Geotechnical, Hydrogeological & Ground Movement Assessment

of

No. 75
Bayham Street
Camden
London
NW1 0AA

for

W12 Studios Limited

LBH4318 Ver 1.8

September 2016

LBH WEMBLEY

Geotechnical & Environmental

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Foreword-Guidance Notes

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THIRD PARTY INFORMATION

The report may present an opinion on the disposition, configuration and composition of soils, strata and any contamination within or near the site based upon information received from third parties. However, no liability can be accepted for any inaccuracies or omissions in that information.

DRAWINGS

Any plans or drawings provided in this report are not meant to be an accurate base plan, but are used to present the general relative locations of features on, and surrounding, the site.

1. Introduction

1.1 Background

It is proposed to refurbish the existing building at the front the site, including the retention of all floors and party walls. It is also proposed to refurbish the former workshop building at the rear of the site, along with the provision of two new floors.

The excavation of a single storey basement is proposed across the whole site footprint.

1.2 Brief

LBH WEMBLEY Geotechnical & Environmental have been appointed by W12 Studios Limited to prepare a geotechnical, hydrogeological and ground movement assessment in order to assist the design development of the scheme and to support a Basement Impact Assessment being undertaken by Michael Alexander Consulting Engineers.

1.3 Report Structure

The report initially describes the findings of desk study searches. Following this, the findings of an intrusive ground investigation are reported. Consideration is then given to the hydrogeological and geotechnical aspects of the development and this is followed by an assessment of the ground movements that may be associated with the proposed development and the potential damage to neighbouring structures that may occur.

2. The Site

2.1 Site Location

The site is located on the western side of Bayham Street in Camden, approximately 1km north of Euston Station, and may be located by National Grid Reference 529115,183653 or postcode NW1 0AA.

2.2 Topographical Setting

The site is situated in a generally level area of Camden at an elevation of approximately +25m OD. The natural ground surface may be expected to fall gently eastwards towards the River Fleet.

2.3 Site Description

The site is L shaped, measuring approximately 20m in depth from the frontage on Bayham Street and 17m in width at the rear from its boundary with Nos. 1 & 2 Pratt Mews to the northwest to the rear garden of No. 69 Bayham Street to the southeast.

The existing building on the site is composed of a three storey brick front section, extending from the Bayham Street frontage. At ground floor level this space is currently used as a workshop, with the above two floors being offices.

The remainder of the site is a tall single storey workshop space with a mezzanine floor.

The site is bounded to the northwest by No. 77 Bayham Street and by an extension to Nos. 1 & 2 Pratt Mews, and to the southwest by the rear of Nos. 1 & 2 Pratt Mews. To the southeast stands No. 73 Bayham Street. The remaining boundaries are comprised of the edge walls of the rear gardens of Nos. 73, 71 and 69 Bayham Street.

2.4 Proposed Development

The current proposals include the refurbishment of the existing building at the site, including the retention of the front façade and the excavation of a new single storey basement across the entire site footprint to provide a building spanning over five storeys. All existing party walls are retained along with the existing first and second floors of the masonry building that forms the front part of the site fronting onto Bayham Street.

3. Desk Study

3.1 Site History

In the late 17th Century the site was occupied by an end of terrace building with a rear yard or garden and an access-way between the house (No. 75) and its northwestern neighbour (No. 79) to allow access to the rear area. The surrounding streets were similarly built with terraced houses.

At the end of the 17th Century the end of terrace house was demolished and replaced by a new building occupying the entirety of the plot. This new building was connected to a long building behind Nos. 1-5 Pratt Mews to form a large 'T' shaped building which was used as an organ manufactory. At this time neighbouring buildings were also constructed to the rear of Nos. 73 and 71 Bayham Street.

At the time of the First World War a number of 'pianoforte works' were in business in the local area.

Between the Wars the buildings of 1-5 Pratt Mews were in use as motor body builders with a small smithy.

Aerial photography at the end of the Second World War shows the building in its present configuration where it appears that the 'T' shaped works building was joined to the two buildings to the rear of Nos. 73 and 71, under one roof. The remaining former parts of the works appear to have merged into Nos. 1 & 2 Pratt Mews at this time.

In the mid-1950s the buildings of Nos. 1 & 2 Pratt Mews had merged with the buildings to their north (immediately adjacent to the northwest of the site) and were in use as a scrap metal depot. A car body works was present fronting onto Bayham Street approximately 60m to the southeast. A row of small houses leading northwards from Kings Terrace were demolished at this time, creating an open yard space south of the site.

In the late 1960s all of the houses on the east side of Bayham Street (between Pratt Street and Plender Street), all the houses on Regina Street, all the houses on Curnock Street and all the houses on the west side of Camden Street (between Pratt Street and Plender Street) were demolished and a large residential development consisting of accommodation blocks surrounding open spaces was constructed opposite the site. The long building that formerly formed the top of the 'T' shaped works was merged into the scrap metal depot at this time and the former printing works was in use as a clothes factory.

By the early 21st Century the buildings on and surrounding the site appear to have attained their present configuration.

3.2 Geological Information

The British Geological Survey (BGS) records indicate that the site is underlain by London Clay. No superficial deposits are recorded.

3.3 Hydrogeological / Hydrological Information

The course of the River Fleet runs approximately 300m to the northeast, crossing Pratt Street at its junction with College Street.

The Environment Agency (EA) classifies the London Clay as an Unproductive Strata.

The site is not located with a groundwater source protection zone and there do not appear to be any licensed groundwater abstractions within 500m of the site.

3.4 Other Environmental Information

Searches have not indicated recorded landfills within 450m of the site.

It is indicated that the site is not located in a radon affected area, as less than 1% of homes are above the action level. It is further reported that no radon protective measures are necessary in the construction of new dwellings or extensions.

4. Ground Investigation

A ground investigation was carried out on 17th February 2014 that comprised three window sample boreholes (WS1 to WS3) to a maximum depth of 5m, extended by dynamic probing to a maximum depth of 10m. A series of five structural foundation trial pits were also hand excavated as part of a parallel structural investigation.

The exploratory hole records and dynamic probe results, together with the results of geotechnical laboratory tests carried out on selected soil samples are appended, together with a site plan indicating the exploratory positions.

4.1 Ground Conditions

The ground investigations confirmed the expected general strata comprising a varying thickness of made ground overlying London Clay.

4.2 Made Ground

The site surface comprised around 200mm of cemented flint pebbles and cobbles (hoggin), topped by a concrete screed.

Beneath the hoggin, in the front area of the site where it would appear that there had previously stood a terraced house with a basement, made ground was encountered to a depth of 1.8m. This material comprised soft dirty brown sandy clay containing stones and fragments of brick, slate, tile, mortar and oyster shells.

In the remaining areas of the site, comprising the former rear area of the end of terrace building, and the former rear areas of Nos. 73 and 71 Bayham Street, similar made ground was encountered to a depth of around 1m, though less brick fragments were noted and no oyster shells or whole bricks encountered.

4.3 London Clay

Beneath the made ground the London Clay Formation was encountered. The clay generally comprised initially soft to firm becoming firm orange-brown silty clay, becoming stiff and mottled grey at around 4.0m depth.

The results of the plasticity index testing have confirmed the stratum to be of high shrinkability.

One of the boreholes refused at 4.2m depth possibly due to the presence of a claystone.

Deeper historical boreholes within the area indicate that the London Clay is present to around 30m depth overlying the Lambeth Group, with the underlying Thanet Sand present at around 45m depth and the Chalk at around 50m depth.

4.4 Groundwater

No groundwater was encountered by the investigation.

4.5 Existing Foundations

The brick foundations of the party wall shared with No. 77 Bayham Street have been found to extend to a depth of 2m below floor level (+27.4mOD), within No. 75 the foundation steps out in three brick corbels at its base, the foundation is assumed to be 1m wide. It is believed that No. 77 has a cellar.

The brick foundation of the party wall shared with No. 73 Bayham Street has been found to extend to a depth of 1.8m below floor level (+27.4mOD), stepping out in three corbels and is assumed to be approximately 1m wide. What is believed to be a former floor slab was encountered on the No.75 side of this foundation; this is believed to be a remnant of the floor slab of a basement of the previous No. 75. The thicknesses of made ground encountered at the Bayham Street end of the site support the assumption that the former house had a basement that has now been infilled.

The remaining party walls all appear to have shallow brick foundations placed at depths between 0.5m and 0.8m below floor level (+27.4mOD) and stepping out in three brick corbels and are all assumed to be approximately 1m wide.

5. Hydrology and Hydrogeology

5.1 Hydrological and Hydrogeological Conditions

It is not believed that any near-surface groundwater table is present within the area of the site given the impermeability of the London Clay soils.

5.2 Potential Impacts

Screening checklists for the potential impacts of the proposed basement on subterranean (groundwater) flow and surface flow and flooding are appended to this report.

No potential subterranean (groundwater) flow potential impacts associated with the construction of the proposed development are identified.

No potential surface flow or flooding potential impacts associated with the construction of the proposed development are identified.

6. Geotechnical Assessment

The investigation has revealed the presence of a variable thickness of made ground overlying London Clay. Given the ground conditions encountered and the scale of the development, it is anticipated that a spread foundation solution should be feasible.

6.1 Basement Construction

Basement excavations are expected to reach to a depth of around 4.85m (+22.55mOD) below the existing floor level of +27.4mOD. This depth includes for a 600mm thickened toe section of the proposed underpins, below the proposed basement floor level of +23.15mOD.

A key factor in the design of the new basement construction will be the need to preserve the stability of the adjacent buildings and highway at all times, both during excavation and construction and in the permanent situation.

The sensitivity of the surrounding buildings will need to be considered. The excavations must be provided with sufficient temporary support and propping as they are excavated to ensure that ground movements are minimised.

6.2 Ground Heave and Foundation Selection

Excavation of the basement will result in unloading of the clay leading to elastic heave of the underlying soil. Where the weight of the new building is less than that of the soil removed, long term heave is unavoidable and must be accommodated. However, in this case where it is envisaged that the weight of the new building is similar to that of the removed soil, there is an opportunity to distribute the new structural loading onto the soil at basement level by means of an effective raft foundation so as to thereby counteract the potential heave movements.

