. The front garden is located at approximately 109.44. Stepped patio/decking areas to the rear of the property range between 109.83m AOD to 111.22m AOD, increasing to approximately 111.79m AOD within the soft landscaped garden area.
PROPOSED DEVELOPMENT	At the time of reporting, November 2018, the proposed development was understood to comprise the excavation of a basement below the entire footprint of the ground floor (between ~109 – 112m AOD), including construction of lightwells, as well a single storey rear extension. The basement will be excavated ~3.40m below first floor level (formed at 106.40m AOD). The retaining wall foundation of the basement is to be formed at ~2.00m below driveway level (floor level of front garage) (bdl) and ~4.20m below patio level (bpl) at the rear garden. Due to installation of props at a high level for the side lightwell the founding depth for this structure has been reduced to 1.75m below patio level (bpl). The proposed development was understood not to involve any re-profiling of the site and its immediate environs. A willow leaf pear tree, located in the rear of the site will be removed to facilitate the construction of the basement.
CONCEPTUAL SITE MODEL AND MATTERS OF CONCERN HIGHLIGHTED BY SCREENING	The following geotechnical concerns have been formulated by this desk based review and should be analysed investigated further. • Soils with the potential for volume change potential are likely to be encountered under the site. Soils volume change potential to be determined along with depth of root penetration with reference to proximity of nearby trees; • Removal of trees; • Potential for low undrained shear strength in shallow soils; • Potential for Made Ground due to construction activities in site history and backfilling of pond. • Basement excavation and land stability given neighbouring properties and roads; • Land stability with respect to slope; • Potential for shallow groundwater to be encountered perched within shallow Made Ground; or within sand/silty bands of the Bagshot Formation and Claygate Member of the London Clay Formation. Proximity of lost tributary; • Presence of a Secondary Aquifer and whether basement will affect saturated Aquifer; • Temporary works whilst underpinning; • Surface Water Run-off due to an increase of the area or proposed hardstanding; • Heave of soils following overburden pressure release.

FIELDWORK UNDERTAKEN

Site works were undertaken on the 23rd and 25th May 2018 and comprised the drilling of one 1No. Dart Windowless Sampler Borehole (BH1) at driveway level (107.45m AOD), to a depth of 7.00m below driveway level (bdl), and 2No. Hand Held Window Sampling Rigs (WS2-WS3). WS2 was drilled within the patio area at 109.83m AOD, to 4.80m below patio level (bpl). WS3 was drilled within the upper rear garden at 111.72m AOD, to 3.30m below rear garden level (brgl).

GROUND CONDITIONS ENCOUNTERED

Trial Hole Logs can be seen in Appendix A.

For ease of reading, m bgl in the table below refers to metres below trial hole level. The difference in mAOD between each trial hole has not been considered. For specific mAOD differences refer to GWPR2630/GIR/July 2018.

Summary of Strata Encountered – Trial Holes at Ground Level (BH1, WS2-WS3 & TP2/FE2)

Strata	Depth Encountered (m bgl)	Thickness (m)
MADE GROUND Lean concrete/concrete slab and slab/sand.	GL	0.08 – 1.00
MADE GROUND (TP2/FE2) Brown stone sub-base.	0.12	0.08
MADE GROUND (WS3 & TP2/FE2) Brown/orange-brown gravelly sandy silty clay/gravelly silty clay/gravelly silty clayey sand. The sand was fine to coarse grained. The gravel was rare to occasional, fine to, sub-angular to sub-rounded brick and ash. Pockets of sand were noted in WS3 from upper rear garden level to 0.70m bgl and the Made Ground became more sandy with depth.	GL – 0.20	0.28 – 1.00
BAGSHOT FORMATION Brown/brown-orange clayey silty sand/sandy silty clay/silty sandy clay. The sand was fine to medium grained. Within WS3 the soils became more sandy with depth. Pockets of sand were observed from 0.08 – 1.00m and 2.00 – 4.80m bgl within WS2, and from 0.48 – 0.80m bgl within TP2/FE2	0.08 – 1.00	>0.32 - >04.72
CLAYGATE MEMBER OF THE LONDON CLAY FORMATION (BH1) Interbedded layers of brown/brown-orange mottled silty very sandy clay/silty sandy clay with clayey silty sand/silty very clayey sand. The sand was fine to medium grained.	2.20	>3.70

ROOTS

The depth of roots in each trial hole are tabulated below:

Borehole	Depths of Roots (m bgl)
BH1	1.50m below driveway level
WS2	1.50m below patio level
WS3	1.80m below upper rear garden level
TP2/FE2	0.80m below rear garden wall level (full depth of trial hole)

GROUNDWATER

The groundwater conditions during the intrusive investigation are tabulated below:

Borehole	Groundwater Conditions
BH1	Groundwater strike at 3.80m below driveway level (103.65m AOD)
WS2	Groundwater strike at 3.70m below patio level (106.13m AOD)
WS3	N/A
TP2/FE2	N/A

A return groundwater monitoring visit undertaken by a Ground and Water Limited Engineer on the well installed in BH1 on the 20th June 2018 revealed groundwater to be resting at 4.09m bdl (103.36mAOD) in the 4.30m deep well (103.15mAOD).

