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Non Technical Summary – Ground Investigation and Basement Impact Assessment Report

CLIENT	Mr and Mrs Freedman c/o Vincent and Rymill
SITE ADDRESS	28 Maresfield Gardens, South Hampstead, London NW3 5SX
REPORT REFERENCE	GWPR1761
ENGINEER	Roger Foord, Ground and Water Limited
INVESTIGATION LOCATIONS	Please see Figure 1 Attached. Site works were undertaken on the 5th August 2016 and comprised the drilling of one Dart Windowless Sampler Borehole (BH1) to a depth of 10.45m bgl and one hand held window sampler borehole (WS2) to a depth of 5.00m bgl. In addition, two trial pit foundation exposures (TP/FE1 and TP/FE2) were excavated to enable measurement of the shape and configuration of the existing foundations at the rear of the property. A 19mm combined bio-gas and groundwater monitoring well was installed in BH1 to 5.00m bgl.

GROUND CONDITIONS ENCOUNTERED

Summary of Strata Encountered BH1, WS2, TP/FE1 and TP/FE2

Strata	Depth Encountered (m blgl)	Thickness (m)
MADE GROUND (BH1/TP/FE1 and TP/FE2 only): Tarmac/yorkstone over crushed brick and concrete sub-base	GL	0.20 – 0.26
MADE GROUND: Dark brown slightly gravelly silty clay. Gravel is occasional, fine to medium, sub-angular to sub-rounded brick and rare to occasional, fine, sub-angular to sub-rounded carbonaceous material (ash/clinker)	GL – 0.26	0.30 – 0.90
LONDON CLAY FORMATION: Brown silty CLAY with rare fine selnite crystals	0.60 – 0.90	1.00 – 2.00
LONDON CLAY FORMATION (WS2 only): Brown silty CLAY with fine selenite crytals and sub-rounded flint gravel	1.90	0.30
LONDON CLAY FORMATION (BH1 and WS2 only): Brown silty CLAY with pockets of orange silt, veins of grey silt and rare fine selenite crystals.	2.20 – 2.60	>2.80 – 4.60
LONDON CLAY FORMATION (BH1 only): Dark grey brown silty CLAY with rare selenite crystals..	7.20	>2.80

GROUNDWATER	Groundwater was not encountered during the intrusive investigation. Three return visits to monitor the combined bio-gas and groundwater well installed in BH1 were undertaken by a Ground and Water Limited Engineer on the 21st September 2016, 29th September 2016 and 16th January 2017. Water was noted to be resting at 2.70m bgl, 2.48m bgl and 1.41m bgl respectively in the 5.00m deep well installed. This groundwater was considered to represent seepages of perched water from within the Made Ground or silt bands of the London Clay Formation accumulating in a standpipe installed within impermeable soils of the London Clay Formation.
ROOTS	Roots were noted to 1.50m bgl in BH1 and 1.00m bgl in WS2. Decaying roots were noted at 3.50m bgl in both boreholes. The decaying roots were assumed to be relict and therefore unlikely to affect the serviceability of the foundations of the basement.
GEOTECNICAL PROPERTIES	Based on the results of geotechnical classification testing the soils of the London Clay Formation were shown to have a **high** potential for volume change in accordance both BRE240 and NHBC Standards Chapter 4.2. Consistency Index calculations indicated the London Clay Formation to be stiff. Geotechnical analysis revealed the soils to be heavily overconsolidated with no potentially significant root exacerbated