Broadly speaking, the foundation options are therefore to either provide conventional spread foundations in conjunction with heave accommodation measures or to construct a rigid box type basement that will act as a raft.

6.3 Temporary and Permanent Propping

The following parameters would normally be applicable for the design of conventional retaining walls where movement is acceptable:

Stratum	Bulk Density	Effective Cohesion	Effective Friction Angle
	(kg/m^3)	(c' - kN/m^2)	(ϕ' - degrees)
Made Ground	1700	Zero	Zero
London Clay	1850	Zero	20

However, in this case the main factor governing the design of the basement propping will be the need to limit lateral deflection and associated settlement adjacent to the existing buildings and the adjoining boundary walls. Hence a Ko condition must be modelled for both the temporary and permanent conditions.

In the permanent condition both the basement floor slab or raft and the ground floor slab may be designed to act as props, but during construction it will be necessary to provide temporary props.

It is recognised that unfortunately where, as in this case, it is necessary to adopt conventional underpinning techniques rather than to install an embedded piled retaining wall prior to any excavation; it is inevitable that there will be temporary relaxation of the horizontal earth pressures. This will be limited at any one time to the area surrounding each individual pin excavation and monitoring of movements can be used to ensure that any resulting ground strain is immediately restored by positive prop loading.

6.4 Spread Foundations

At the new basement level of 4.85m depth, spread foundations of up to 2m in width/breadth may be designed to an assessed net allowable bearing pressure of 150kN/m^2. Alternatively, a basement raft may be designed to distribute the structural loading across the full basement area.

It is understood that the basement is to be supported on a 1.2m wide and 600mm deep thickened section of reinforced concrete, with the remainder of the basement floor being constructed as a 200mm thick reinforced concrete suspended slab on top of a Cellcore void former.

6.5 Waterproofing

Groundwater was not encountered during the investigation. However, there is the potential for surface water to collect around the basement structure in the long term. Hence, the basement should be fully waterproofed and it will be necessary for the basement to be designed to withstand hydrostatic pressures in accordance with the guidance provided in BS8102:2009, Code of Practice for the Protection of Below-Ground Structures against Water from the Ground, with an assumed ground water table at 1m depth.

6.6 Surface Water Drainage

The cohesive soils underlying the site essentially preclude the use of conventional soakaways and off-site disposal by means of a surface water sewer system will be required.

6.7 Foundation Concrete

The results of chemical analyses carried out on selected samples of the soils encountered on the site indicate soluble sulphate concentrations falling within Class DS-1 as defined by BRE Special Digest 1 (2005). The recommendations of that guidance should therefore be followed, assuming an Aggressive Chemical Environment for Concrete (ACEC) site classification of AC-1s for an assumed static groundwater regime.

7. Ground Movement Assessment

7.1 Ground Model

Excavation of the basement will result in unloading of the clay leading to theoretical heave movement of the underlying soil in both the short and long term, depending upon any reapplication of loading. An analysis has been carried for a modelled situation, based on a soil model devised from both published information on the London Clay and the results of the ground investigation. The soil layers of this model are detailed in the table below.

Analysis Layer:	Upper Boundary (m OD)	Thickness (m)	Average C_u (kN/m^2)	Soil Stiffness (kN/m^2)	
				E_u	E'
London Clay (cohesive)	+22.55	3.85	75	33750	18750
London Clay (cohesive)	+18.70	5.00	115	51750	28750
London Clay (cohesive)	+13.70	5.00	155	69750	38750
London Clay (cohesive)	+8.70	5.00	195	87750	48750
London Clay (cohesive)	+3.70	5.00	235	105750	58750
London Clay (cohesive)	-1.30	5.00	275	123750	68750
Lambeth Group (cohesive)	-6.30	5.00	315	141750	78750
Lambeth Group (cohesive)	-11.30	5.00	355	159750	88750
Assumed Rigid	-15.60	4.30			

The Undrained Modulus of Elasticity (Eu) has been based upon an empirical relationship of Eu = 450 x Cu, and the Drained Modulus of Elasticity (E') has been based upon an empirical relationship of 250 x Cu.

Poisson's Ratios of 0.5 and 0.1 have been used for short term (undrained) and long term (drained) conditions respectively.

The analysis uses classic modified Boussinesq elasticity theory, assuming uniform unloading of a semi-infinite elastic half-space, using the above parameters for stratified homogeneity and with the introduction of an assumed rigid boundary at 40m (-15.6m OD).

The analysis calculates the theoretical Boussinesq elastic stress decrease due to the applied net unloadings (beneath the given unloaded areas) at the mid-level of each of the 8 No. soil layers defined above.

Short-term and long-term heave movements are then calculated at each calculation point for each stratum, using the given values of Stiffness Moduli and Poisson's Ratio over the whole area of the site on a 2m by 2m grid.

7.2 Neighbouring Structures

There are a number of structures immediately surrounding the site as follows.

7.2.1 Number 77 Bayham Street

Immediately northwest of the site, No. 77 Bayham Street is a three storey brick-built residential property which is thought to have a cellar to a depth of approximately 1.8m and is likely to have been constructed at a similar time to the original No. 75 Bayham Street. It has a single storey extension to its rear, believed to have been added in the 1990s.

7.2.2 Nos. 1 & 2 Pratt Mews office extension)

A two storey brick construction office extension with (assumed) shallow foundations believed to have been constructed during the 1940s.

7.2.3 Former organ manufactory

A three storey high brick building, formerly part of the organ manufactory that comprised the buildings of the site. The original structure had been constructed by the 1890s, however the modern structure appears newer and it is possible it has been vertically extended or completely rebuilt.

7.2.4 Number 73 Bayham Street

Immediately southeast of the site, No. 73 Bayham Street is a three storey brick-built residential property which is thought to have a cellar to a depth of approximate 1.5m. It was constructed in the 1800s at the same time as the original No. 75 Bayham Street and has a later two storey brick extension to the rear.

7.3 Ground Movements

During excavation of the basement and demolition of the buildings, the anticipated vertical settlement movements resulting from the proposed underpinning will tend to counteract the theoretical elastic heave movements.

In the long term, the weight of the new building will serve to counter the stress relief resulting from demolition of the existing buildings and the excavation of the new basement.

7.3.1 Modelling of Short Term Movements

There are several components of short term movement that will interact to affect the neighbouring structures. These are settlements associated with the underpinning and the potential for heave due to the unloading of the building during both demolition and soil unloading during the basement excavation.

7.3.1.1 Short Term Heave Movements due to Demolition

An estimation of the effects of the unloading of the existing strip foundations and ground beneath the existing floor slab at an assumed depth of 1.0m, due to the demolition of the building has been carried out. The loads removed during demolition have been calculated from a load takedown provided by the structural engineer. Where ground floors are to be removed, these have been applied over the floor area rather than on the strip foundation. For the existing masonry building, it is indicated that only the ground floor is to be removed; whereas for the workshop area to the rear, the ground floor, first floor and roof are to be removed.

In this situation, negligible (<1mm) heave movements are observed.

7.3.1.2 Short Term Heave Movements due to Excavation

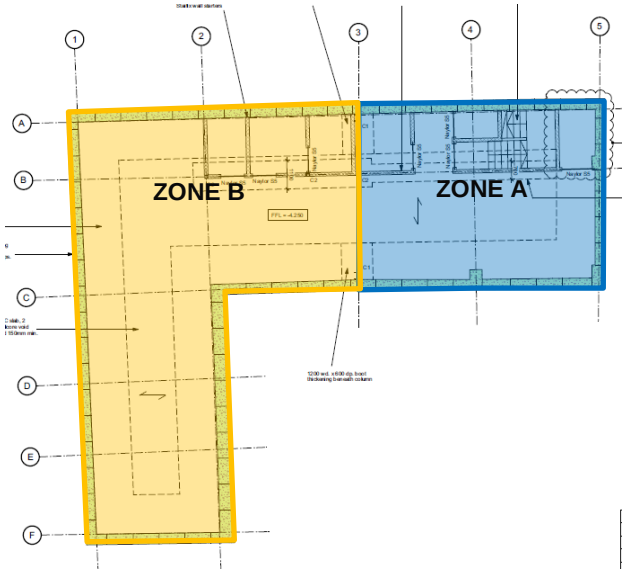
The potential effect of the planned basement excavation has been considered through applying an unloading of -88kN/m^2 across the basement area.

7.3.1.3 Net Short Term Movements

Based on the short term heave movements due to demolition and excavation the analysis suggests that, by the time basement excavation is complete, approximately 10mm of heave is likely to have taken place around the boundaries of the excavation.

7.3.2 Structural Loading

Loading information provided by Michael Alexander Consulting Engineers indicates that the unfactored structural loading on the thickened toe section of the underpins will be equivalent to approximately 76kN/m^2 for the front (Zone A) and 116kN/m^2 for the rear (Zone B) of the new building basement area as defined on the plan below.



Plan showing division of the structure into Zone A (blue - from line 3 to line 5) and Zone B (yellow - line 1 to line 3)

This load condition comprises a dead loading of 74kN/m^2 (Zone A) / 116kN/m^2 (Zone B) and a live loading of 2kN/m^2 (Zone A) / 5kN/m^2 (Zone B). By convention, when considering the average loading condition, the above figures have been reduced to be 100% unfactored dead load plus 25% unfactored live load.

7.3.3 Post Construction Movements

The new structural loading will be transferred to the London Clay by means of the proposed thickened toe sections of the underpinning to form an effective perimeter strip foundation as the structure is built. Post construction movements are likely to be limited to within the site itself and significant ongoing movement of adjacent properties is not envisaged following completion of the development.

8. Damage Assessment

The movement of an underpinned wall is dependent upon the standard of workmanship and temporary propping that is achieved. Assuming a high quality of workmanship, the party wall settlements arising from the proposed underpinning have been assumed to be 5mm per stage of underpinning. Two stages of underpinning are proposed and thus up to 10mm of settlement is anticipated.

The ground settlements behind a conventionally underpinned wall cannot be modelled. However it can be stated that, provided horizontal movements can be adequately limited by good workmanship and temporary propping, the scale of damage will be minimised.

