geotechnical and environmental consultants

ground&water

Basement Impact Assessment and Ground Investigation Report

34 Belgrave Mews South London SW1X 8BT

On behalf of Leconfield Property Group

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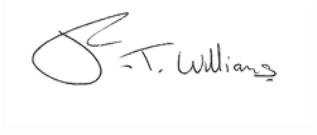
V1.01			
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EXECUTIVE SUMMARY	
PROPOSED DEVELOPMENT	At the time of reporting, December 2023, the proposed development was understood to comprise the construction of a full footprint basement level to a depth of 2.70m bgl. The proposed development fell within Geotechnical Design Category 2 in accordance with Eurocode 7. The proposed development plan can be seen within Figure 3 – Figure4.
GEOLOGY	A study of the aquifer maps on the DEFRA website revealed the site was underlain by a Secondary (A) Aquifer comprising the superficial Kempton Park Gravel Member, underlain by Unproductive Strata comprising bedrock deposits of the London Clay Formation.
HYDROGEOLOGY	Examination of the Environment Agency records showed that the site did not fall within a Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater. No surface water features were present within a 250m radius of the site. The nearest surface water feature was an unnamed pond associated with Green Park located 359m north-east. From analysis of hydrogeological and topographical maps the actual groundwater table was anticipated to be encountered at moderate depth within the superficial soils of the Kempton Park Gravel Member. Further perched groundwater may be present at deeper depths within silty/sandy pockets of the London Clay Formation. It was considered that groundwater was flowing in a southerly direction toward the River Thames and in line with local topography. Examination of the Environment Agency records showed that the site was located within a Flood Zone 1, i.e. an area with a very low probability of flooding.
VOLUME CHANGE POTENTIAL	Foundations in contact with the Kempton Park Gravel Member should be designed in accordance with soils of no volume change potential.
FOUNDATION DESIGN	Foundations constructed on the granular superficial soils of the Kempton Park Gravel Member at the basement level of ~2.70m bgl can be designed based on an allowable bearing capacity of 250kN/m2. This is based on the ground conditions encountered and the in-situ strength data recorded.
SUB-SURFACE CONCRETE	**Made Ground** The water soluble sulphate concentration ranged between 50.90mg/kg - 232mg/kg, with a pH of between 9.53 – 10.40. The total potential sulphate was <0.06%. **Kempton Park Gravel Member** According to Box C6 of BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' the Kempton Park Gravel Member did not fall within a list of UK geological formations known to contain pyrite. Consequently, it was not required to consider the levels of total potential sulphate in the classification process. The water soluble sulphate concentration was 15.20mg/kg, with a pH of 8.95. The total potential sulphate was <0.06%. According to BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' a Sulphate Design Class of DS-1 could be used for sub-surface concrete in contact with the Kempton Park Gravel Member. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1. **London Clay Formation** According to Box C6 of BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' the London Clay Formation fell within a list of UK geological formations known to contain pyrite. It was therefore required to consider the levels of total potential sulphate in the classification process. The water soluble sulphate concentration was 71.90mg/kg, with a pH of 8.42. The total potential sulphate was <0.06%.

EXECUTIVE SUMMARY	
	According to BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' a Sulphate Design Class of DS-1 could be used for sub-surface concrete in contact with the London Clay Formation. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1.

1.0 INTRODUCTION

1.1 General

Ground and Water Limited were instructed by Leconfield Property Group on the 26th October 2023 to conduct a Basement Impact Assessment and Ground Investigation Report on the site at 34 Belgrave Mews South London SW1X 8BT. The scope of the investigation was detailed within the fee proposal GW-2450REV2, dated the 26th October 2023.

1.2 Aims of the Investigation

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

The investigation was to be undertaken to provide parameters for the design of foundations by means of in-situ and laboratory geotechnical testing undertaken on soil samples recovered from trial holes.

The proposed development includes a basement. A Basement Impact Assessment, including screening and detailed comment on surface water flooding/management or combined flooding (sourced from SFRA or similar sources) was part of the remit of the report.

The requirements of the following reports were reviewed with respect to this project:

- The Basement Development in Westminster Supplementary Planning Document, produced by Westminster City Council in October 2014;
- The Basement Development in Westminster Statutory Documents to Accompany SPD, produced by Westminster City Council in October 2014.
- The Westminster City Council's Residential Basement Report, produced by Alan Baxter in July 2013
- The Draft Surface Water Management Plan for the City of Westminster, produced by Halcrow in June 2011; and,
- The Draft Strategic Flood Risk Assessment, produced by the City of Westminster in 2019.

In addition, a Ground Movement Assessment for the impact of the proposed development on surrounding properties and assets was in the remit of the report.

The techniques adopted for the investigation were chosen considering the requirements of the client, anticipated ground conditions, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

1.3 Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

Previous phases of reporting have been undertaken by Ground and Water Limited. This report should be read in conjunction with:

- Phase 1 Desk Study Report GWPR5680/DS/November 2023; and

- Phase 1 Contamination Assessment Report GWPR5680/CAR/December 2023.

1.4 Technical Glossary

Generic technical terms can be viewed within the glossary provided within Appendix B.

2.0 SITE SETTING

2.1 Site Location

The site comprised a ~100m^2 roughly rectangular-shaped plot of land, orientated in a north-east to south-west direction, along the south-eastern side of Belgrave Mews South. The site was located in the central portion of Belgravia, central London.

The Easting Northing for the centre of the site was approximately TQ 28382 79301. A site location plan is given within Figure 1.

2.2 Site Description

A Site Walkover was undertaken on the 7th November 2023. A description of the site, as noted during the Site Walkover, is tabulated below.

Site Description Sheet	
Use of site	At the time of the site walkover, 7th November 2023, the site was noted to comprise and disused residential development.
Site topography	The site was noted to be relatively flat and level with no major slopes and/or undulations.
Area topography	The area surrounding the site was noted to be relatively flat with a slight slope downwards in a generally southerly direction towards the River Thames.
Structures on-site	The structure on-site comprised a low-rise two-storey terraced mews structure with associated rear courtyard area. A small wooden shed structure was located within the rear courtyard area.
Structures off-site	Generally, the structures off-site along the mews also comprised low-rise two-storey terraced mews structures however the property at No.27 contained three-stories.
Use of surrounding ground	The surrounding land was noted to largely comprise private residential dwelling spaces.
Boundary features	North-western: Site boundary comprising the entrance to Belgravia Mews South. North-eastern: Party wall with No.36 Belgravia Mews South. South-eastern: Brick walling adjoining No.11 Eaton Place. South-western: Party wall with No.36 Belgravia Mews South.
Site covering	The site covering was noted to be entirely formed of hardstanding.
Contamination sources onsite	None noted
Contamination sources off-site	None noted
Vegetation onsite	None noted
Vegetation off-site	None noted
Services	Services were likely to be present.

2.3 Site Topography

The site did not contain a basement/lower ground floor. At the time of reporting a topographical survey was not available however using online tools it was determined the site was located at an approximate level of 8.00m AOD. The surrounding area in which the site was located was noted to be generally flat and level with no major slopes and/or undulations. A contour map has been provided within Figure 2.

2.4 Nearby Assets and Subterranean Developments

No railway cuttings were noted within a 250m radius of the site. No London Underground tunnels were noted within a 250m radius of the site. The site is not in close proximity to any National Rail lines. The site was considered to be not sufficiently close to underground transport services, in order for these to affect the property and there are no approved proposals for any TfL services in the vicinity that would affect the development.

The properties along Belgravia Mews South were mainly two-storey, terraced private residential properties, No.27 was noted to be a three-storey development. At the time of reporting (December 2023), it was understood that No.32 did contain a basement structure whist No.36 was currently attaining planning for a basement structure.

2.5 Proposed Development

At the time of reporting, December 2023, the proposed development was understood to comprise the construction of a full footprint basement level to a depth of 2.70m bgl.

The proposed development fell within Geotechnical Design Category 2 in accordance with Eurocode 7. A Plan view of the proposed development plan can be seen within Figure 3 and a section view is displayed in Figure 4.

A pumping mechanism will be installed for the proposed basement. There is a likelihood that this may fail and allow excess water to accumulate. If this were to occur, the build-up of water would be gradual and noticeable before it becomes a significant life-threatening hazard.

The amount of hardstanding across the entire site was not anticipated to change. Based on the SUDS assessment in this report, SUDS were not required. The levels on-site were considered to remain the same.

2.6 Geology

The British Geological Survey Solid and Drift Geology Map for the Belgravia area (South London Sheet No. 270) revealed that the site was underlain by superficial Kempton Park Gravel Member and bedrock deposits of the London Clay Formation. No areas of Made Ground or Reworked Ground were noted within a 250m radius.

2.7 Hydrogeology and Hydrology

A study of the aquifer maps on the DEFRA website revealed the site was underlain by a Secondary (A) Aquifer comprising the superficial Kempton Park Gravel Member, underlain by Unproductive Strata comprising bedrock deposits of the London Clay Formation.

Examination of the Environment Agency records showed that the site did not fall within a Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater.

No surface water features were present within a 250m radius of the site. The nearest surface water feature was an unnamed pond associated with Green Park located 359m north-east.

From analysis of hydrogeological and topographical maps the actual groundwater table was anticipated to be encountered at moderate depth within the superficial soils of the Kempton Park Gravel Member. Further perched groundwater may be present at deeper depths within silty/sandy pockets of the London Clay Formation. It was considered that groundwater was flowing in a southerly direction toward the River Thames and in line with local topography.

Examination of the Environment Agency records showed that the site was located within a Flood Zone 1, i.e. an area with a very low probability of flooding.

2.8 BGS Borehole Records

A BGS borehole (TQ27NE2214) located ~165m south-east of the site revealed a 1.30m capping of Made Ground overlying interbedded superficial sandy gravelly clay and sandy gravel deposits to a depth 9.00m bgl. Bedrock deposits of the London Clay Formation were then noted to a depth of 53.00m bgl overlying deposits of the Lambeth Group to a depth 65.00m bgl. No groundwater was noted.

2.9 Flooding

A summary of the risk of various flooding types has been summarised in the following table.

Summary of Flood Risk			
Type of Flooding	**Figure Reference**	**On-site Flood Risk**	**Maximum Nearby Flood Risk**
Rivers and Seas	Figure 5	Flood Zone 1	Flood Zone 1
Flood Defences	Figure 5	Not Protected	Not Protected
Reservoir	Figure 6	No Risk	No Risk
Surface Water Flooding	Figure 7 - Figure 11	Very Low	Very Low
Groundwater Flooding	Figure 12	Potentially Elevated Groundwater	No Records of Groundwater Flooding Incidents
Sewer Flooding	Figure 13	7 – 10 Reported Incidents within SW1 Postcode District	
Critical Drainage Areas/Local Flood Risk Areas	Figure 14	Located within the Counters Creek Catchment CDA only. Not located within a LFRZ.	

2.10 Radon

A review of the freely available UK Health Security Agency radon database, UK Radon, indicated that the site was located within a 1km grid square, where the maximum radon potential of <1% was recorded. Basic radon protection measures are required in areas where more than 3% of houses are at or above the Action Level. As the site includes a basement, then based on BRE211 (2023-Update), underground structures are vulnerable to radon ingress and accumulation, therefore consideration should be given to upgrade waterproofing systems to include protection against radon, regardless of the area they are constructed.

2.11 Unexploded Ordnance Review

A review of the data available on www.zeticauxo.com/ revealed the site was located within the London high-risk area associated with unexploded ordnance (UXO). The London area is further separated into 25No. categories based on bombing densities, where green is indicated for areas having <10 bombs dropped per km^2 and red is indicated for areas having >150 bombs dropped per km2. The site is situated within the dark red area, ~halfway through the spectrum.

2.12 Historic Landfill Tool Review

A review of the data available on www.groundsure.io/ revealed no active or historical landfills within a 250m radius of the site.