STANDARD

BAGSHOT FORMATION (Cohesive) (BH1) (1.10-2.20m bdl): SPT "N" blow count of 12. Medium

PENETRATION TESTING (SPT's)	undrained shear strength (60kPa). CLAYGATE MEMBER OF THE LONDON CLAY FORMATION (Granular) (BH1) (2.20 – 7.00m bdl): SPT "N" blow count of 8-15. Loose/Medium Dense to Medium Dense granular soil. CLAYGATE MEMBER OF THE LONDON CLAY FORMATION (ASSUMED BASED ON DYNAMIC PROBE) (GRANULAR) (DP1) (7.10 – 8.10m bd): Equivalent SPT "N" blow count of 20-30. Medium Dense to Dense granular soil. CLAYGATE MEMBER OF THE LONDON CLAY FORMATION (ASSUMED BASED ON DYNAMIC PROBE) (COHESIVE) (DP1) (8.10 – 13.10m bdl): Equivalent SPT "N" blow count of 9-27. Medium to High/Very High undrained shear strength (45-135kPa).
VOLUME CHANGE POTENTIAL	The cohesive soils of the Bagshot Formation were shown to have **MEDIUM** volume change potential in accordance both BRE240 and NHBC Standards Chapter 4.2. The granular soils of the Claygate Member of the London Clay Formation were shown to have **NO** volume change potential in accordance with BRE240 and NHBC Standards Chapter 4.2. The cohesive soils of the Claygate Member of the London Clay Formation were shown to have **MEDIUM** volume change potential in accordance both BRE240 and NHBC Standards Chapter 4.2. No potential moisture deficits were noted in any tested samples. Geotechnical laboratory results can be seen in Appendix B.
FOUNDATION RECOMMENDATIONS	Effective widths of basement walls were provided by the structural engineer. Due to the lateral pressures applied on the wall, the pressure distribution at the bottom of the foundation will not be evenly distributed and a triangular distribution is expected. The pressures used are an average between the maximum and minimum expected loads across the distribution. Minimal settlements heave were found across all walls, with a maximum of 5.60mm found at Wall B. Walls B, E, & G may experience a small amount of heave (maximum ~1mm) at 4.20m bpl (~106.40m AOD) due to reduction in effective stress at depth. Wall A was not included as this is already underpinned by previous basement works to No. 16 Rosecroft Avenue. Due to installation of props at a high level for the rear lightwell the founding depth for this structure has been reduced to 1.75m below patio level (bpl). The basement slab, with a self – weight of ~10kN/m^2 may experience overburden pressure relief of ~6.53mm constructed at 2.00m bdl and ~17.84mm constructed at ~4.20m bpl (equating to ~106.40m AOD). It is estimated that 30-50% of the total heave will be immediate, indicating that between 9.80 – 11.00mm of total heave may occur beneath the slab at 2.00m bdl and 26.76 – 30.33m bpl will occur at 4.20m bpl (equating to ~106.40m AOD).
HYDROGEOLOGICAL RISK ASSESSMENT	Groundwater was encountered at 3.80m bdl (103.65mAOD) within BH1, located at the front of the property, and at ~3.70m bpl (106.13mAOD) within WS2, located at the rear of the property (110.25m aOD). This groundwater was considered to represent the underlying saturated aquifer or the downward migration of perched water from the overlying Made Ground. A return visit to monitor the combined gas and groundwater monitoring well installed in BH1 by a Ground and Water Limited Engineer on the 20th June 2018. Groundwater was noted to be resting at 4.09m bdl (103.36mAOD) in the 4.30m bdl (103.15mAOD) deep well. It was considered **unlikely** that the retaining walls near the front driveway will encounter groundwater and **possible** that the retaining walls near the rear garden patio will encounter groundwater. Keeping the retaining walls shallow to the rear may mean groundwater ingress is avoided, the groundwater

	level was measured at 0.27m shallower than the proposed basement. As the basement is constructed on the slope of a hill, it will need to permit groundwater flow downslope. It was considered unlikely that the basement will significantly block groundwater flow as it was likely that groundwater will be able to percolate downward and under the basement into the sand bands present in the Bagshot Formation and Claygate Member of the London Clay Formation. Consideration should be given to additional drainage to help facilitate this process.
ASSESSMENT OF GROUND MOVEMENT	Ground movement assessment was carried out on the neighbouring properties within Section 7.7 of the full ground investigation report (GWPR2630/GIR/July 2018). In terms of building damage assessment and with reference to Table 2.5 of C580 (After Burland et , 1977), the 'Description of typical damage' given the calculated movements it is likely to fall within category of damage '1' Very Slight to '0' Negligible. Mitigation measures to minimise potential movements are provided in Section 7.7 7 of the full ground investigation report (GWPR2630/GIR/October 2018).
SUB-SURFACE CONCRETE	DS1, AC1
SURFACE WATER/DRAINAGE	The proposed development was expected to increase the amount of hardstanding by 47m^2 and a slight increase in the amount of surface water discharged into the ground was anticipated. The principles of sustainable urban drainage system (SUDS) and the requirements of the Sustainable Drainage Scheme should be applied to reduce the risk of flooding from surface water ponding and collection associated with the construction of the basement.

THIS EXECUTIVE SUMARY MUST BE READ IN CONJUNCTION WITH THE FULL REPORT.