Broadly speaking, it is assessed that if overall lateral ground movements can be limited to less than 10mm, Burland scale Category 2 (Slight) damage to neighbouring structures can be expected for the situation at this site, whilst if lateral movements of less than 5mm can be achieved, Burland scale Category 1 (Very Slight) damage can be expected.

9. Mitigation of Movements

9.1.1 Settlement due to underpinning

The settlement due to underpinning is dependent upon good workmanship and is dependable on the quality of the dry packing of the proposed underpins beneath the existing foundation. Appropriate propping in both the temporary and the long term without any relaxation will be crucial in limiting lateral defections and hence the severity of damage.

9.1.2 Heave Movements within the site

It would appear that there is a possible slight mismatch between the weight of soil that is to be removed during the basement excavation and the weight of the new structure that is to replace this. In this situation of net unloading there would inevitably be a component of long term heave movement affecting the central areas of the site that could proceed for several decades.

The analysis suggests that there could be up to about -15mm of post construction heave beneath the centre of the site. In order to accommodate this movement it is recommended that a layer of compressible material be included beneath a basement floor that spans across the remaining width of the building in a suspended fashion.

9.1.3 Monitoring

Monitoring of the front façade and neighbouring properties will be an essential tool in the prevention of unacceptable movements. The monitoring plan must include a clear set of achievable contingency actions to be completed as an immediate response to any movement exceeding agreed trigger levels.

APPENDIX

SCREENING CHECKLISTS

SITE PLAN SHOWING EXPLORATORY POSITIONS

BOREHOLE RECORDS

TRIAL PIT RECORDS

DYNAMIC PROBE RESULTS

GEOTECHNICAL RESULTS

GROUND MOVEMENT MODELLING

Screening Checklists

Screening uses checklists to identify whether there are matters of concern (with regard to hydrogeology, hydrology or ground stability) which should be investigated using a BIA (Section 6.2 and Appendix E of the CGHSS) and is the process for determining whether or not a BIA is required. There are three checklists as follows:

- subterranean (groundwater) flow
- slope stability
- surface flow and flooding
-

Screening Checklist for Subterranean (Groundwater) Flow

Question	Response	Justification
Is the site is located directly above an aquifer?	**NO**	The BGS records that the site is underlain by London Clay Formation. No superficial deposits are recorded.
Will the proposed basement extend beneath the water table surface?	**NO**	No groundwater is expected within the impermeable London Clay.
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	**NO**	The nearest surface water feature is the River Fleet located approximately 390m east of the site.
Is the site within the catchment area of the pond chains on Hampstead Heath?	**NO**	The site is outside of the catchment areas of the Hampstead Heath ponds as shown in Figure 14 of the CGHHS
Will the proposed development result in a change in the area of hard-surfaced/paved areas?	**NO**	The site is presently 100% covered by buildings and the proposed development also involves 100% coverage
Will more surface water (e.g. rainfall and run-off) than at present will be discharged to the ground (e.g. via soakaways and/or SUDS)?	**NO**	There is no drainage to the ground.
Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than the mean water level in any local pond?	**NO**	There are no nearby surface water features.

Screening Checklist for Stability

Question	Response	Justification
Does the existing site include slopes, natural or manmade, greater than 7 degrees?	**NO**	The site is level.
Does the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees?	**NO**	No re-profiling of the site is planned.
Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees?	**NO**	No slopes greater than 7 degrees are present.
Is the site within a wider hillside setting in which the general slope is greater than 7 degrees?	**NO**	No. Figure 16 of the CGHHS shows the site to be in an area of zero to seven degrees slope.
Is London Clay the shallowest strata at the site?	**YES**	Carry forward to Scoping
Will trees be felled as part of the proposed development and/or are works proposed within tree protection zones where trees are to be retained?	**NO**	No trees are present on the site.
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	**NO**	No evidence of cracks or building movements was evident upon visiting the site and no effects were noted in any of the adjacent and surrounding buildings.
Is the site within 100m of a watercourse of a potential spring line?	**NO**	The nearest surface water feature is the Grand Union Canal located 450m north of the site.
Is the site within an area of previously worked ground?	**YES**	Figure 3 of the CGHHS shows the site to be in an area of worked ground. Carry forward to Scoping.
Is the site within an aquifer?	**NO**	The London Clay Formation is classified as Unproductive Strata.
Will the proposed basement extend beneath the water table such that dewatering may be required during construction?	**NO**	No water table is expected to be present.
Is the site within 50m of the Hampstead Heath ponds?	**NO**	The Hampstead Heath ponds are over 3km to the north of the site.
Is the site within 5m of a highway or pedestrian right of way?	**YES**	Carry forward to Scoping
Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?	**YES**	Carry forward to Scoping
Is the site over (or within the exclusion zone of) tunnels, e.g. railway lines?	**NO**	The northbound and southbound tunnels of the northern line lie underneath Camden High Street, approximately 50m west of the rear of the site.

Screening Checklist for Surface Flow and Flooding

Question	Response	Justification
Is the site within the catchment area of the pond chains on Hampstead Heath?	**NO**	The site is outside of the catchment areas of the Hampstead Heath ponds as shown in Figure 14 of the CGHHS
As part of the site drainage, will surface water flows (e.g. rainfall and run-off) be materially changed from the existing route?	**NO**	Surface water flows will be disposed of by the existing means.
Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?	**NO**	The site is presently 100% covered by buildings and the proposed development also involves 100% coverage
Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface-water being received by adjacent properties or downstream watercourses?	**NO**	All drainage is to the sewer as per existing.
Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**NO**	All drainage is to the sewer as per existing.
Is the site in an area known to be at risk from surface water flooding, or is it at risk of flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	**NO**	The site is in a Flood Zone 1 (less than 1 in 1000 chance of flooding). The site is not on a street indicated on Figure 15 of the CGHHS to have been flooded in either 1975 or 2002. There are no nearby surface water features.

Screening Checklists

Screening uses checklists to identify whether there are matters of concern (with regard to hydrogeology, hydrology or ground stability) which should be investigated using a BIA (Section 6.2 and Appendix E of the CGHSS) and is the process for determining whether or not a BIA is required. There are three checklists as follows:

- subterranean (groundwater) flow
- slope stability
- surface flow and flooding
-

Screening Checklist for Subterranean (Groundwater) Flow

Question	Response	Justification
Is the site is located directly above an aquifer?	**NO**	The BGS records that the site is underlain by London Clay Formation. No superficial deposits are recorded.
Will the proposed basement extend beneath the water table surface?	**NO**	No groundwater is expected within the impermeable London Clay.
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	**NO**	The nearest surface water feature is the River Fleet located approximately 390m east of the site.
Is the site within the catchment area of the pond chains on Hampstead Heath?	**NO**	The site is outside of the catchment areas of the Hampstead Heath ponds as shown in Figure 14 of the CGHHS
Will the proposed development result in a change in the area of hard-surfaced/paved areas?	**NO**	The site is presently 100% covered by buildings and the proposed development also involves 100% coverage
Will more surface water (e.g. rainfall and run-off) than at present will be discharged to the ground (e.g. via soakaways and/or SUDS)?	**NO**	There is no drainage to the ground.
Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than the mean water level in any local pond?	**NO**	There are no nearby surface water features.

Screening Checklist for Stability

Question	Response	Justification
Does the existing site include slopes, natural or manmade, greater than 7 degrees?	**NO**	The site is level.
Does the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees?	**NO**	No re-profiling of the site is planned.
Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees?	**NO**	No slopes greater than 7 degrees are present.
Is the site within a wider hillside setting in which the general slope is greater than 7 degrees?	**NO**	No. Figure 16 of the CGHHS shows the site to be in an area of zero to seven degrees slope.
Is London Clay the shallowest strata at the site?	**YES**	Carry forward to Scoping
Will trees be felled as part of the proposed development and/or are works proposed within tree protection zones where trees are to be retained?	**NO**	No trees are present on the site.
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	**NO**	No evidence of cracks or building movements was evident upon visiting the site and no effects were noted in any of the adjacent and surrounding buildings.
Is the site within 100m of a watercourse of a potential spring line?	**NO**	The nearest surface water feature is the Grand Union Canal located 450m north of the site.
Is the site within an area of previously worked ground?	**YES**	Figure 3 of the CGHHS shows the site to be in an area of worked ground. Carry forward to Scoping.
Is the site within an aquifer?	**NO**	The London Clay Formation is classified as Unproductive Strata.
Will the proposed basement extend beneath the water table such that dewatering may be required during construction?	**NO**	No water table is expected to be present.
Is the site within 50m of the Hampstead Heath ponds?	**NO**	The Hampstead Heath ponds are over 3km to the north of the site.
Is the site within 5m of a highway or pedestrian right of way?	**YES**	Carry forward to Scoping
Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?	**YES**	Carry forward to Scoping
Is the site over (or within the exclusion zone of) tunnels, e.g. railway lines?	**NO**	The northbound and southbound tunnels of the northern line lie underneath Camden High Street, approximately 50m west of the rear of the site.