3.0 BASEMENT IMPACT ASSESSMENT

A scoping and screening assessment was undertaken for the proposed development based on the supplementary planning document (SPD) for the London Borough of Westminster. This stage should identify any areas of concern and therefore focus efforts on further investigation.

3.1 Stage 1: Screening

The screening questions/fields for three distinct topics (surface water/flooding, groundwater, and stability) have been summarised within this section of the report.

Questions relating to surface water and flooding, as well as discussion and conclusions, can be viewed within the following table.

Surface Water and Flooding Screening Flowchart		
Question	**Discussion**	**Conclusion**
Question 1: As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route.	**No**: The amount of hardstanding in plan view is not anticipated to change, therefore, no fundamental change to the volume of rainfall or the peak surface run-off is anticipated.	No further action required.
Question 2: Will the proposed basement development result in a change in the proportion of hard surfaced/paved external areas.	**No:** The amount of hardstanding in plan view is not anticipated to fundamentally change.	No further action required.
Question 3: 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:** The amount of hardstanding in plan view is not anticipated to fundamentally change, therefore, no fundamental change to surface water inflows is anticipated.	No further action required.
Question 4: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses	**No:** No effects on the quality of the surface water can be expected due to the proposed development comprising the construction of a basement for residential purposes and lowering of the courtyard. No change of use is expected.	No further action required.
Question 5: Is the site in an area known to be at risk from surface water flooding.	**No:** Data from the Environment Agency website and SFRA, indicated that the site was at very low risk of surface water flooding.	No further action required.
Question 6a: Is the site within a Critical Drainage Area (CDA)?	**Yes:** The site was located within the Counters Creek Catchment CDA and not any other CDAs.	**Take forward to scoping.**
Question 6b: Is the site within a Local Flood Risk Zone (LFRZ)?	**No:** The site was not located within a LFRZ.	No further action required.

Questions relating to groundwater, as well as discussion and conclusions, can be viewed within the following table.

Subterranean (Groundwater) Screening Flowchart		
Question	**Discussion**	**Conclusion**
Question 1a: Is the site located directly above an aquifer?	**Yes:** The site was located on a Secondary (A) Aquifer comprising the superficial Kempton Park Gravel Member, underlain by Unproductive Strata comprising bedrock deposits of the London	**Take forward to scoping.**

Subterranean (Groundwater) Screening Flowchart		
Question	**Discussion**	**Conclusion**
	Clay Formation.	
Question 1b: Will the proposed basement extend beneath the water table surface?	**Yes:** The groundwater table was anticipated to be at shallow depth within the superficial soils of the Kempton Park Gravel Member. Further small amounts of groundwater may be present within any sandy/silty bands within the London Clay Formation.	**Take forward to scoping.**
Question 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	**No:** No surface water features were noted within a 250m radius of the site.	No further action required.
Question 3: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas.	**No:** The amount of hardstanding in plan view is not anticipated to fundamentally change.	No further action required.
Question 4: As part of site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS).	**No:** The amount of hardstanding in plan view is not anticipated to fundamentally change.	No further action required.
Question 5: 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 or spring line.	**No:** No surface water features were noted within a 250m radius of the site.	No further action required.

Questions relating to ground stability, as well as discussion and conclusions, can be viewed within the following table.

Stability Screening Flowchart		
Question	**Discussion**	**Conclusion**
Question 1: Does the existing site include slopes, natural or man-made greater than 7° (approximately 1 in 8).	**No:** No significant slopes were noted. No deep failures were expected due to the geology and the depth of the basement.	No further action required.
Question 2: Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8).	**No:** No significant exposed slopes were noted or expected within the proposed development.	No further action required.
Question 3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8).	**No: N**o significant slopes greater than 7°, natural or man-made, were noted within close proximity to the site.	No further action required.
Question 4: Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8).	**No: N**o significant slopes greater than 7°, natural or man-made, were noted within close proximity to the site.	No further action required.
Question 5: Is the London Clay the shallowest strata at the site.	**No:** The British Geological Survey Solid and Drift Geology Map for the Belgravia area (South London Sheet No. 270) revealed that the site was underlain by superficial Kempton Park Gravel Member and bedrock deposits of the London Clay Formation. No areas of Made Ground or Reworked Ground were noted	No further action required.

Stability Screening Flowchart		
Question	**Discussion**	**Conclusion**
	within a 250m radius.	
Question 6: Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained.	**No:** No trees (if any present) were considered to be removed and no construction will take place in RPZ.	No further action required.
Question 7: Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.	**Potentially:** Anticipated geology considered the presence of cohesive soils of the London Clay Formation is likely to have volume change potential, and therefore would be subject to subsidence due to shrinkage-swelling.	**Take forward to scoping.**
Question 8: Is the site within 100m of a watercourse or potential spring line?	**No:** No surface water features/spring lines were noted within a 250m radius of the site.	No further action required.
Question 9: Is the site within an area of previously worked ground?	**No:** No Made Ground/Worked Ground was noted within a 250m radius of the site.	No further action required.
Question 10: Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction.	**Yes:** The DEFRA online maps indicated that the site was located on a Secondary (A) Aquifer comprising the Kempton Park Gravel Member. From analysis of hydrogeological and topographical maps, the groundwater table was anticipated to be at shallow depth within the superficial soils. Further small amounts of groundwater may be present within any sandy/silty bands within the London Clay Formation.	**Take forward to scoping.**
Question 11: Is the site within 5m of a highway or pedestrian right of way?	**Yes:** The site is located adjacent to the highway associated with Belgravia Mews South.	**Take forward to scoping.**
Question 12: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	**No:** The proposed development comprised the underpinning of the property to create a full footprint basement level. At the time of reporting (December 2023), it was understood that No.32 did contain a basement structure whist No.36 was currently attaining planning for a basement structure.	No further action required.
Question 13: Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	**No:** No railway cuttings were noted in close proximity to the site. No London Underground tunnels were noted in close proximity to the site. The site is not in close proximity to any National Rail lines. The site was considered to be not sufficiently close to underground transport services, in order for these to affect the property and there are no approved proposals for any TfL services in the vicinity that would affect the development.	No further action required.

3.2 Stage 2: Scoping

There are areas of concerns that the Screening process have highlighted.

- **Perched Water and Groundwater:** It was anticipated that groundwater may be perched on top of the London Clay Formation, within the superficial Kempton Park Gravel Member. Given the proposed basement depth, it was likely that the basement may encounter perched water/groundwater during construction. **This is to be taken forward for further assessment through a ground investigation and the installation of a monitoring well.**

- **Seasonal Soil Moisture and Volume Change Potential:** Anticipated geology considered the presence of mainly granular soils of the Kempton Park Gravel Member however cohesive soils of the London Clay Formation were expected to be underlying the superficial deposits. The London Clay Formation is likely to be subject to subsidence due to shrinkage-swelling. **The depth and volume change potential of the underlying soils should be investigated.**

- **Pressure Induced Settlement and Heave:** Given the overburden pressure release following excavation of soil, as well as the loading of retaining wall foundations, the pressure across the basement is likely to cause differential settlement and heave. **Regarding the bulk basement construction, care will need to be taken to ensure that the slab is protected through accommodating heave (primarily) and any seasonal if applicable.**

- **Retaining Wall Design:** Given the design of basements, retaining walls should be appropriately designed to withstand the horizontal pressure of adjacent strata. **Retaining walls should be appropriately designed**.

- **Instability During Excavation:** Stability issues may arise during the excavation through natural soils and any potential localised Made Ground. **Specific measures to be undertaken throughout excavation and construction will be discussed within this report, and more specifically the construction method statement.**

- **Ground Movement and Nearby Assets:** Various buildings and structures were noted in close proximity to the site, with some having basements/lower ground floors evident, and others not; therefore, differential foundation depths would cause potential damage to the walls of nearby buildings, due to soil displacement following the excavation/installation of the basement. This may also cause damage to nearby roads, pavements and utilities. **A Ground Movement Assessment (GMA) is required to assess the soil displacement and damage to nearby buildings, roads, pavements and utilities.**

- **Sub-Surface Concrete in Aggressive Ground Conditions:** Concrete may corrode if unsuitable concrete is used. A suitable concrete class should be used for all sub-surface concrete used for all foundations, based on the levels of sulphates and the pH within the ground it is being constructed on/through. **Testing in accordance with BRE Special Digest is required to be undertaken and a concrete specification is to be provided.**

- **Surface Water Flooding and Site Drainage:** Data from the Environment Agency website indicated that the site, and the majority of the surrounding area, was at very low risk of surface water flooding. The effect the proposed development will have on surface water flooding and the requirements to prevent surface water flooding and site drainage is to be discussed further within this report.

- **Groundwater Flooding and Flow:** As the site was underlain by a Secondary (A) Aquifer, underlain by Unproductive Strata, there was considered to be a risk of groundwater flooding; however. **A groundwater monitoring well should be installed as part of the site investigation, as well as groundwater dip measurements following the site works, to investigate groundwater levels.**

- **Sewer Flooding:** Given their subterranean position, basements can be susceptible to flooding from sewers. Data from the SFRA show that the postcode district of SW1 had 7 – 10 Reported Incidents. **The effect the basement will have on the risk of sewer flooding and the requirements to prevent sewer flooding is to be discussed further within this report.**

A site-specific ground investigation has been undertaken to inform design, including provision of information on the existing foundations. The results of this investigation and subsequent engineering considerations are provided within this report.

A qualified arboriculturist should be consulted for advice on the impact of nearby trees to the construction of the basement.

4.0 SITE WORKS

4.1 Scope of Works

Site works were undertaken between the 7th – 8th November 2023 and comprised the drilling of 1No. modular windowless sampler trial hole (WS01) to a depth of 5.45m bgl. Standard penetration testing was conducted at 1.00m intervals. A super heavy dynamic probe (DP01) was then undertaken through the base to a final depth of 10.00m bgl. A groundwater monitoring well was installed within WS01 to a depth of 4.50m bgl. Site works also included the excavation of 4No. trial pits (TP/FE01 – TP/FE02 and TP01 – TP02) to depths of between 0.80m – 1.40m bgl.

A combined ground-gas/groundwater monitoring standpipe, with an internal diameter of 50mm, was installed to 5.00m bgl within WS01, with a response zone between 1.00m – 4.50m bgl. The installation details can be viewed within the table below.

Combined Ground-gas and Groundwater Monitoring Well Construction						
Trial Hole	**Type of Installation**	**Depth of Installation (m bgl)**	**Thickness of slotted piping with gravel filter pack (m)**	**Depth of plain piping with bentonite seal (m bgl)**	**Response Zone (m bgl)**	**Piping internal diameter (mm)**
WS01	Standpipe	4.50	3.50	1.00	1.00 – 3.50	50

The approximate location of the trial hole locations can be seen within Figure 16.

Prior to commencing the ground investigation, a walkover survey was carried out to identify the presence of underground services and drainage. Where underground services/drainage were suspected and/or positively identified, the exploratory position was relocated away from these areas.

As a further precautionary measure, the borehole was hand excavated to 1.00m below the local ground level (bgl) and scanned with a Cable Avoidance Tool (CAT scanner) to minimise the risk to services.

Upon completion of the drilling works, the trial holes were backfilled and made good, in relation to the surrounding area.

4.2 Sampling Procedures

Small disturbed samples were recovered from the trial holes at the depths shown on the trial hole records. Soil samples were generally retrieved from each change of strata and/or at specific areas of concern. Samples were also taken at approximately 0.5m intervals during broad homogenous soil horizons.

A selection of samples were despatched for geotechnical testing purposes.