	moisture deficits. The cohesive soils of the London Clay Formation comprised very low/low to very high undrained shear strength (20 - 160kPa in accordance with Stroud (1974)). The undrained shear strength of the soils generally increased with depth.
FOUNDATION RECOMMENDATIONS	At the time of reporting, February 2017, the proposed development was understood to comprise the construction of a single storey rear and side excavation and the basement below the proposed rear extension and extending out below the rear garden. A founding depth of ~4.50m bgl for the basement has been proposed. Due to the soils having a high volume change potential, foundations must not be placed within cohesive root penetrated and/or desiccated soils and the influence of the trees surrounding the site must be taken into account. The base of foundation excavations must extend at least 300mm into non-root penetrated soils. Should trees be removed from footprint of proposed development then a piled foundation should be considered. Roots were noted to 1.50m bgl in BH1 and 1.00m bgl in WS2. Decaying roots were noted at 3.50m bgl in both boreholes. The decaying roots were assumed to be relict and therefore unlikely to affect the serviceability of the foundations of the basdement. Given the above and the depth of roots noted in the boreholes, a minimum founding depth of 1.80m is required for the side extension and the proposed foundation depth of ~4.50m bgl was considered suitable for the proposed basement. Foundations remote from the basement constructed on the soils of the London Clay Formation at ~1.80m bgl can be designed based on a presumed safe bearing capacity of ~75kN/m^2 increasing to 200kN/m^2 for the basement foundations at ~4.50m bgl. This is based on trial hole records, inspection of samples recovered, geotechnical laboratory results and referral to BS 8004:1986, *Code of Practice for Foundations,* the results of the insitu testing, and based on 5mlong by 0.75 wide and 5m long by 1m wide strip foundations ot a 1.50m by 1.50m pad foundation and a maximum settlement of ~25mm. It must be noted that a bearing capacity of less than 75kN/m^2 at 4.70m bgl could result in heave due to a reduction in effective stress at depth. This will need to be taken into account in final design.
SULPHATES	Sulphate concentrations measured in 2:1 water/soil extracts taken from the London Clay Formation, from both the geotechnical and chemical laboratory testing, fell into Class DS-1 of the BRE Special Digest 1, 2005, *'Concrete in Aggressive Ground'*. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1s for foundations within the London Clay Formation. For the classification given, the "static" and "natural" case was adopted given the cohesive soils and the residential use of the site. The sulphate concentration in the samples ranged from 280 - 410mg/l with a pH range of 7.1 - 8.3. The total sulphate concentration recorded was 0.04 - 0.14%. Rising sulphate values should be taken into account should ferruginous staining/pyrite nodules be encountered within the London Clay Formation.
BASEMENT EXCAVATIONS AND STABILITY	Based on the ground conditions encountered within the boreholes the soils of the London Clay Formation were shown to have an angle of shear resistance (Φ') of 20 with ka and kp values of 0.49 and 2.04 respectively.These have been designed based on the SPT profile recorded, results of geotechnical classification tests and reference to literature. Based on the groundwater readings taken during this investigation to date, it was considered likely that significant perched groundwater from within the Made Ground or silt bands within the London Clay Formation would be encountered during basement excavation. Dewatering from sumps introduced into the floor of the excavation is likely to be required, especially after a period of excessive rainfall. Consideration should be given to creating a coffer dam using contiguous piled or sheet piled walls to aid basement construction below the perched water table. The advice of a reputable dewatering company should be sought.
HYDROGEOLOGICAL EFFECTS	It was considered unlikely that the basement will be constructed below the groundwater level. However, significant perched groundwater is likely to be encountered during construction, especially

	after a period of excessive rainfall.
	An assessment of ground movements was carried out for the surrounding properties due to the excavation of the basement below the proposed rear extension, extending out below the rear garden.
GROUND MOVEMENT ANALYSIS	In terms of building damage assessment and with reference to Table 2.5 of C580 (after Burland et al, 1977), the 'Description of typical damage' given the calculated movements it is likely that the damage assessment for the neighbouring peoperties (28 and 30-32 Maresfield Gardens) will fall into Category 0, 'Negligible'.
PROXIMITY OF UNDERGROUND TUNNELS	An enquiry was made to Network rail over the impact the proposals could have on the structural integrity of railway tunnels close to the site. Network Rail have confirmed that their structures team have no objections to your proposals
SURFACE WATER DISPOSAL	The principles of sustainable urban drainage system (SUDS) should be applied to reduce the risk of flooding from surface water ponding and collection associated with the construction of the basement.