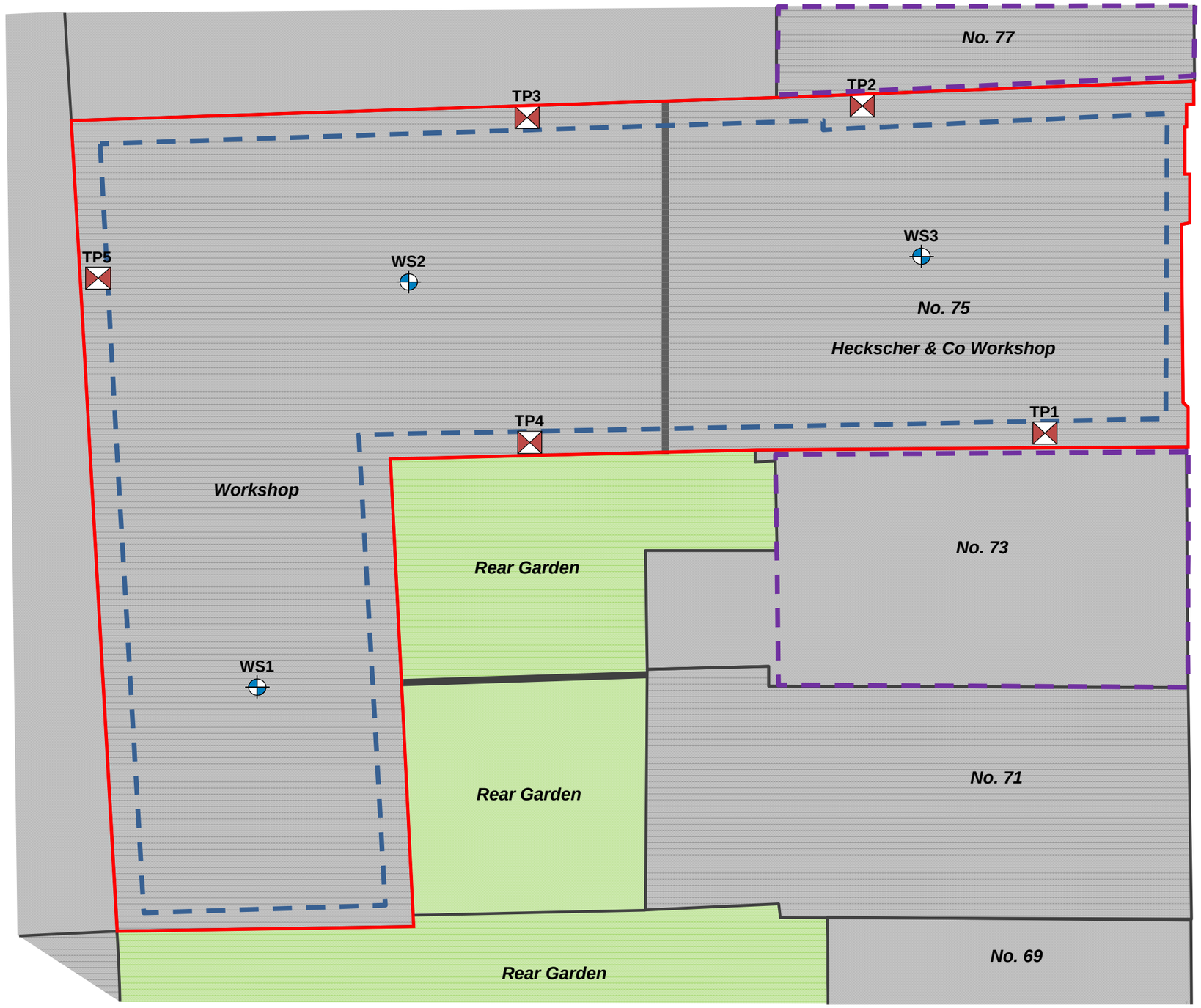
Screening Checklist for Surface Flow and Flooding

Question	Response	Justification
Is the site within the catchment area of the pond chains on Hampstead Heath?	**NO**	The site is outside of the catchment areas of the Hampstead Heath ponds as shown in Figure 14 of the CGHHS
As part of the site drainage, will surface water flows (e.g. rainfall and run-off) be materially changed from the existing route?	**NO**	Surface water flows will be disposed of by the existing means.
Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?	**NO**	The site is presently 100% covered by buildings and the proposed development also involves 100% coverage
Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface-water being received by adjacent properties or downstream watercourses?	**NO**	All drainage is to the sewer as per existing.
Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**NO**	All drainage is to the sewer as per existing.
Is the site in an area known to be at risk from surface water flooding, or is it at risk of flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	**NO**	The site is in a Flood Zone 1 (less than 1 in 1000 chance of flooding). The site is not on a street indicated on Figure 15 of the CGHHS to have been flooded in either 1975 or 2002. There are no nearby surface water features.

PROJECT: Bayham Street, NW1
CLIENT: Yorkshire Prosperity Limited

LBH4318
26/10/2015

SITE PLAN



Site Boundary
Existing Building
Soft Landscaping
Proposed Basement
Assumed extent of neighbouring basement
Window sample borehole with heavy weight dynamic probe
Hand dug trial pit

BAYHAM STREET

DO NOT SCALE

PROJECT: No. 75 Bayham Street LBH4318

CLIENT: Yorkshire Prosperity Limited

BOREHOLE WS1

BORING METHOD: Dynamic Window Sampler

Date: 17.02.2015

GROUND WATER: No groundwater was encountered

REMARKS: Heavy Weight Dynamic Probe from GL to 10m depth

Samples No	Samples Type	Depth m	Tests	Legend	Depth m	Approx OD = 27.42 — Description
					0.12	MADE GROUND: Concrete over flint gravel
					0.90	MADE GROUND: Dirty brown soft slightly sandy CLAY with occassional flint and brick fragments and rare pockets (<30mm) of brown sandy silt.
1	D	2.50				Soft to firm brown silty CLAY. Becoming firm at 2.5m depth
					4.50	Stiff brown mottled grey silty CLAY
					5.00	Base

U=Undisturbed
B= Bulk
D=Disturbed
W=Water

Sheet No:

PROJECT: No. 75 Bayham Street LBH4318

CLIENT: Yorkshire Prosperity Limited

BOREHOLE WS2

BORING METHOD: Dynamic Window Sampler

Date: 17.02.2015

GROUND WATER: No groundwater was encountered

REMARKS: Heavy Weight Dynamic Probe from GL to 10m depth

Samples No	Samples Type	Depth m	Tests	Legend	Depth m	Approx OD = 27.44	Description
					0.20		MADE GROUND: Concrete over flint gravel
					0.90		MADE GROUND: Dirty brown soft sandy CLAY with occassional flint, mortar, brick fragments and clay pipe
							Soft to firm brown silty CLAY.
							Becoming firm at 3.0m depth
1	D	3.50					
					4.50		Stiff brown mottled grey silty CLAY
					5.00		Base

U=Undisturbed
B= Bulk
D=Disturbed
W=Water

Sheet No:

LBH WEMBLEY **Geotechnical & Environmental**

PROJECT: No. 75 Bayham Street LBH4318

CLIENT: Yorkshire Prosperity Limited

BOREHOLE WS3

BORING METHOD: Dynamic Window Sampler

Date: 17.02.2015

GROUND WATER: No groundwater was encountered

REMARKS: Borehole refused at 4.2m possibly due to claystone within the London Clay
Heavy Weight Dynamic Probe from GL to 8m depth

Samples No	Samples Type	Depth m	Tests	Legend	Depth m	Approx OD = 27.52 — Description
					0.26	MADE GROUND: Concrete over flint gravel
					1.80	MADE GROUND: Dirty brown soft sandy CLAY with occassional flint, mortar, brick fragments, slate, oyster shells and clay pipe.
						Firm brown silty CLAY.
						Becoming stiff at 3.5m depth.
1	D	4.00			4.20	
						Base
					5.00	Base

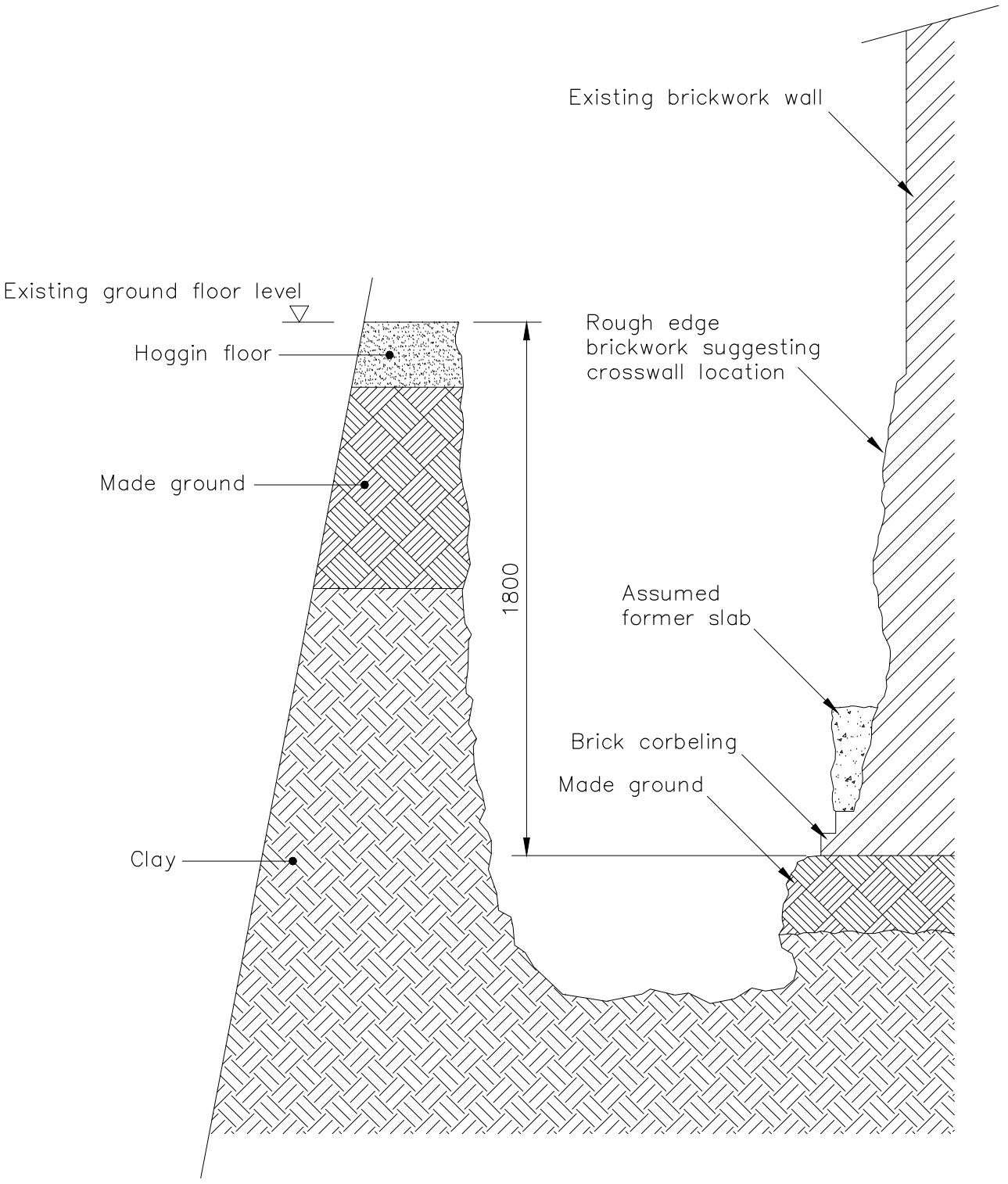
U=Undisturbed
B= Bulk
D=Disturbed
W=Water