5.0 ENCOUNTERED GROUND CONDITIONS

5.1 Soil Conditions

The trial holes were logged by a Ground and Water Limited representative, generally in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'. Any rock or weathered rock samples were logged in accordance with BS EN 14689 'Geotechnical

The ground conditions encountered within the trial holes constructed on the site did generally conform to that anticipated from examination of the geology map. A capping of Made Ground was noted to overlie the superficial deposits of the Kempton Park Gravel Member and the bedrock London Clay Formation.

The succession of conditions and description of soils encountered in the trial holes in descending order is tabulated below.

Summary of Strata Encountered (WS01; TP/FE01 – TP/FE02 & TP01 – TP02)			
Strata	**Top Depth (m bgl)**	**Base Depth (m bgl)**	**Thickness (m)**
MADE GROUND: Pale grey very gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-rounded flint (30% - 70%), concrete (20% - 60%) and brick (10%).	GL	0.30	0.30
MADE GROUND: Orangish brown very gravelly fine to coarse SAND. Gravel is fine to coarse angular to subrounded flint (50%) and concrete (50%).	GL	0.90	0.90
MADE GROUND: Dark brown gravelly very sandy CLAY. Gravel is fine to coarse sub-angular to subrounded. Sand is fine to coarse flint (50% - 60%), concrete (30%), brick (20% - 30%) and calcareous material (10%).	0.30	0.70	0.40
MADE GROUND: Dark reddish brown sandy fine to coarse sub-rounded GRAVEL of brick (100%). Sand is fine to coarse.	0.30	0.70	0.40
KEMPTON PARK GRAVEL MEMBER: Dark orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub rounded of flint.	0.30 – 0.90	>0.80 - >1.40	>0.30 - >0.50
KEMPTON PARK GRAVEL MEMBER: Dark orangish brown very gravelly fine to coarse SAND. Gravel is fine to coarse sub-angular to subrounded of flint.	1.30	4.10	2.80
LONDON CLAY FORMATION: Dark greyish brown silty CLAY.	4.10	>5.45	>1.35

For details of the composition of the soils encountered at particular points, reference must be made to the individual trial hole logs within Appendix D of this report. A trial hole location plan can also be viewed within Figure 16.

5.2 Foundation Exposures

The hand excavation of 2No. Foundation Exposures (TP/FE01 – TP/FE02) was undertaken across the site. A tabulated summary showing the depth and width of each foundation can be viewed below, as well as the bearing stratum. Diagrams of each foundation exposure can be viewed within Figures 17 – Figure 20.

Summary of Foundations Encountered			
Trial Hole	**Depth of Foundation (m bgl)**	**Width at the Base of Foundation (mm)**	**Bearing Stratum**
TP/FE01 (South-East Wall)	1.28	270	Kempton Park Gravel Member
TP/FE01 (South-West Wall)	0.90	60	Kempton Park Gravel Member
TP/FE02 (North-West Wall)	0.50	50	Kempton Park Gravel Member
TP/FE02 (North-East Wall)	0.60	90	Made Ground

5.3 Roots Encountered

Fresh roots were noted to a proven depth of 0.80m bgl within WS01. No fresh roots were noted within the remaining trial holes.

It must be noted that the chance of determining actual depth of root penetration through a narrow diameter borehole is low. Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

5.4 Groundwater Conditions

No groundwater strikes were noted within the trial holes.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was undertaken in November – December 2023 when groundwater levels are likely to be approaching their annual maximum (highest elevation). Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site.

Groundwater monitoring was undertaken on one occasion to date. The results can be seen tabulated below.

Groundwater Observations			
Date	**Trial Hole**	**Water Level**	**Final Well Depth**
16/11/2023	WS01	Dry	3.80

5.5 Obstructions

No artificial or natural sub-surface obstructions were noted during construction of the trial holes.

6.0 IN-SITU AND LABORATORY TESTING

6.1 In-Situ Strength Testing

Standard Penetration Tests (SPTs) and Super Heavy Dynamic Probes (SHDPs) were undertaken as part of the site investigation. The results of the SPT's have not been amended to consider hammer efficiency, rod lengths and overburden pressure in accordance with Eurocode 7. The test results are presented on the borehole logs within Appendix C. An interpretation of the in-situ geotechnical testing results is given in the table below.

Interpretation of In-situ Geotechnical Testing Results					
Strata	**SPT "N" Blow Counts**	**Equivalent Undrained Shear Strength (Cu) (kPa)**	**Granular (Density)**	**Cohesive Soil Type (Cu)**	**Trial Hole/s**
Kempton Park Gravel Member	20	-	Medium Dense	-	WS01/1.20m – 1.65m bgl
	50	-	Very Dense	-	WS01/2.00m – 3.45m bgl
London Clay Formation	16	80	-	High	WS01/5.00m – 5.45m bgl
	30	150	-	Very High	WS01/4.00m – 4.45m bgl
Assumed London Clay Formation	*~7 - ~17*	*~35 - ~85*	-	*Low – High*	*DP01/~6.00m - ~10.00m bgl*

It must be noted that field measurements of undrained shear strength (Cu) are dependent on a number of variables including disturbance of sample, method of investigation and also the size of specimen or test zone.

6.2 Geotechnical Laboratory Testing

A programme of geotechnical laboratory testing, scheduled by Ground and Water Limited and carried out by an accredited geotechnical testing laboratory was undertaken on samples recovered. Details of the specific tests used in each case are given below.

Standard Methodology for Laboratory Geotechnical Testing		
Test	**Standard**	**Number of Tests**
Atterberg Limit Tests	BS1377:2016:Part 2:Clauses 3.2, 4.3 & 5	1
Particle Size Distribution Tests	BS1377:2016:Part 2:Clause 9	3
Water Soluble Sulphate and pH Test	BS1377:2018:Part 3:Clause 5	1
BRE Special Digest 1 Tests	BRE Special Digest 1 "Concrete in Aggressive Ground (BRE, 2005).	2

6.2.1 Atterberg Limit Testing

The results of the Atterberg limit testing undertaken can be seen tabulated below. The test results are presented within Appendix D.

Atterberg Limit Tests Results Summary							
Stratum	Moisture Content (%)	Passing 425 µm sieve (%)	Modified PI (%)	Soil Class	Consistency Index (Ic)	Volume Change Potential	
						BRE	NHBC
London Clay Formation	26	100	50.00	CV	Stiff	High	High

- NP – Non-plastic
- BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
- Soil Classification based on British Soil Classification System.
- Consistency Index (Ic) based on BS EN ISO 14688-2:2018.

6.2.2 Moisture Deficit Assessment

The results of the Atterberg Limit tests were analysed to determine the Liquidity Index of the samples, to give an indication as to whether the sample recovered showed a moisture deficit as well assessing their degree of consolidation. Liquid Limit analyses was undertaken to assess whether there were any potentially significant moisture deficits within the samples tested.

A potential moisture deficit, caused by lithology (over consolidated cohesive soils) was noted within WS01 at 5.00m bgl.

6.2.3 Particle Size Distribution Testing

The results of particle size distribution (PSD) testing undertaken show that the Kempton Park Gravel Member did have volume change potential in accordance with BRE240 but not NHBC Standards Chapter 4.2. The results of the PSD testing can be viewed within Appendix D.

Particle Size Distribution Tests Results Summary			
Stratum	Range Passing 63µm Sieve (%)	Volume Change Potential	
		BRE	NHBC
Kempton Park Gravel Member	2 - 19	Yes	Yes

- Volume Change Potential refers to BRE Digest 240 (based on Grading test results).
- Shrinkability refers to NHBC Standards Chapter 4.2 (based on Grading test results).
- BRE 240 states that a soil has a volume change potential when the clay fraction exceeds 15%. Only the silt and clay combined fraction are determined by sieving therefore the volume change potential is estimated from the percentage passing the 63µm sieve.
- NHBC Standards Chapter 4.2 states that a soil is shrinkable if the percentage of silt and clay passing the 63µm sieve is greater than 35% and the Plasticity Index is greater than 10%.

7.0 ENGINEERING CONSIDERATIONS

7.1 Soil Characteristics and Foundation Considerations

A summary of the soil characteristics following the intrusive site investigation and laboratory testing and the relevant foundation considerations has been provided below. The following information from the ground investigation was considered pertinent to the design of foundations.

- Foundations should be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.
- Foundations in contact with the Kempton Park Gravel Member should be designed in accordance with soils of no volume change potential.
- The design and construction of the basement and associated structural elements would need to take into account the volume change potential of the respective soils.
- The loads of proposed foundations should not exceed the allowable bearing capacity of the soils they are founding upon.
- Foundations must not be placed within fresh root penetrated and/or desiccated soils with volume change potential. It is recommended that foundations are taken at least 300mm into non-fresh root penetrated strata if the soils have volume change potential, or into soils of no volume change potential.
- The influence of trees on or surrounding the site will need to be taken into account in final design (NHBC Standards Chapter 4. 2) (tree rings).
- Any water ingress must be prevented from entering foundation trenches and excavations must be kept dry and either concreted or blinded as soon after excavation as possible. If water were allowed to accumulate within the excavation for even a short period of time, an increase in heave occur. The shear strength will also be reduced, resulting in lower bearing capacities, resulting in increased settlements. Instability issues may arise within the foundation trenches, in case of perched water being present.
- Final designs for the foundations should be carried out by a suitably qualified Engineer based on the findings of this investigation and with reference to the anticipated loadings, serviceability requirements for the structure and the developments proximity to former, present, and proposed trees.

7.2 Geotechnical Analysis

This section of the report states suitable geotechnical parameters for the soils encountered as well as analysis the bearing capacity of the soils. A settlement/heave analysis was also undertaken following the construction of the proposed development using Pdisp from Oasys.

7.2.1 Geotechnical Parameters for Modelling

Following a literature review from well documents publications, the short-term and long-term Young's Modulus (E short term and E') has been produced. The parameters, shown below, were used when undertaking the settlement/heave analysis within Pdisp.

Summary of Geotechnical Parameters							
Geological Strata	Depth (m bgl)		Short-term Young's Modulus (Eu short term) (kPa)		Long-term, Young's Modulus (E' long term) (kPa)		Poisson's Ratio
	Top	Base	Top	Base	Top	Base	
Made Ground	0.00	0.70	10,000	10,000	10,000	10,000	0.45
Kempton Park Gravel Member (Cohesive)	0.70	1.30	23,000	23,000	17,250	17,250	0.45
Kempton Park Gravel Member (Granular)	1.30	2.45	40,000	100,000	40,000	100,000	0.30
	2.45	3.45	100,000	100,000	100,000	100,000	0.30
	3.45	4.10	100,000	100,000	100,000	100,000	0.30
London Clay Formation	4.10	5.45	60,000	60,000	45,000	45,000	0.45
	5.45	53.00	60,000	330,900	45,000	248,175	0.45

Made Ground

Made Ground was modelled between ground level and 0.70m bgl. A short-term and long-term Young Modulus (Eu and E') of 10MPa was suitable and on the conservative side, regarding Made Ground encountered on site. A Poisson's Ratio of 0.45 was considered suitable for these soils, given their variable nature.

Kempton Park Gravel Member (Cohesive)

Cohesive deposits of the Kempton Park Gravel Member were modelled between 0.70m – 1.30m bgl. The relationship between Eu and Cu is generally dependent on strain levels. For small strains, ratios of between 600 – 1500 can be observed, for Plasticity indices below 30% and overconsolidation ratio of <2. (*Jamiolkowski et al 1979*). This is also reflected for various types of cohesive soils in the London basin, within graphs depicting strains and Eu/Cu ratios, included in *"Burland JB, Standing, JR, and Jardine, FM (2001) Building response to tunnelling, case studies from construction of the Jubilee Line Extension CIRIA Special Publication 200".* A relationship of 1.15*N for the Eu value (in MPa) was considered suitable for the shallow Kempton Park Gravel Member, based on published literature (CIRIA 1995 / Butler 1975). (Eu/N = 1.0 – 1.2 for cohesive soils). A Poisson's Ratio of 0.45 was considered suitable for these soils, given their cohesive nature.

Lynch Hill Gravel Member

Given the granular soils are permeable, no significant long-term draining of the soil was anticipated to occur and therefore the short and long-term modulus was considered sensible to remain the same. The widely accepted relationship between recorded SPTs within granular soils and E values of 2000* SPT "N" values was used for this consideration. The value was cross-referenced with representative published data (Obrzud & Truty 2012), showing a range of between 50 – 320MPa for the Young Modulus for dense sands and gravels. This also aligns with the drained modulus (30 – 160MPa) for River Terrace Gravels included in *"Burland JB, Standing, JR, and Jardine, FM (2001) Building response to tunnelling, case studies from construction of the Jubilee Line Extension CIRIA Special Publication 200".* A Poisson's Ratio of 0.30 was considered suitable for the granular soils.

London Clay Formation

Cohesive soils of the London Clay Formation were encountered from 4.10m bgl - >5.45m bgl during site works but inferred as extending to ~53.00m bgl based on BGS borehole records.

Where SPT "N" Values were undertaken, the Cu could be calculated by multiplying by 5, as stated by Stroud (1974). Where the London Clay Formation was inferred, a design line was taken from "*Burland JB, Standing, JR, and Jardine, FM (2001) Building response to tunnelling, case studies from construction of the Jubilee Line Extension CIRIA Special Publication 200*". The equation was undrained shear strength = (depth into the LCF x 8) + 50.

The relationship between Eu and Cu is generally dependent on strain levels. For small strains, a ratio of 750 can be adopted based on well documented publications. This is also reflected for the London Clay Formation, after extensive research, within graphs depicting strains and Eu/Cu ratios included in *"Burland JB, Standing, JR, and Jardine, FM (2001) Building response to tunnelling, case studies from construction of the Jubilee Line Extension CIRIA Special Publication 200".* A Poisson's Ratio of 0.45 was considered suitable for these soils, given their cohesive nature.

Long-Term Conditions

A ratio of E' to Eu of ~0.75 was considered a sensible approach for this stage in the design, for cohesive soils. For Made Ground, it was considered suitable for E' and Eu to be equal, given that these soils are more permeable and to limit the level of anticipated Young Modulus at a representative value.

7.2.2 Bearing Capacity Analysis

Foundations constructed on the granular superficial soils of the Kempton Park Gravel Member at the basement level of ~2.70m bgl can be designed based on an allowable bearing capacity of 250kN/m^2. This is based on the ground conditions encountered and the in-situ strength data recorded.

7.2.3 Settlement/Heave Analysis

Analyses of vertical ground movements, using the Mindlin analysis method within Pdisp software, was undertaken to assess the potential movements resulting from changes of net vertical pressure changes. Geotechnical parameters noted in the previous section of this report were used for the model. A rigid boundary at depth was considered at 53.00m bgl, for calculation purposes. The inputs and outputs of this analysis can be viewed within Appendix F.

Five representative stages of construction, in terms of the net change in vertical pressure, have been modelled. These were considered to adequately approximate the movements rising from the basement construction.

- **Stage 1:** Excavation of the retaining wall voids, with short-term conditions;
- **Stage 2:** All previous loads/load removals, as well as loads associated with the construction of the retaining walls, with short-term conditions;
- **Stage 3:** All previous loads/load removals, as well as loads associated with the mass excavation of the basement footprint, with short-term conditions;
- **Stage 4:** All previous loads/load removals, as well as loads associated with the construction of the basement slab, with short term conditions. The basement is fully constructed from this stage onwards;
- **Stage 5:** All previous loads/load removals, for long-term conditions.

As the proposed development did not comprise the demolition of the existing building, the existing loads of the property were not anticipated to change throughout the development. The final loads

were based on calculations by the structural engineers and they were selected to be representative of the site.

Given the overall square shape of the basement, the excavation was based on a rectangle using the maximum length and width of the basement. This was considered conservative and will ensure accurate results.

The overburden pressure release following the excavation and removal of soils was based on a specific weight of soil of 19kN/m. Based on a proposed basement depth of 2.70m bgl, an overburden pressure release of 51.30kN/m^2. The overburden pressure release was modelled at 2.70m bgl.

Retaining wall loads were modelled as extending 1.00m towards the centre of the basement. It should be noted that loads were not known and 30kPa and 60kPa were used as representative positive pressures at base of walls, in order not to overestimate mainly heave. For a more settlement focused analysis and in order to be more precise, the loading regime should be given to Ground and Water Limited. All loads were modelled at 2.70m bgl.

A tabulated summary of all applied loads, at each stage/model, can be viewed below.

Summary of Net Bearing Pressure Changes for PDisp Analysis				
Description	**Applied Load (+ive)/ Load Removal (-ive) (kN/m²)**			
	Stage 1	**Stage 2**	**Stage 3**	**Stage 4 and 5**
Excavation of Retaining Wall Voids	-51.30	-51.30	-51.30	-51.30
Construction of Retaining Walls		30.00	30.00	60.00
Mass Excavation Void			-51.30	-51.30
Construction of Basement Slabs				10.00

The method stated above was considered to comprise a comprehensive and reasonably conservative approach, in order to estimate the maximum potential heave and settlements.

A tabulated summary concluding the amount of soil displacement shown at the basement depth within the contour plots can be viewed below. It should be noted that the soil displacement between models are not cumulative values; therefore, the amount of soil displacement between models should not be added together as each model shows each construction stage individually.

Settlement/Heave Analysis	
Model	**Soil Displacement**
Model 1	0.794 – 1.55mm heave. No settlement
Model 2	0.329mm – 0.643mm heave. No settlement
Model 3	0.912mm – 3.30mm heave. No settlement
Model 4	0.807mm – 2.72mm heave. No settlement
Model 5	0.39mm – 2.88mm heave. No settlement
Diagrammatic representation can be viewed within Appendix F. Please note that the above figures should not be added together (or be superimposed) and that they represent anticipated movements at different accumulated stages of construction, in order to approach and test all expected combinations of loading regimes (models).	

A maximum amount of heave of 3.30mm was noted following the mass excavation of the basement void (Model 3), and was noted to be the maximum amount of heave during the construction phases.

Once constructed, the maximum amount of heave increased from 2.72mm for short term conditions (Model 4), to 2.88mm for long term conditions (Model 5); therefore, the highest risk of movement will likely occur during the construction of the basement and later through long-term heave of the constructed basement.

7.2.4 Additional Comments

Regarding the bulk basement construction, care will need to be taken to ensure that the slab is protected through accommodating heave. Heave protection measures will need to be incorporated.

The final design of the basement structure will also need to take into account environmental factors, reference should be made to the Contamination Assessment Report (GWPR5680/CAR/December 2023) for further details.

Final designs for the foundations should be carried out by a suitably qualified Engineer based on the findings of this investigation and with reference to the anticipated loadings, serviceability requirements for the foundations. A Structural Engineer will also need to review the anticipated ground movements and assess their potential impact on the existing structure and neighbouring properties. It must be noted that finalised construction will aid the structural stability of the neighbouring party walls, reducing the risk of the seasonal movements noted during the structural works.

7.3 Retaining Walls, Excavations and Stability

Shallow excavations in the Made Ground are likely to be marginally stable at best. Long, deep excavations, through these strata and into the underlying London Clay Formation are likely to become unstable.

Appropriate propping and support should be incorporated during construction of the basement.

The excavation of the basement must not affect the integrity of the adjacent structures beyond the boundaries. The excavation must be supported by suitably designed retaining walls. It is considered unlikely that battering the sides of the excavation, casting the retaining walls and then backfilling to the rear of the walls would be suitable given the close proximity of the party walls.

The retaining walls for the basement will need to be constructed based on the soils encountered with an appropriate angle of shear resistance (Φ') and effective cohesion (C') for the ground conditions encountered, regarding long-term considerations, as well using an appropriate undrained shear strength Cu for short-term considerations.

The overlying Made Ground needs to be considered in the design of the basement. A conservative value of Cu will need to be considered.

Based on the ground conditions encountered within the boreholes the following parameters tabulated below could be used in the design of retaining walls, for a long-term consideration. These have been designed based on the in-situ strength testing profile recorded, results of geotechnical classification tests and reference to literature.

Retaining Wall/Basement Design Parameters					
Strata	**Unit Volume Weight (kN/m³)**	**Cohesion Intercept (c') (kPa)**	**Angle of Shearing Resistance (°)**	**Ka (Rankine)**	**Kp (Rankine)**
Made Ground	~19	0	12	0.66	1.52
Kempton Park Gravel Member (Cohesive)	~20 – 22	0	24 – 28	0.36 – 0.42	2.37 – 2.77
Kempton Park Gravel Member (Granular)	~20 – 22	0	32 – 40	0.22 – 0.31	3.25 – 4.60
London Clay Formation	~20 – 22	0 – 5	24 – 28	0.36 – 0.42	2.37 – 2.77

It should be noted that the Ka and Kp values presented in the table, are shown for guidance and they are derived from the Rankine theory for soil pressures. The values for angles of internal friction provided are considered to be characteristic values of the soils encountered.

According to C760, a design method (e.g. EC7) should be adopted and followed through the whole design process. In addition, the following considerations should be considered during the design process:

- Appropriate consideration of groundwater levels.
- Surcharge pressure equivalent to the pressures of any adjacent buildings.
- Surcharge pressures from potential piling work platforms and heavy plant traffic.

Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported before excavations are entered by personnel.

Ground Instability Recommendations

No significant instability issues related with soils are expected and no instability issues were observed during the ground investigation. Specific measures should be included in a competent Construction Method Statement for the works on this site by the structural engineer and the contractor. If instability is noted, the following could be applied for good workmanship and mitigation of any risk. It should be noted that these are indicative.

- Where soft/loose spots are encountered, trench sheets should be left in. Alternatively, a back prop with precast lintels or sacrificial boards should be installed. If the soil support to the ends of the lintels is insufficient, brace the ends of the PC lintels with 150x150 C24 timbers and prop with Acrows diagonally back to the ground.
- Where voids are present, trench sheeting with 75mm diameter holes should be installed, to allow the concrete to flow behind the trench sheeting thereby filling any voids encountered in soils behind.
- Prior to casting, a layer of DPM should be installed between trench sheeting (or PC lintels) and new concrete. The lintels should be cut into the soil by 150mm either side of the pin. A site stock of a minimum of 10 lintels should be present to prevent delays due to ordering.

7.4 Ground Movement Analysis

The ground movement assessment, in accordance with CIRIA C760 and resulting damage assessment

can be viewed within this section.

7.4.1 Models

Multiple models were created to assess soil displacement and the resulting damage to surrounding assets. The inputs and outputs of this analyses can be viewed within Appendix J.

The walls of surrounding properties were modelled at ground floor level (0.00 along the z-axis).

One square excavation was modelled to the basement depth (2.70m bgl), to create an overall excavation similar to that of the basement, based on the maximum length and width of the proposed basement.

Based on the ground conditions encountered, an assessment using the CIRIA curves for sand was undertaken. For Model 1, two user generated curves were created, combining the ground movement curves for installation and excavation, for both horizontal and vertical ground movement.

Model 1 was considered overly conservative given that horizontal movement was calculated for both installation and excavation for embedded walls, which are not present for this construction method; therefore, a second model was created using the CIRIA excavation horizontal movement curve only, rather than the combined horizontal movement curve. A tabulated summary showing which CIRIA curves were used can be viewed below.