Sheet No:

0

100mm WHEN PLOTTED TO SCALE

100



TRIAL PIT 1

Scale 1:20

Client		Job No P3096	
Title 75 BAYHAM STREET, LONDON NW1		Drawing No TP01	Revision / Check
Foundation House 4 Percy Road London N12 8BU Tel 020 8445 9115 Fax 020 8446 9788 E-mail mail@maengineers.com	MICHAEL LEXANDER	Drawn RJC	Scale 1:20 Drg Size A4

0

100mm WHEN PLOTTED TO SCALE

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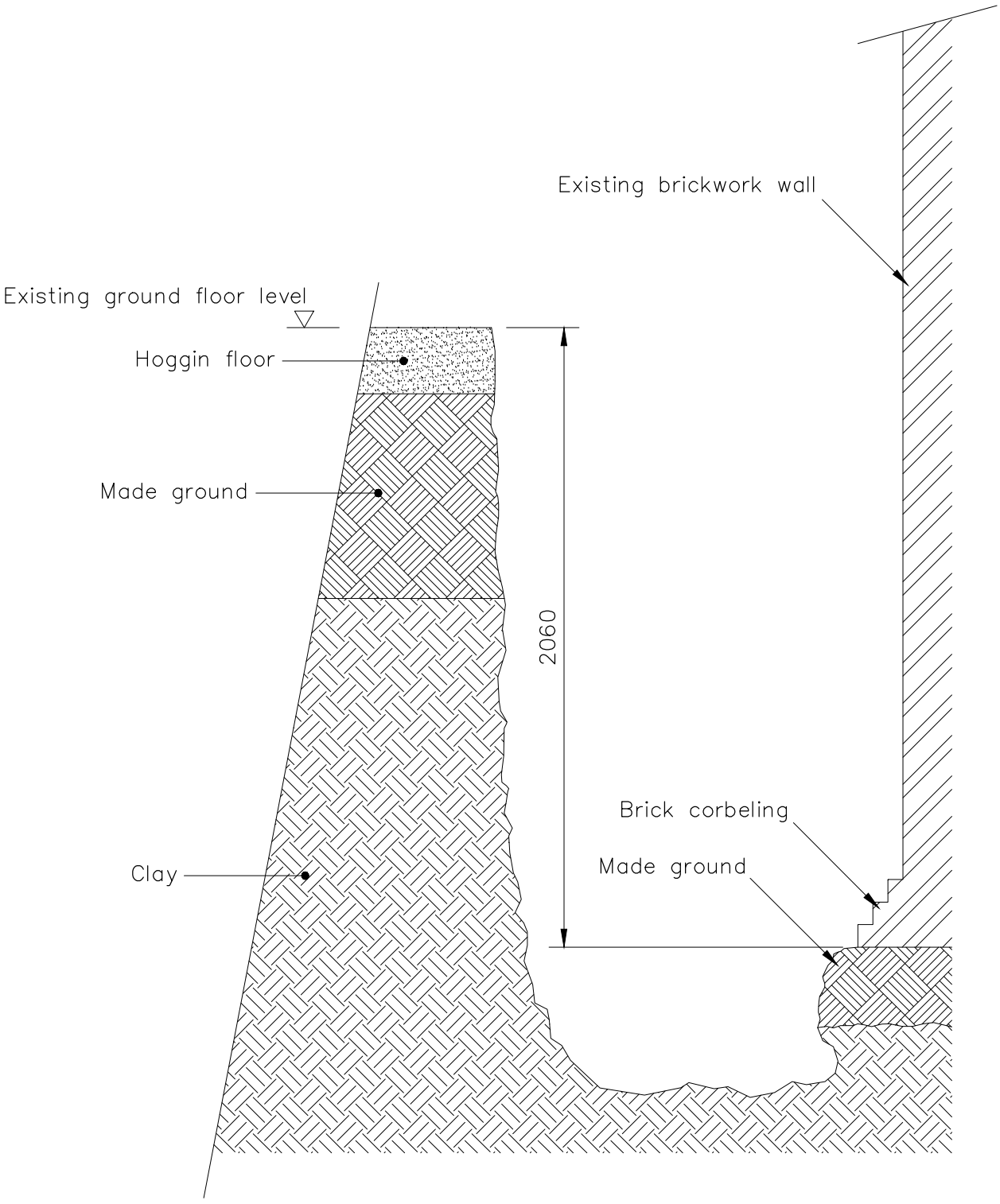

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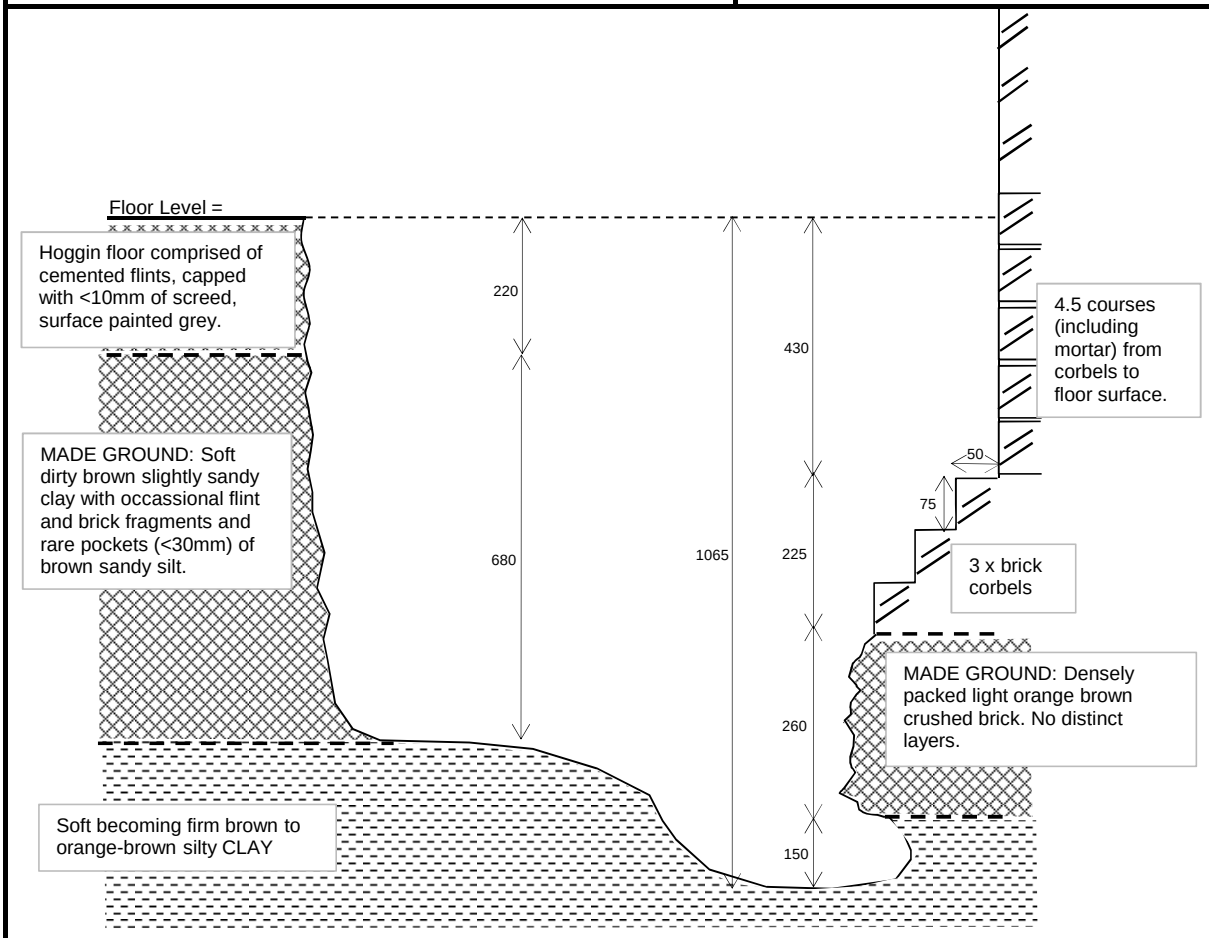
PROJECT: No. 75 Bayham Street LBH4318