Summary of XDisp Analysis Assessments					
Model	PDisp Results	Vertical CIRIA Curves		Horizontal CIRIA Curves	
		Installation Curve	Excavation Curve	Installation Curve	Excavation Curve
1	N/A	Installation of a secant bored pile wall in stiff clay (CIRIA)	Excavation in front of a wall within sand (CIRIA)	Installation of a secant bored pile wall in stiff clay (CIRIA)	Excavation in front of a high stiffness wall in stiff clay (CIRIA)
2	N/A	Installation of a secant bored pile wall in stiff clay (CIRIA)	Excavation in front of a wall within sand (CIRIA)	N/A	Excavation in front of a high stiffness wall in stiff clay (CIRIA)

7.4.2 Analyses

Once the analysis was undertaken, Xdisp segments areas of hogging, sagging and negligible movement along each wall, and gave each segment a category of damage; however, as the wall was thought to act as one structurally, these segments were combined and a damage category for the wall as a whole was given.

The following parameters have been used to inform all assessments.

- Given limitations of the software, a conservative assessment was undertaken assuming that all properties and levels were relative to the ground level.
- The method of basement construction is understood to be traditional underpinning;
- A high wall stiffness has been assumed;
- In the permanent case the wall should be propped at high level;
- Vertical movements resulting from excavation have been considered using CIRIA 760

guidance, graphs for sand/soft to firm clay and engineering judgement. Horizontal movements resulting from CIRIA C760 were also considered, in order to account for the ground's horizontal relaxation. These were considered for stiff clay soils, in the absence of other results in CIRIA guidance; however, they are widely accepted to be suitable, for the assessment, based on the ground conditions encountered and the nature of the basement.

In terms of damage assessment, the widely accepted Burland et al, 1977 method was used for combined segments along structural features.

It was considered that the construction design from the structural engineer will account for any damage resulting from predicted soil displacement on the actual building, as advised in this report.

7.4.3 Results

The following table summarises all walls which were assessed in at least one of the analysis as having Category 1 (Very Slight) damage, or greater. All other walls were assessed as having Category 0 (Negligible) damage for all assessments.

Damage Assessment of Property/Feature Reference			
Wall Reference		Damage Category	
		Analysis 1	Analysis 2
B4	No.32 Belgravia Mews South Front Wall	2	**1**
B22	No.13 Eaton Place Rear Wall	2	1
B5	No.36 Belgravia Mews South Front Wall	2	1
B8	No.36 Belgravia Mews South Rear Wall	2	1
Diagrammatic representation can be viewed within Appendix G.			

It was considered that as the incorporation of both horizontal and vertical CIRIA curves for installation was considered too conservative for an underpin method of construction; therefore, Model 2 considered to be the most appropriate and damage would be expected being limited to Category 1 – 0.

It is likely that the front and rear walls along Belgravia Mews South may act structurally as one wall, potentially lessening structural damage.

7.4.4 Assessment of Roads and Utilities

Based on Model 2, a maximum settlement of 4.05mm – 10.44mm was noted at the closest point of Belgravia Mews South to the centre of the basement, decreasing to a negligible amount (<0.1mm) ~8.00m from this point along Belgravia Mews South. Given the length of the roads, the deflection expected was not anticipated to cause damage; however, monitoring is recommended as good practice.

7.4.5 Additional Comments

It should be noted that using stiff clay data in some movements in this assessment could be argued to have produced less conservative results. This however is countered by the following, which make the results more conservative.

- The size of the developments used to provide the case histories for C760 are significantly

greater than the scale of works proposed. In practice the range of ground movements (relative to the excavation depth and the building dimensions) is therefore likely to be much smaller for this development.

- It must be noted that C760 is written for imbedded walls and experience suggests the underpinning method does not result in significant movement. Therefore, the use of C760 in this context could be considered conservative.

Should the following precautions be included in the Construction Method Statement, as well as best practice and good construction techniques are utilised by a reputable contractor, then ground movements due to underpinning will be limited. In the permanent case the wall will/should always be propped at high level. It is recommended that monitoring is undertaken as good practice.

It will be important that the building contractor is closely supervised and is experienced in this type of construction. It will be critical to prevent exposed faces from collapse or significant ground loss into the new excavation and temporary face support should be maintained where practicable. The adequacy of temporary support will be critical in limiting ground movements. A number of factors will assist in limiting ground movements:

- Most ground movement will occur during excavation and construction so the adequacy of temporary support will be critical in limiting ground movements;
- The speed of propping and support is key to limiting ground movements;
- Good workmanship will contribute to minimising ground movements;
- The assessment assumes the wall is in competent clay;
- Larger movements will be expected where soft soils are encountered at, above and below formation;
- The adequacy of temporary support will be critical in limiting ground movements;

CIRIA C760 advises that ground movements are influenced by the quality of workmanship. The party wall act will apply to this development and will re-enforce good workmanship. The act provides an effective mechanism for ensuring that structural integrity of the neighbouring property is maintained throughout the construction phase. Examples of this can be viewed below.

- Ensuring that adequate propping is in place at all times during construction;
- Minimise deterioration of the central soil mass by the use of blinding/covering with a waterproof membrane;
- Installation of the first (stiff) support quickly and early in the construction sequence for each excavation panel;
- Control dewatering to minimise fines removal and drawdown;
- Avoid overbreak.
- Avoid leaving ground unsupported.

7.5 Structural Monitoring

As stated within the previous section, it is recommended that structural monitoring is undertaken to ensure the movements remain within acceptable limits and to enable mitigation to be effectively implemented in the event of trigger values for movement being exceeded.

The final extent of the structural monitoring will be a matter for the agreement with the neighbours as part of the Party Wall Agreements.

Monitoring positions should be located at the front and rear elevations of the neighbouring properties. The targets should be set at both a low and high level and a minimum of four targets should be installed at each elevation (two targets near party wall and two targets at the far end of the elevation). Precise survey equipment should be used to record all vertical and horizontal components of movement (in three perpendicular dimensions) to a minimum accuracy of 1mm.

Before any excavation or construction works commence, monitoring over a period of at least a month should be undertaken in order to establish a baseline situation and record any seasonal movement trends that may also affect measurements during the development.

During all underpinning works and basement excavation works, monitoring should be undertaken daily at the start and end of every work shift. At other times, monitoring should be undertaken weekly to cover a period prior to commencement of any works and ceasing after completion of the works, by agreement of all interested parties.

7.6 Sub-Surface Concrete Design

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1, 2005, *'Concrete in Aggressive Ground'* considering the pH of the soils. For the classification given below, the "mobile" and "natural" case was adopted given the geology encountered and the residential use of the site. This assessment was based on the results of laboratory testing displayed within Appendix E, specifically relating to sulphates, pH and other water soluble chemicals.

Made Ground

The water soluble sulphate concentration ranged between 50.90mg/kg - 232mg/kg, with a pH of between 9.53 – 10.40. The total potential sulphate was <0.06%.

Kempton Park Gravel Member

According to Box C6 of BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' the Kempton Park Gravel Member did not fall within a list of UK geological formations known to contain pyrite. Consequently, it was not required to consider the levels of total potential sulphate in the classification process.

The water soluble sulphate concentration was 15.20mg/kg, with a pH of 8.95. The total potential sulphate was <0.06%.

According to BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' a Sulphate Design Class of DS-1 could be used for sub-surface concrete in contact with the Kempton Park Gravel Member. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1.

London Clay Formation

According to Box C6 of BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' the London Clay Formation fell within a list of UK geological formations known to contain pyrite. It was therefore

required to consider the levels of total potential sulphate in the classification process.

The water soluble sulphate concentration was 71.90mg/kg, with a pH of 8.42. The total potential sulphate was <0.06%.

According to BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' a Sulphate Design Class of DS-1 could be used for sub-surface concrete in contact with the London Clay Formation. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1.

It is prudent to note that pyrite nodules may be present within the London Clay Formation. Pyrite can oxidise to gypsum and this normally only occurs in the upper weathered layer, but excavation allows faster oxidation and water-soluble sulphate values can rapidly increase during construction. Therefore, rising sulphate values should be considered should ferruginous staining/pyrite nodules be encountered within the London Clay Formation.

7.7 Hydrogeological Effects, Flooding and Surface Water Disposal

Basements have potential to greatly impact hydrological and hydrogeological regimes. Numerous comments and considerations reflecting on the relationship between the basement and groundwater/surface water have been discussed below.

7.7.1 Basement Construction

If the construction works take place during the winter months, when the groundwater level is expected to be at its higher elevation, water could accumulate thus dewatering could be required to facilitate the construction and prevent the base of the excavation blowing before the slab was cast. The lower ground floors must be suitably tanked to prevent ingress of groundwater and also surface water run-off. A dewatering or permitting grout contingency plan should be included within the Construction Method Statement and considered in the final design. As there will be potential for groundwater to collect behind the retaining walls, the basement should be waterproofed and designed to withstand hydrostatic pressures in accordance with BS8102:2009: Code of Practice for the Protection of Below Ground Structures against Water from the Ground.

Should groundwater/perched water be encountered across the site, dewatering from sumps introduced into the floor of the excavation may be required. Consideration could be given to creating a coffer dam using contiguous piled or sheet piled walls to aid construction below the perched water table if groundwater becomes a significant issue. The advice of a reputable dewatering company should be sought.

7.7.2 Site Drainage

The majority of new developments are encouraged to use Sustainable Urban Drainage Systems (SUDS) to manage surface water drainage. This ensures that any volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development unless specific off-site arrangements are made and result in the same effect.

The principles of SUDS and the requirements of the London Plan Policy 5.13 Sustainable Drainage should be applied to reduce the risk of flooding from surface water ponding and collection associated with the construction of the basement.

In accordance with the London Plan Policy 5.13 Sustainable Drainage the surface water run-off should be managed as close to its source as possible in line with the following drainage hierarchy.

- Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
- Rainwater infiltration to ground at or close to source
- Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
- Rainwater discharge direct to a watercourse (unless not appropriate)
- Controlled rainwater discharge to a surface water sewer or drain
- Controlled rainwater discharge to a combined sewer.

Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation.

Soakage testing in accordance with BRE365 was beyond the scope of this investigation.

Any soakaways should be located sufficiently away from buildings and infrastructure, in order to prevent undermining of foundations. Additional drainage may be considered should significant amounts of water be encountered.

Consultation with the Environment Agency must be sought regarding any use that may have an impact on groundwater resources, abstractions and surface water features/watercourses.

7.7.3 Additional Comments

The site itself has the potential to flood from groundwater, due to a Secondary (A) Aquifer underlain by Unproductive Strata. Perched water may be encountered within the Made Ground and the underlying geological formations, especially after periods of prolonged or intense rainfall. **This should be considered in final design.**

Due to the relatively low permeability rates of the cohesive soils, groundwater is more likely to flow through the more permeable Kempton Park Gravel Member. The proposed basement does not extend into the cohesive London Clay Formation, so when groundwater is elevated to above basement level, it can flow beneath the basement as well as around; therefore, groundwater flow direction will not be affected.

Given their subterranean position, lower ground floors can be susceptible to flooding from sewers. In order to minimise the risk of sewer flooding to the development, all subterranean development must be connected to the sewerage network, installed with a positively pumped non-return valve device.

Consultation with the Environment Agency must be sought regarding any use that may have an impact on groundwater resources, abstractions and surface water features/watercourses.

7.8 Discovery Strategy

A full contamination assessment was beyond the scope of this investigation, where targeted sampling was not undertaken. There may be areas of contamination that have not been identified during the course of the intrusive investigation (e.g. underground storage tanks). Such occurrences may be discovered during the construction phases for the redevelopment of the site.

Groundworkers should be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person and then the Local Authority will need to be informed.

7.9 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust would be generated as a result of construction activities.

The site should be securely fenced at all times to prevent unauthorised access. Washing facilities should be provided and eating restricted to mess huts.