CLIENT: Yorkshire Prosperity Limited

TRIAL PIT No TP3



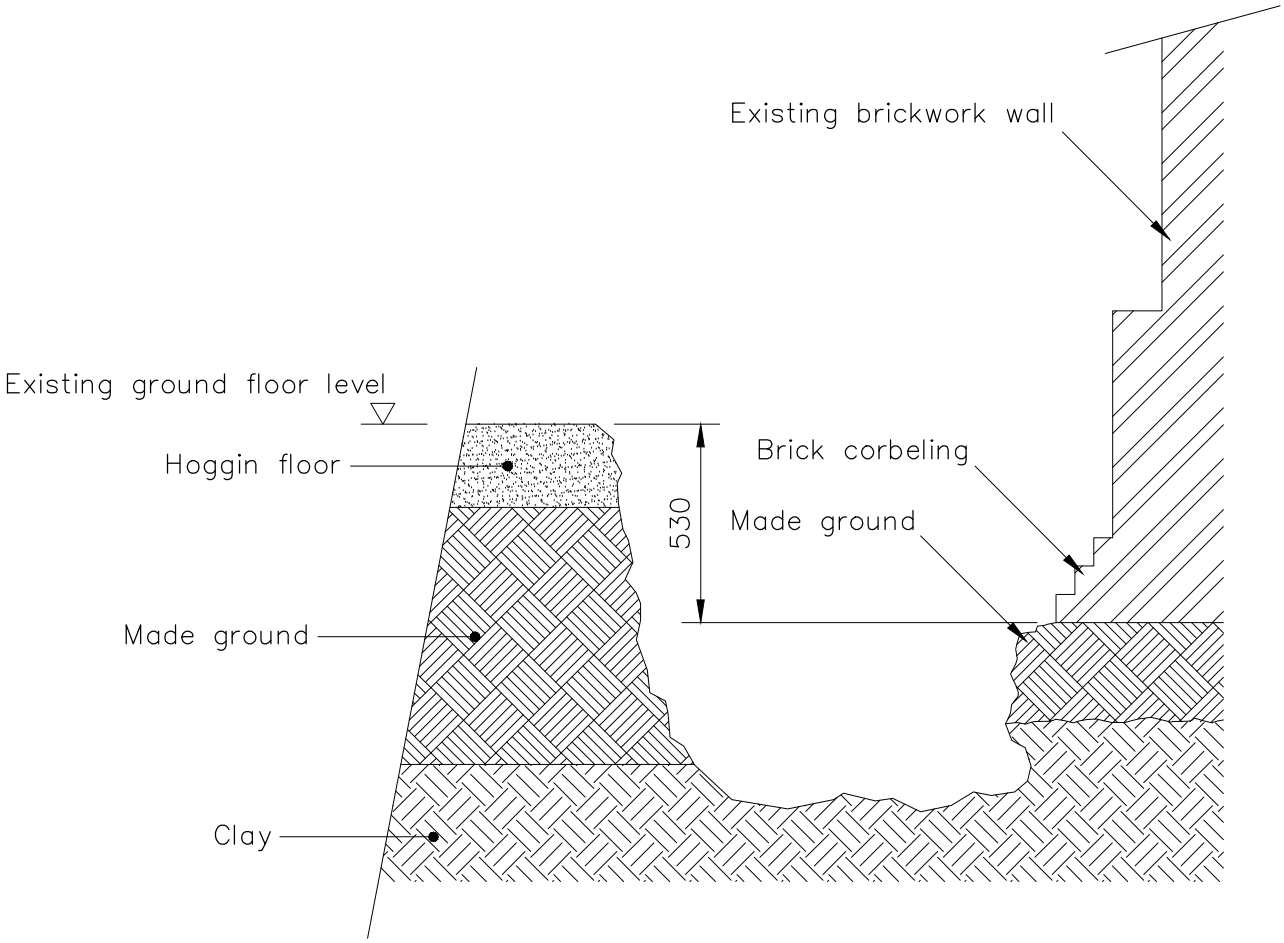
Pit inspected 17.02.15
All dimensions in millimetres
Do not scale
No groundwater encountered

Sheet 1 of 1

0

100mm WHEN PLOTTED TO SCALE

100



TRIAL PIT 4
Scale 1:20

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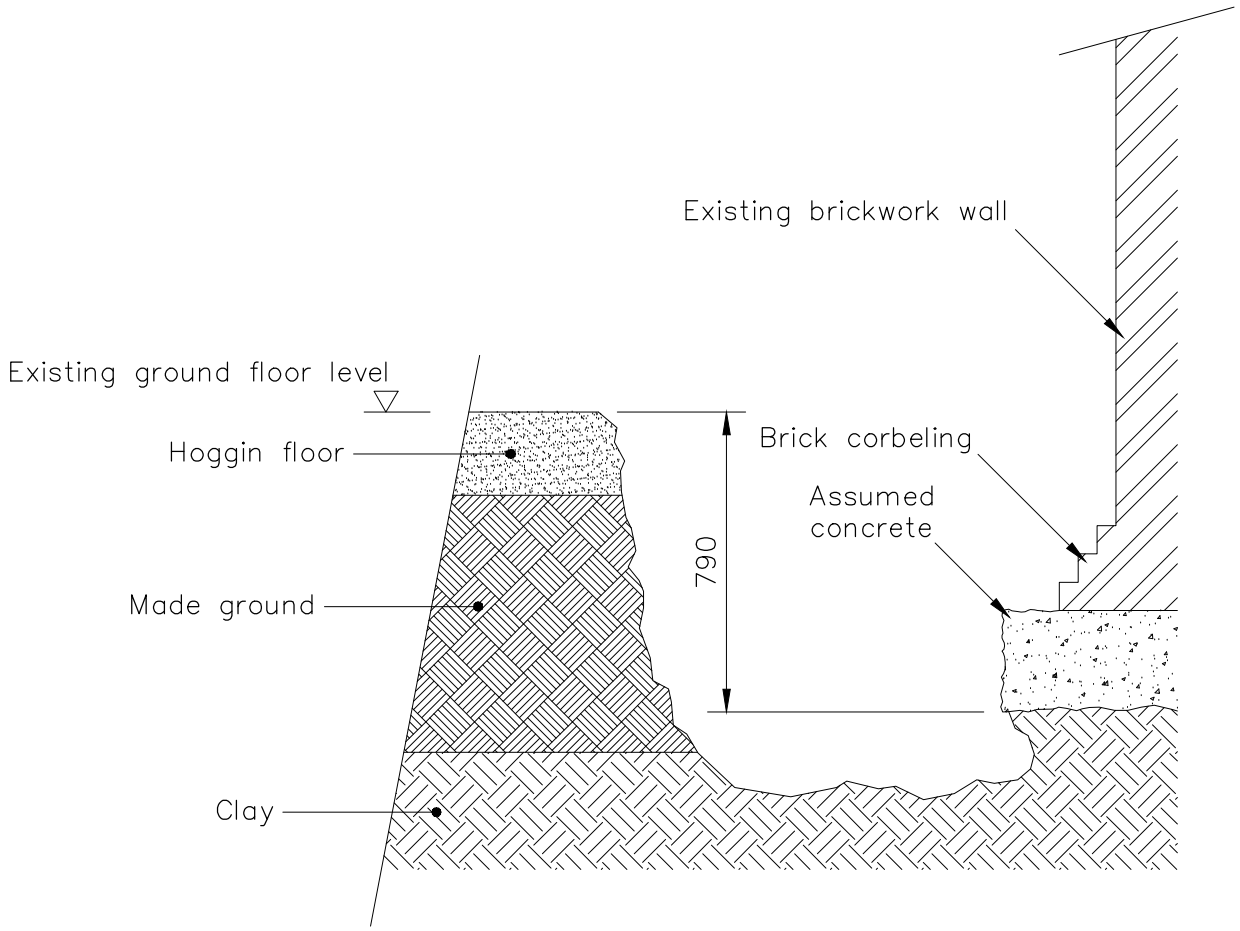
0 100mm WHEN PLOTTED TO SCALE 100



TRIAL PIT 5
Scale 1:20

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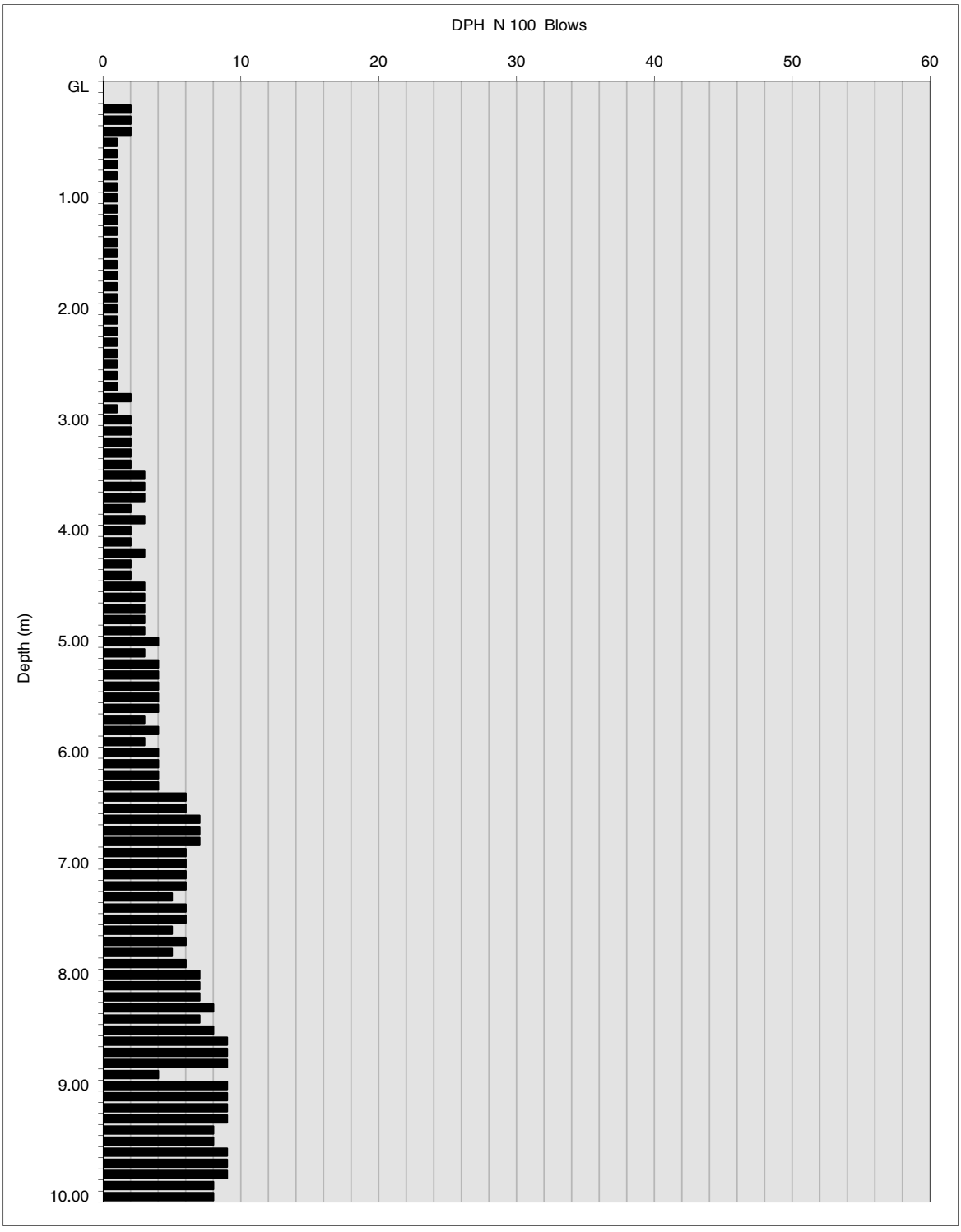
Foundation House 4 Percy Road London N12 8BU Tel 020 8445 9115 Fax 020 8446 9788 E-mail mail@maengineers.com	MICHAEL ALEXANDER	Drawn RJC	Scale 1:20 Drg Size A4

PROJECT:	No. 75 Bayham Street	**DYNAMIC PROBE RESULTS**
CLIENT:	Yorkshire Prosperity Limited	

Probe No: DP1

Date: 17.02.2015



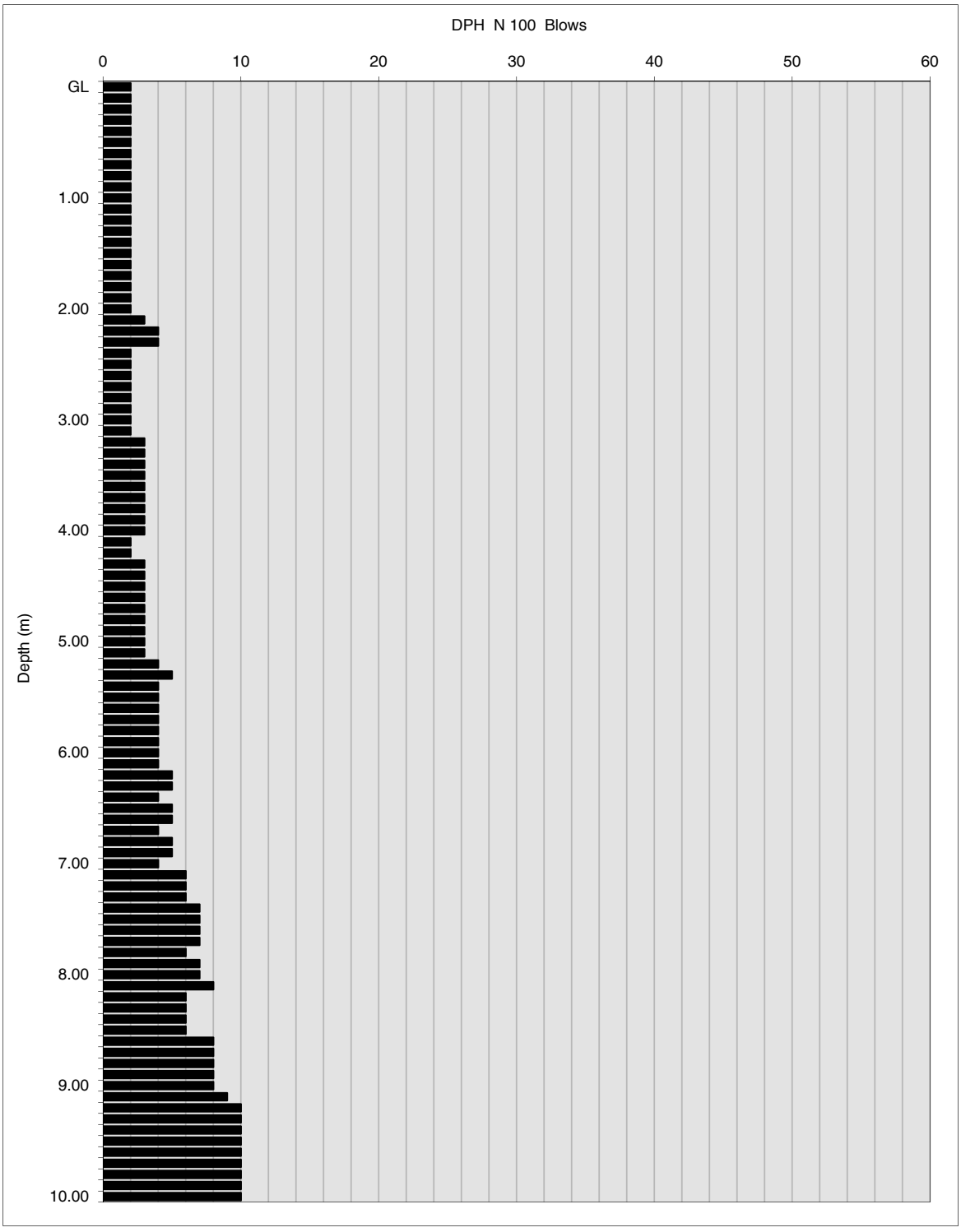
Remarks : Apparatus BS1377:Part 9:1990 - DPH.
Heavy Weight Dynamic Probe

Project No	**LBH WEMBLEY Geotechnical & Environmental**
LBH4318	

PROJECT:	No. 75 Bayham Street	**DYNAMIC PROBE RESULTS**
CLIENT:	Yorkshire Prosperity Limited	

Probe No: DP2

Date: 17.02.2015



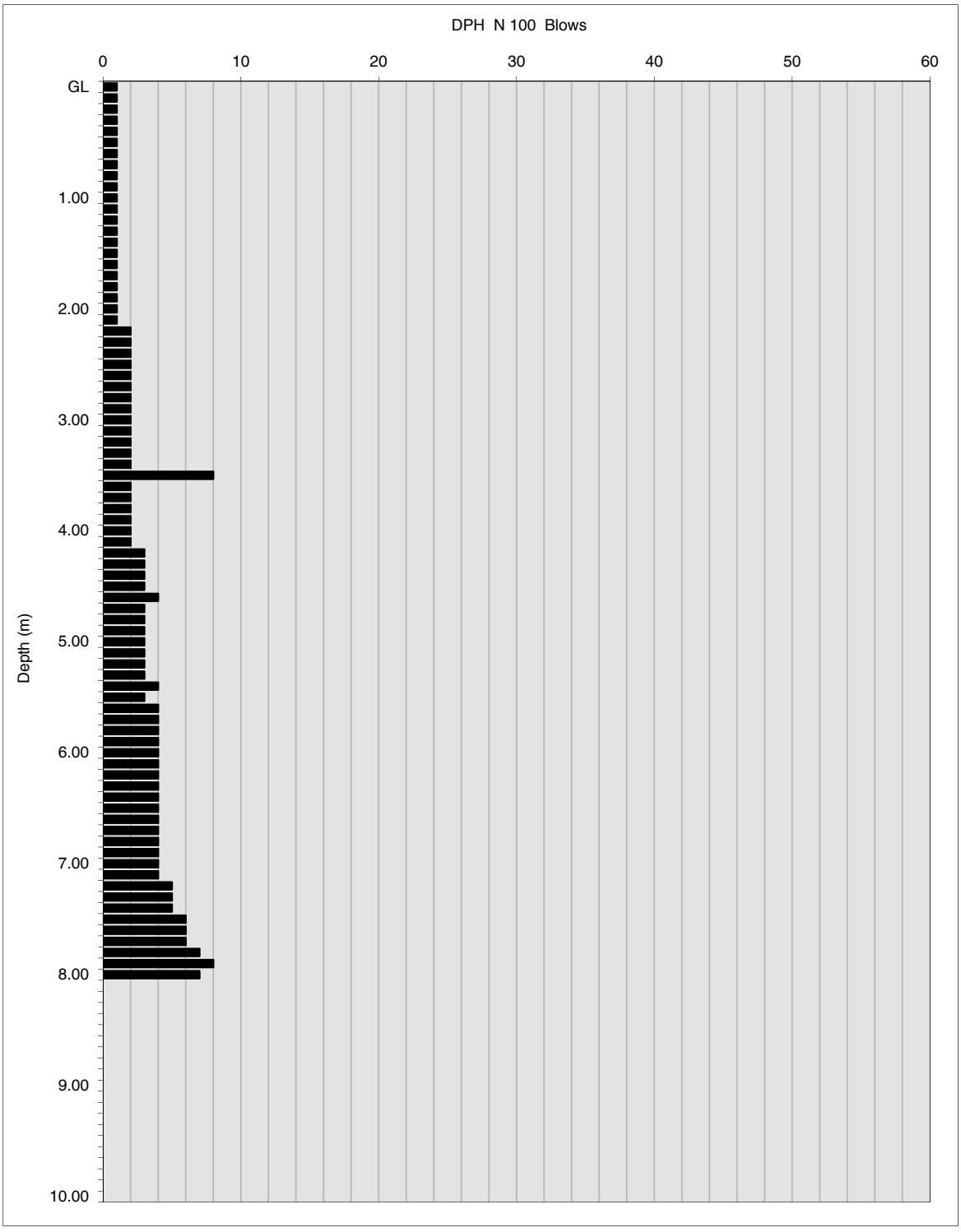
Remarks : Apparatus BS1377:Part 9:1990 - DPH.
Heavy Weight Dynamic Probe

Project No	**LBH WEMBLEY Geotechnical & Environmental**
LBH4318	

PROJECT:	No. 75 Bayham Street	**DYNAMIC PROBE RESULTS**
CLIENT:	Yorkshire Prosperity Limited	

Probe No: DP3

Date: 17.02.2015



Remarks : Apparatus BS1377:Part 9:1990 - DPH.
Heavy Weight Dynamic Probe

Project No LBH4318	**LBH WEMBLEY Geotechnical & Environmental**

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone:- 01327 860947/860060 Fax:- 01327 860430 Email: groundtech@listersgeotechnics.co.uk