FIGURES

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
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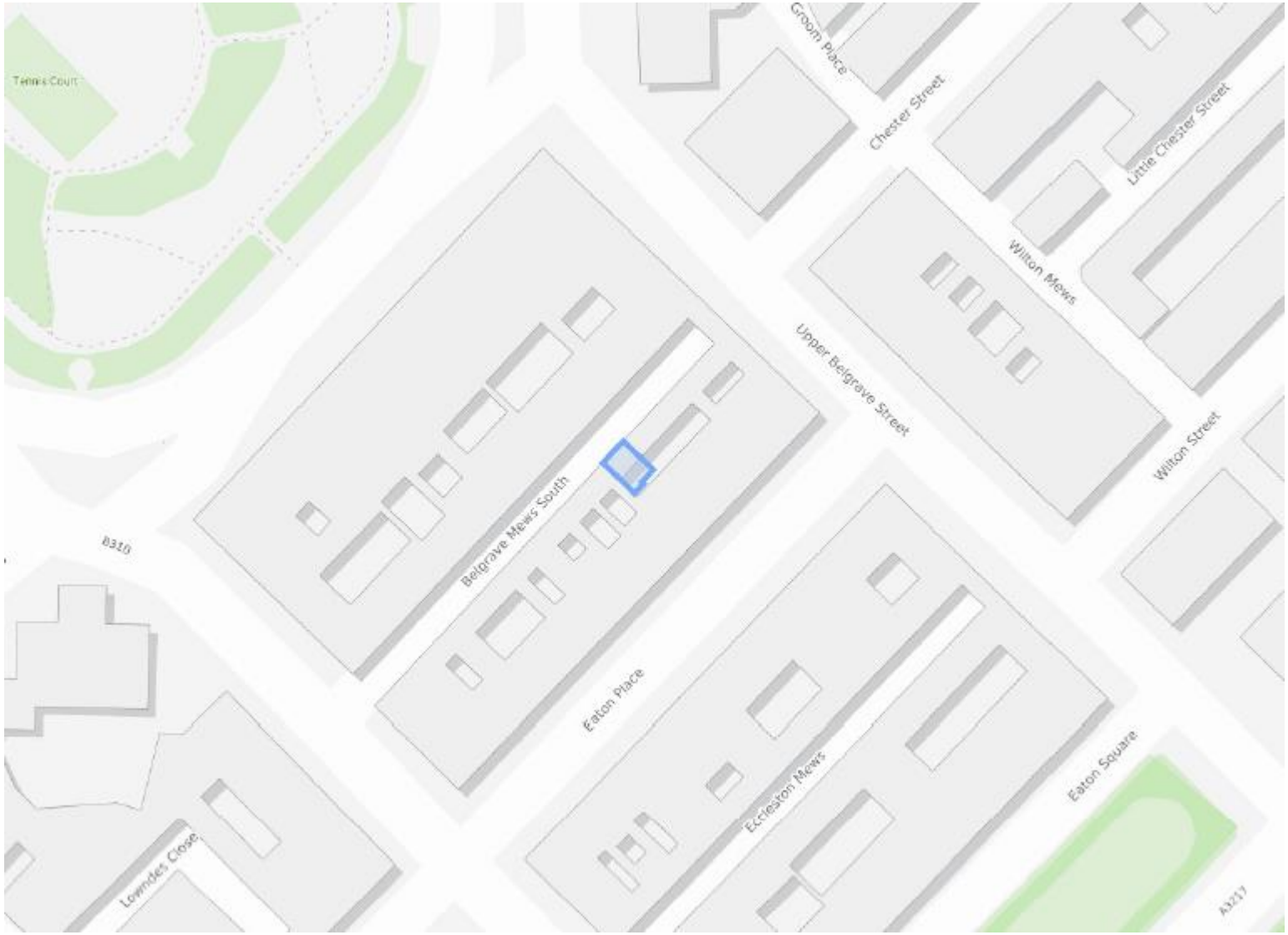
Registered Office: Kineton House, 31 Horse Fair, Banbury, Oxfordshire OX16 0AE Registered in England No. 07032001



Site Location Area

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 1: Site Location Plan	**GWPR5680**

ground&water

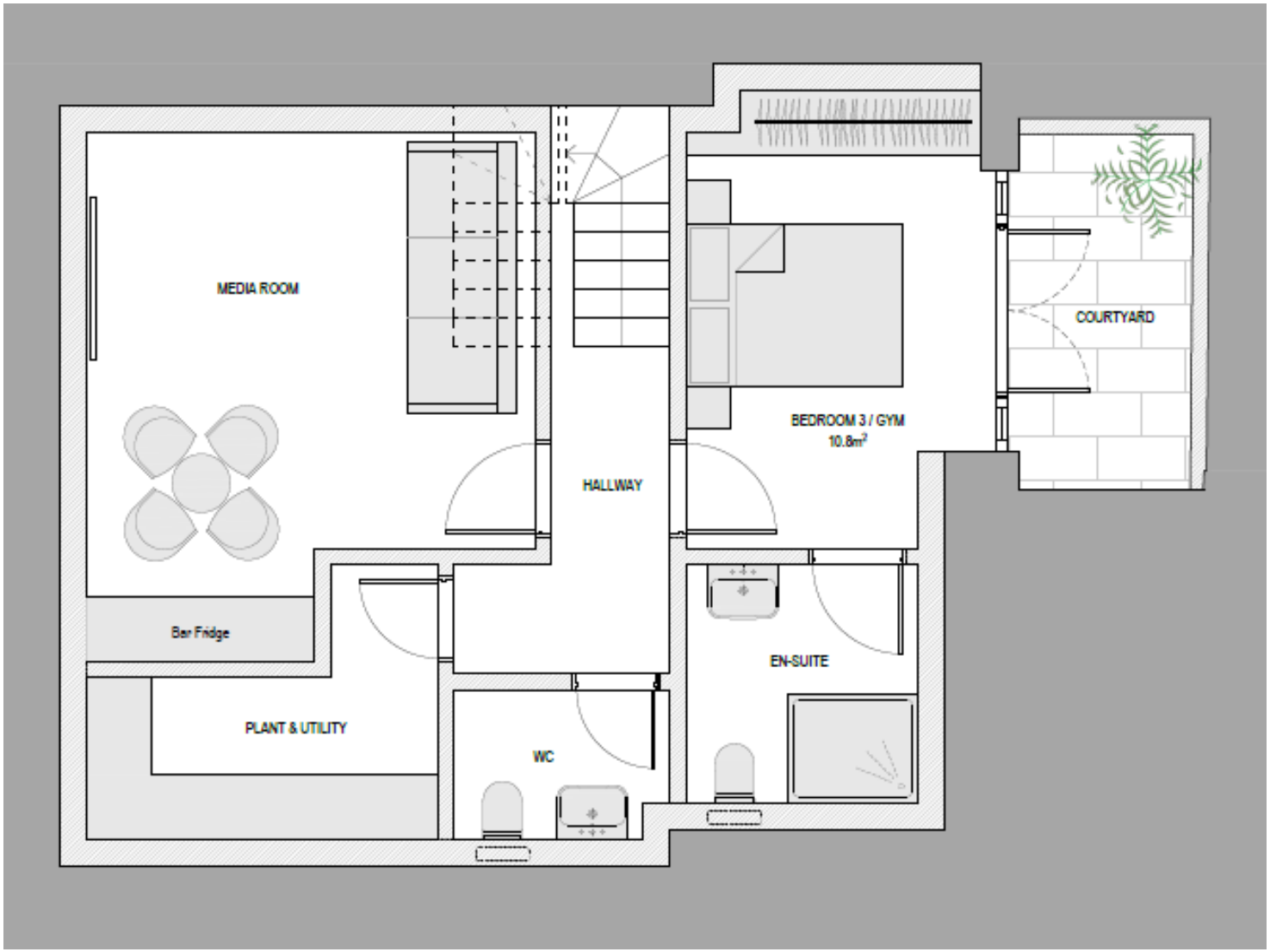
Site Location

27 m
26 m
24 m
23 m
22 m
21 m
19 m
18 m
17 m
16 m
14 m
13 m
12 m
11 m
9 m
8 m
7 m
6 m
4 m
3 m

Not to Scale

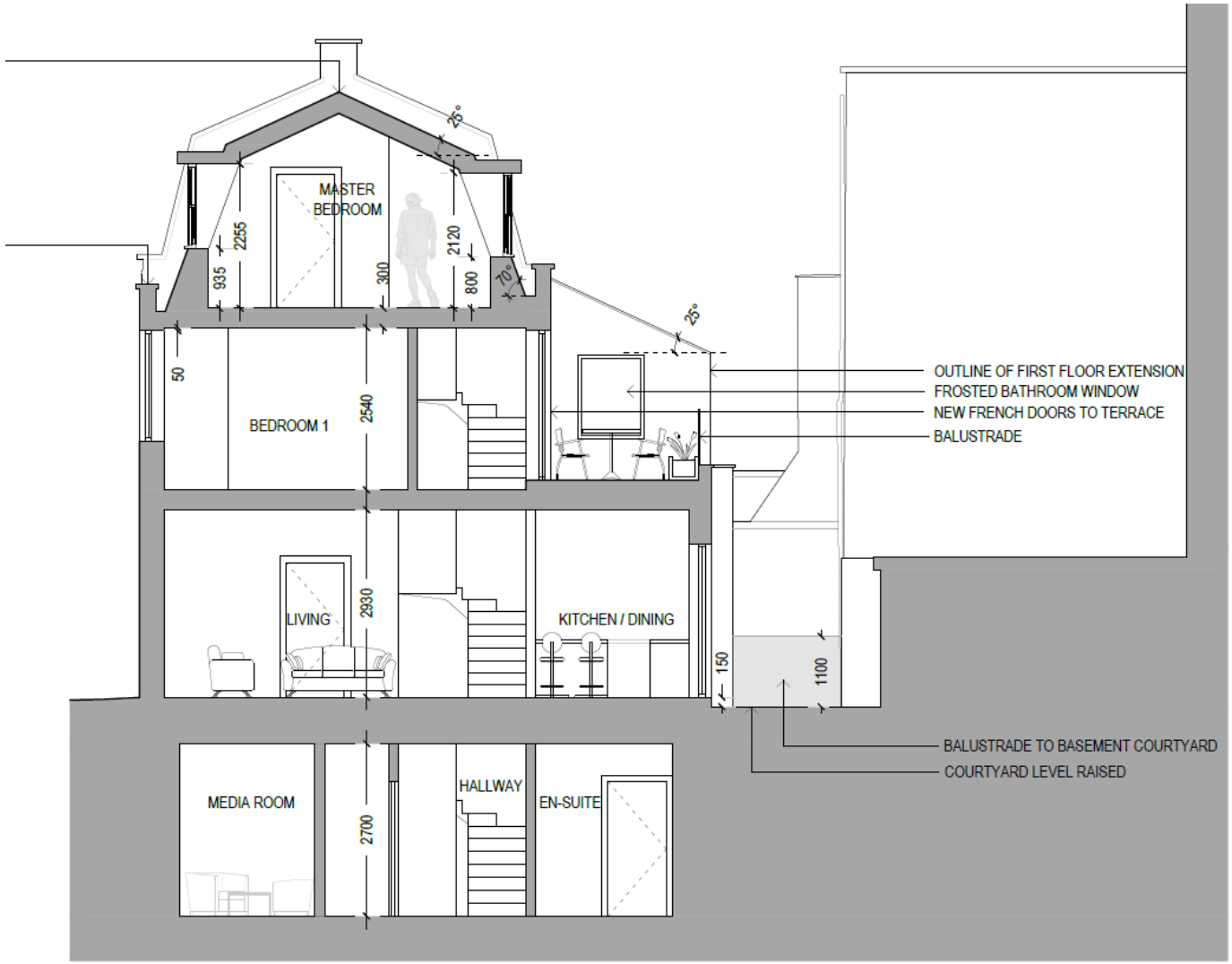
34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 2: Topographical Contour Map	**GWPR5680**

ground&water



Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 3: Proposed Development Plan	**GWPR5680**



Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 4: Proposed Development Plan	**GWPR5680**

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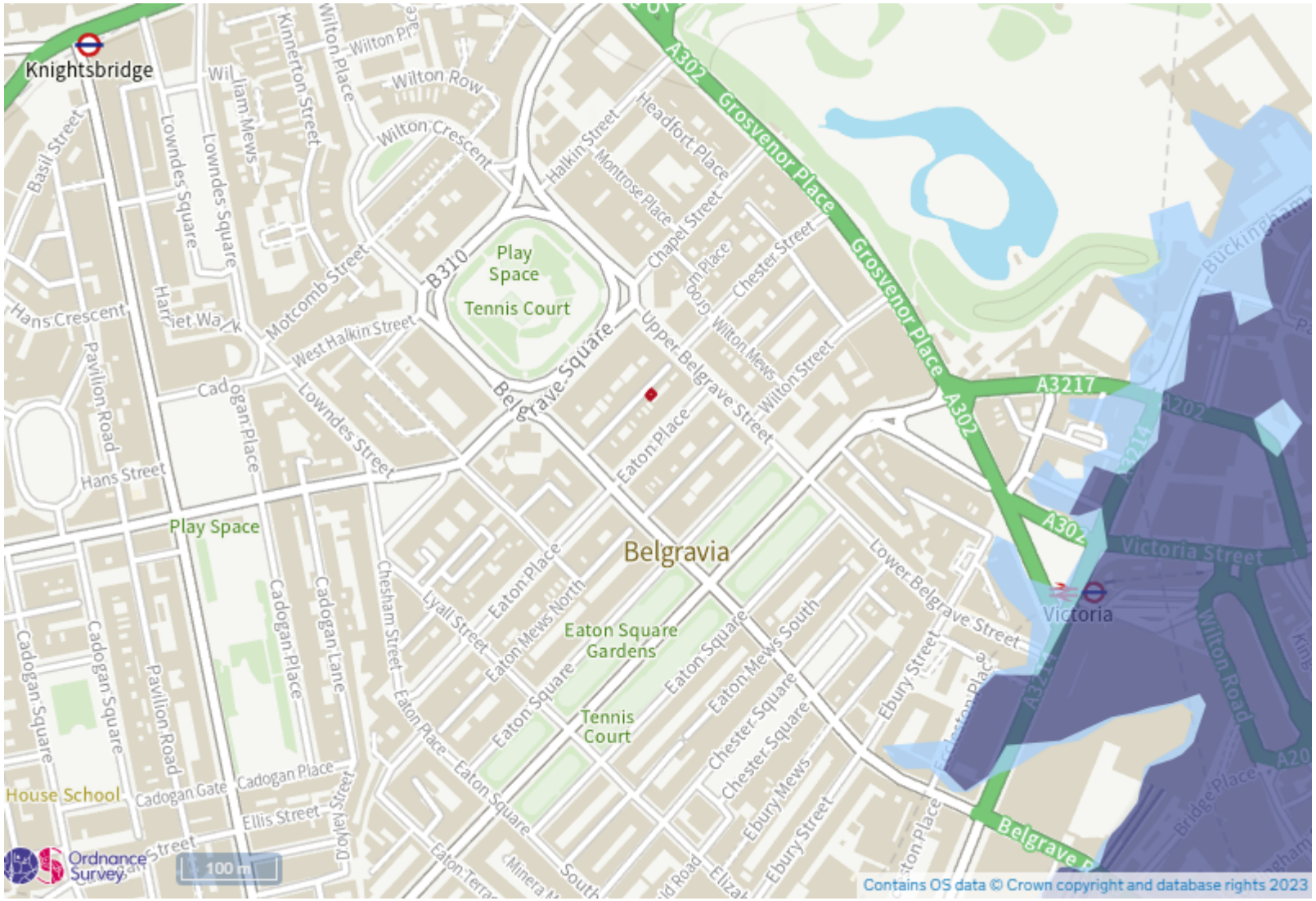

Site Boundary

Your site boundary

Flood zone 3

Flood zone 2

Flood zone 1

Flood defence

Main river

Water storage area

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 5: EA Flooding From Rivers and Seas	**GWPR5680**

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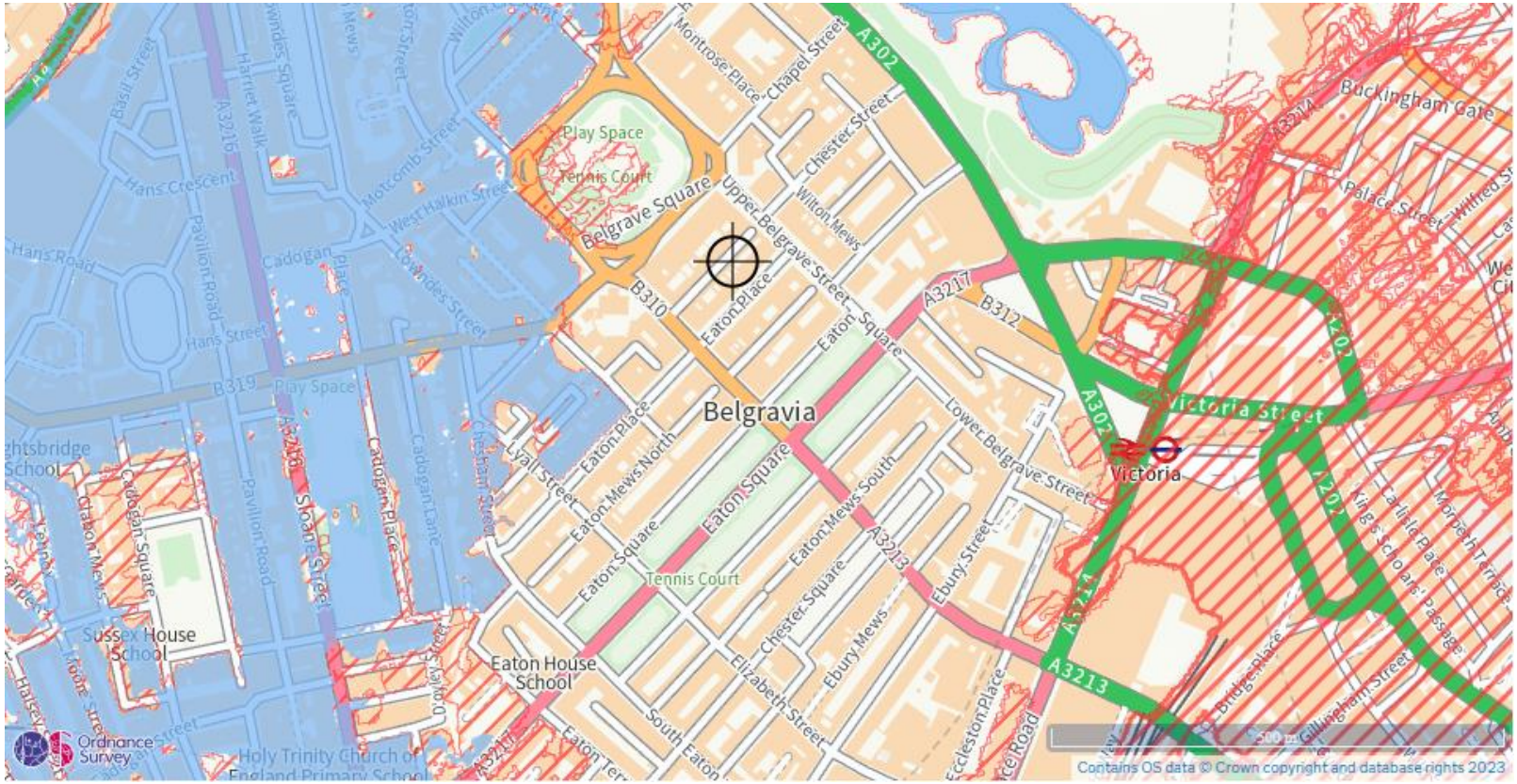

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 6: EA Reservoir Flooding	**GWPR5680**

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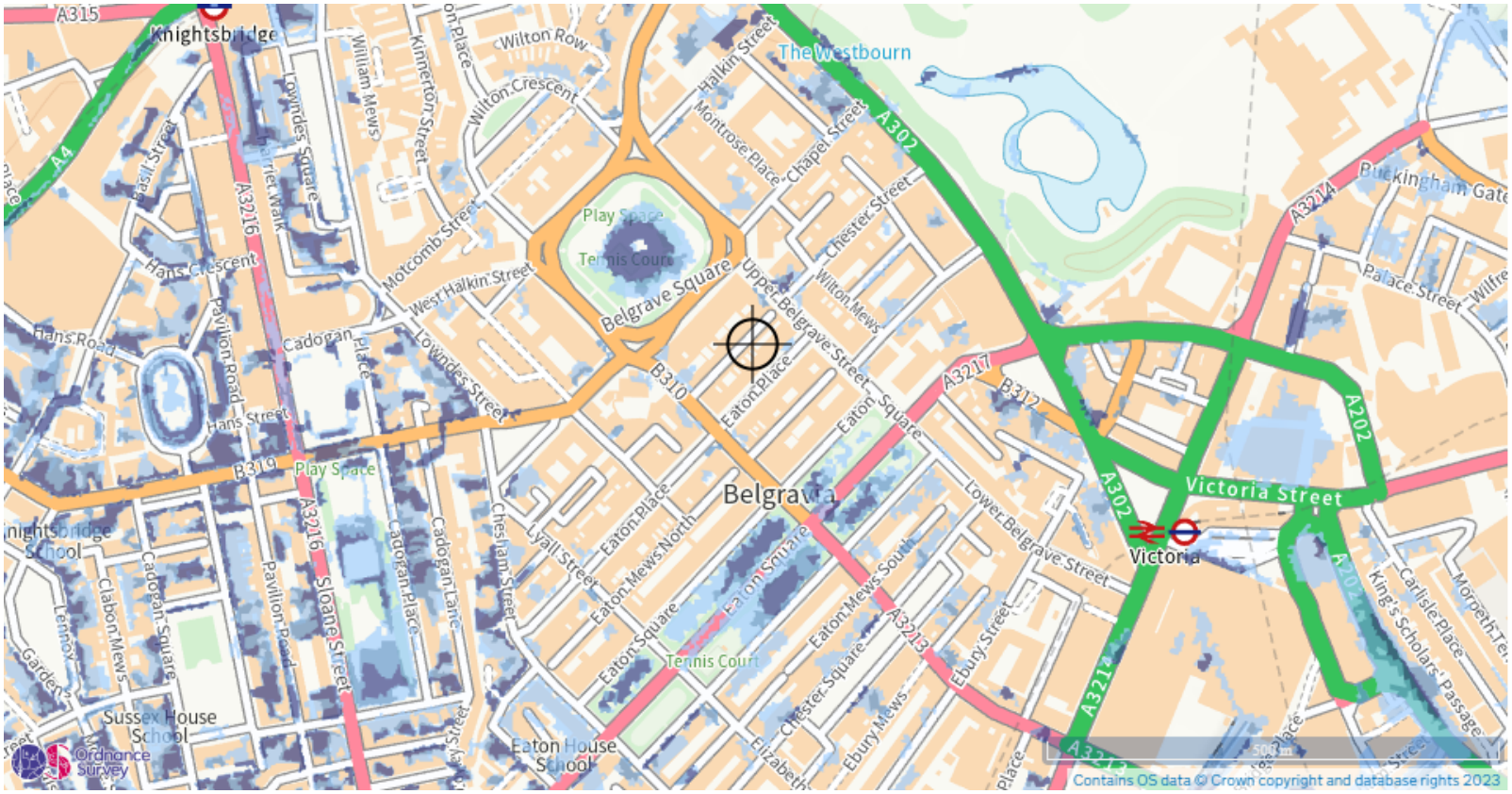