PROJECT INFORMATION		SAMPLE INFORMATION	
Site Location:-	Bayham Street, Camden	**Laboratory Tests Undertaken:-**	
		TEST TYPE	**TEST METHOD** / **TESTED**
		Natural Moisture Contents (MC%)	(BS 1377:Part 2:1990 Clause 3.2) ✓
		Liquid Limits (%)	(BS 1377:Part 2:1990 Clause 4.3) ✓
		Plastic Limits (%)	(BS 1377:Part 2:1990 Clause 5.3) ✓
		Plasticity Index (%)	(BS 1377:Part 2:1990 Clause 5.4) ✓
		Linear Shrinkage (%)	(BS 1377:Part 2:1990 Clause 6.5)
		PSD - Wet Sieving	(BS 1377:Part 2:1990 Clause 9.2)
Client Reference:-	4318	Engineering Sample Descriptions	(BS 5930 : Section 6)
		Passing 425/63 (μm)	- ✓
		Hydrometer	(BS 1377:Part 2:1990 Clause 9.5)
Date Samples Received:-	19th February 2015	Loss on Ignition (%)	-
Date Testing Completed:-	25th February 2015	Soil Suctions (kPa)	BRE Digest IP 4/93, 1993
		Bulk Density (Mg/m^3)	(BS 1377:Part 2:1990 Clause 7.2)
		Strength Tests	(BS 1377:Part 7:1990 Clause 8 & 9)
		Soluble Sulphate Content (SO^4g/l)	(BS 1377:Part 3:1990 Clause 5.3) ✓
		pH value	(BS 1377:Part 3:1990 Clause 9.4) ✓
		California Bearing Ratios (CBR)	(BS 1377:Part 4:1990 Clause 7)
		Compaction Tests	(BS 1377:Part 4:1990 Clauses 3.0-3.6)
The results relate only to the samples tested			

Laboratory testing in accord with BS EN ISO/IEC 17025-2000 and Quality Management in accord with ISO 9001

Signed on behalf of GroundTech Laboratories:- _____ **Technical Signatory**

Quality Assured to ISO 9001

GEOTECHNICAL LABORATORY TEST RESULTS

Project Ref: 15.02.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone:- 01327 860947/860060 Fax:- 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	MC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	MC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m^3	Test Type	Cell Pressure kN/m^2	Deviator Stress kN/m^2	Apparent Cohesion kN/m^2	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
WS 1	D	2.50		34																			6.7	0.04
WS 2	D	3.50	PI/63	32	78	27	51	99	51	CV	98	0.41	29	0.10									6.7	0.15
WS 3	D	4.00	PI/63	32	75	28	47	99	46	CV	97	0.43	30	0.09									6.8	0.15

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Ref
15.02.016

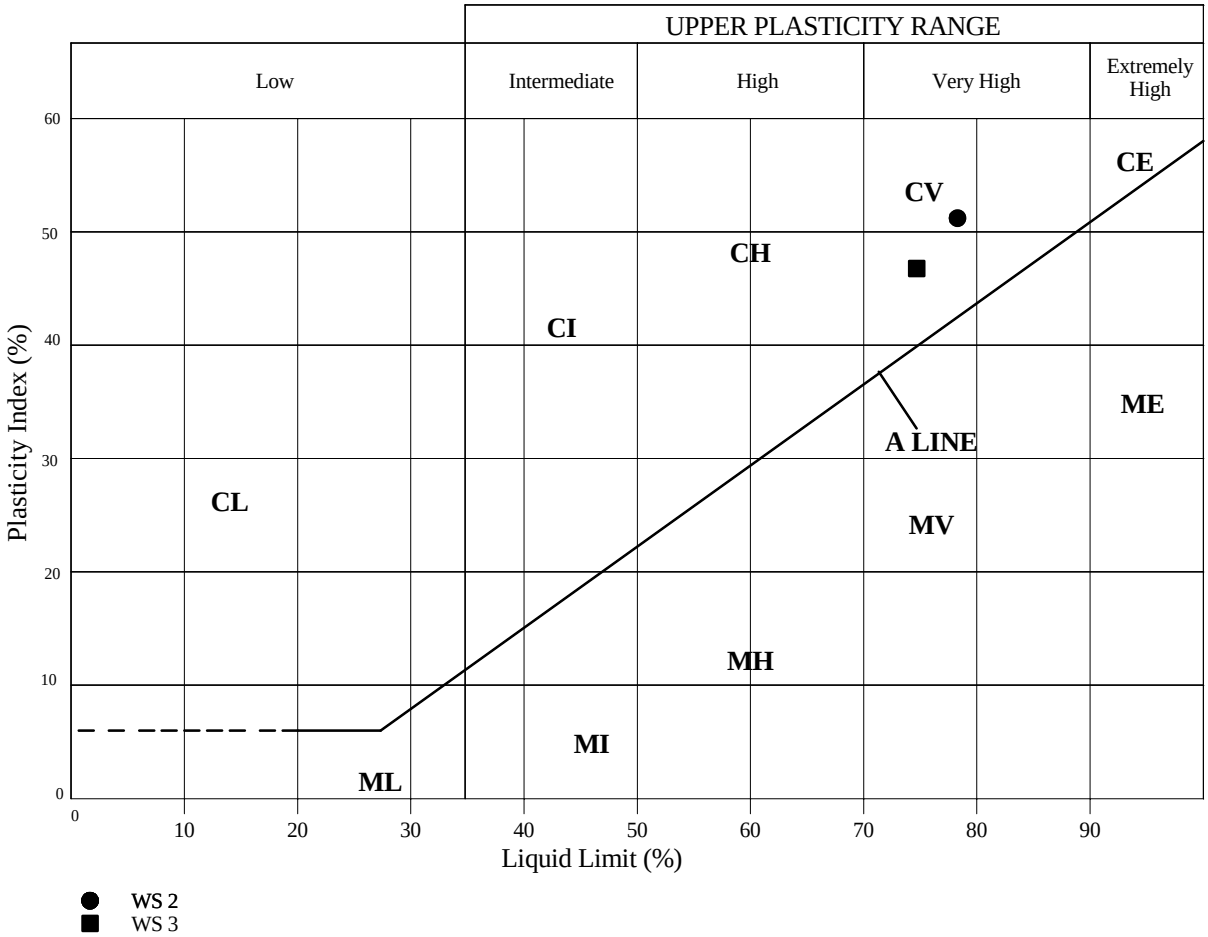
GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone:- 01327 860947/860060 Fax:- 01327 860430

Quality Assured to ISO9001

Site: Bayham Street, Camden



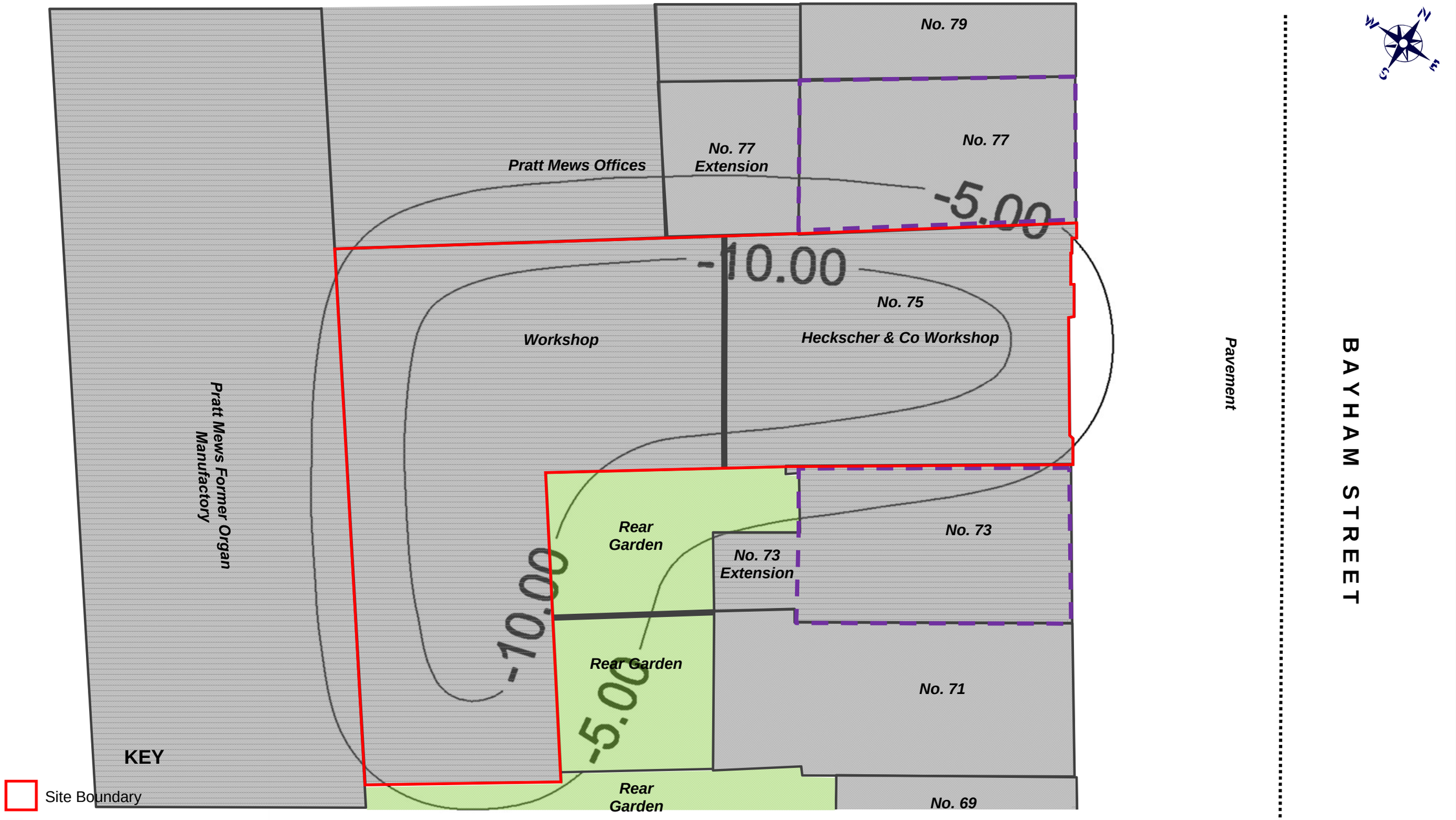
PLASTICITY CHART

Lab. Ref. 15.02.016

PROJECT: Bayham Street, NW1
CLIENT: W12 Studios Limited

LBH4318
23/10/2015

MODEL PREDICTION OF NET SHORT TERM MOVEMENTS



PROJECT:	Bayham Street, NW1	LBH4318	**MODEL PREDICTION OF POST CONSTRUCTION MOVEMENTS**
CLIENT:	W12 Studios Limited	23/10/2015