Location you selected

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 7: EA Surface Water Flooding	**GWPR5680**

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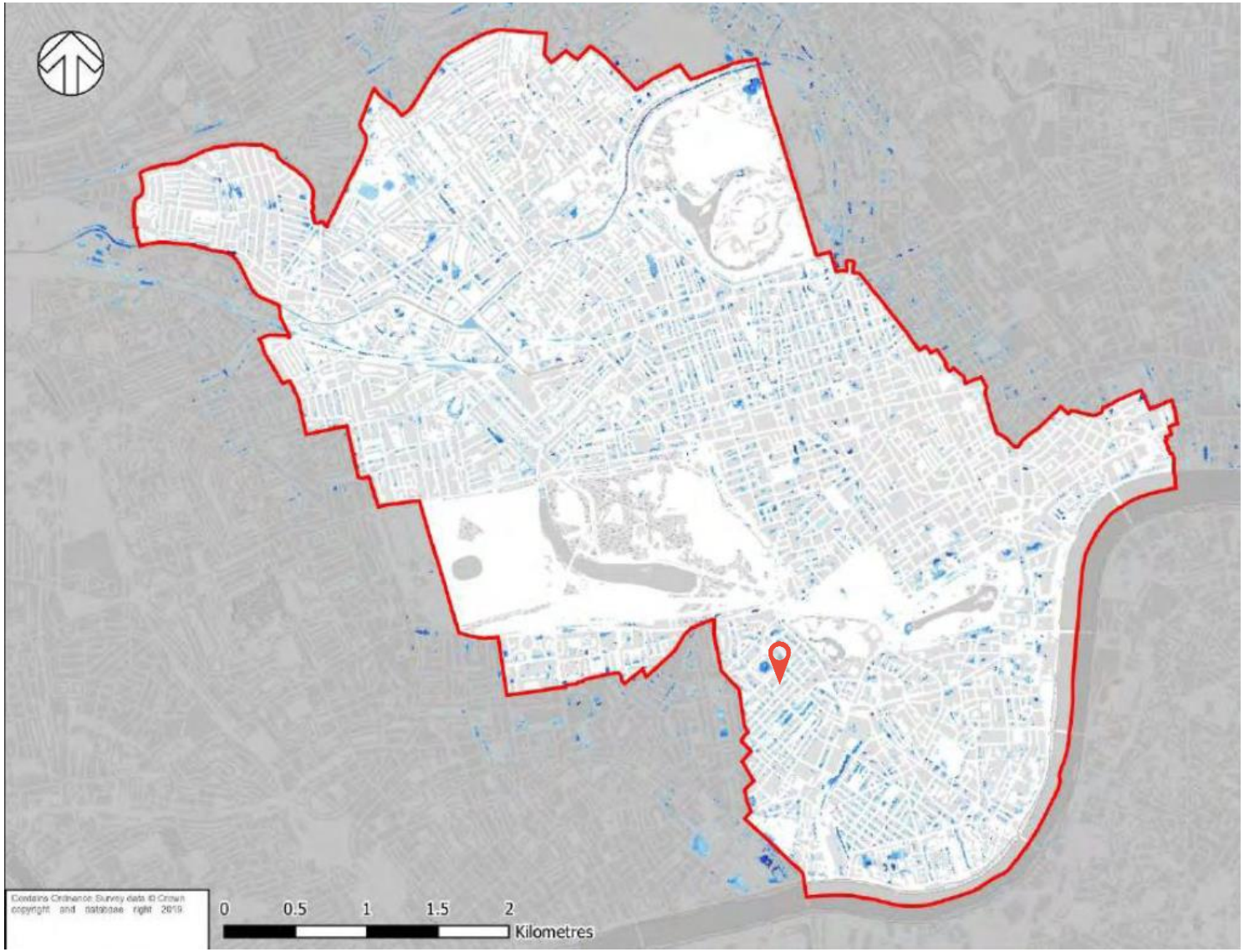

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 8: 1% Annual Probability of Surface Water Flooding (SFRA)	**GWPR5680**

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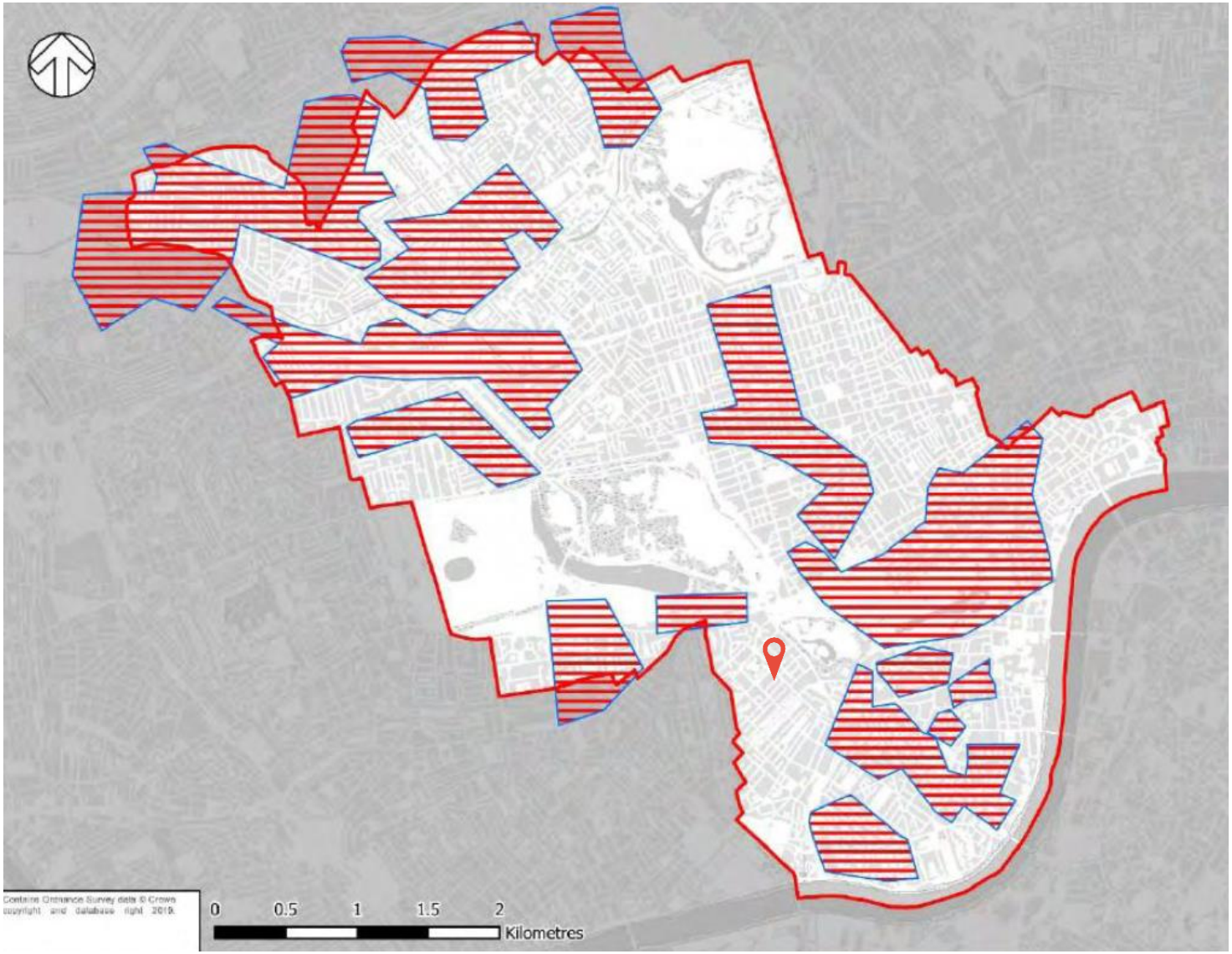

Site Location

London Borough of Westminster

Surface Water Flood Risk Hotspot

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 9: Surface Water Flood Risk Hotspots	**GWPR5680**

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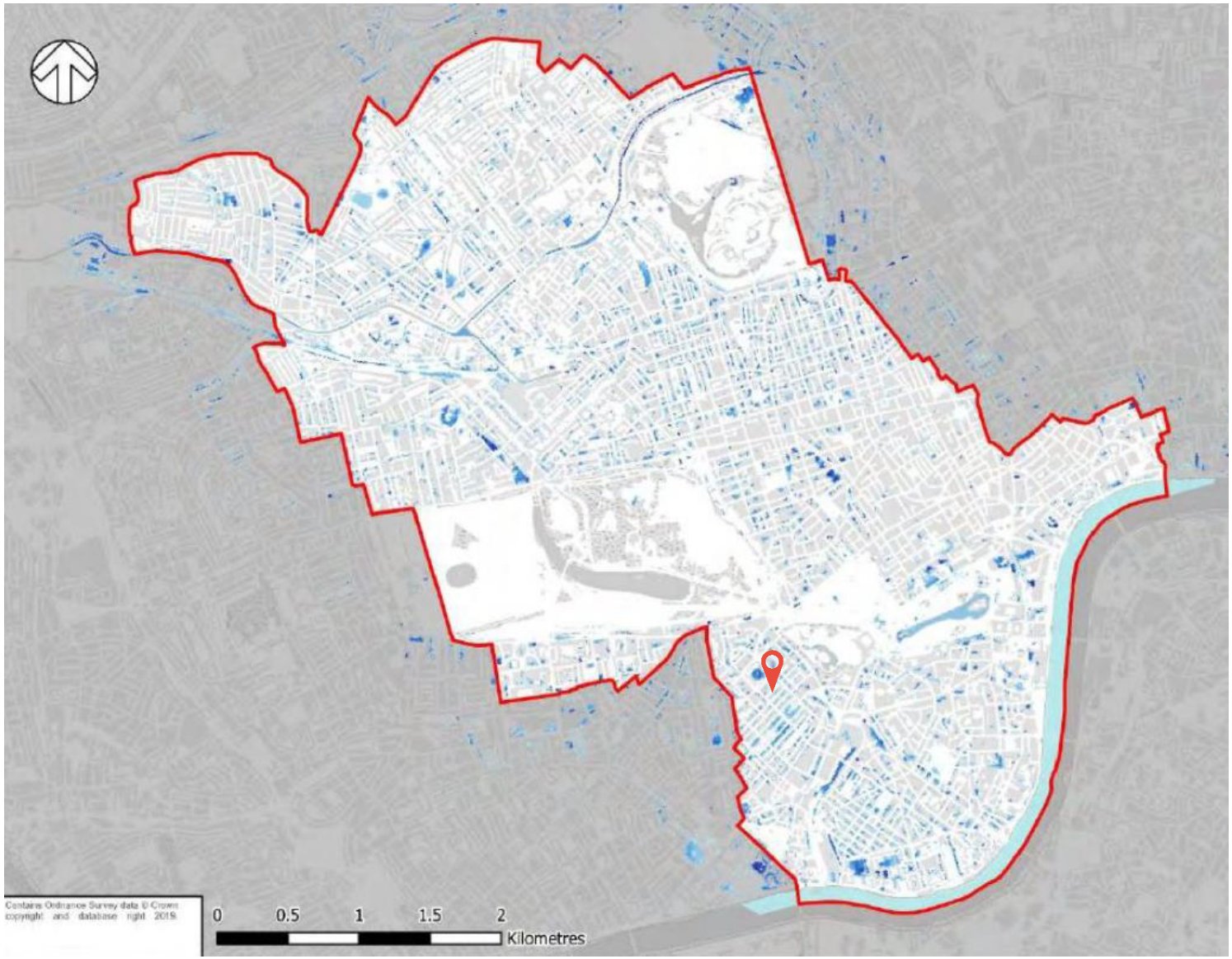


Site Location

London Borough of Westminster

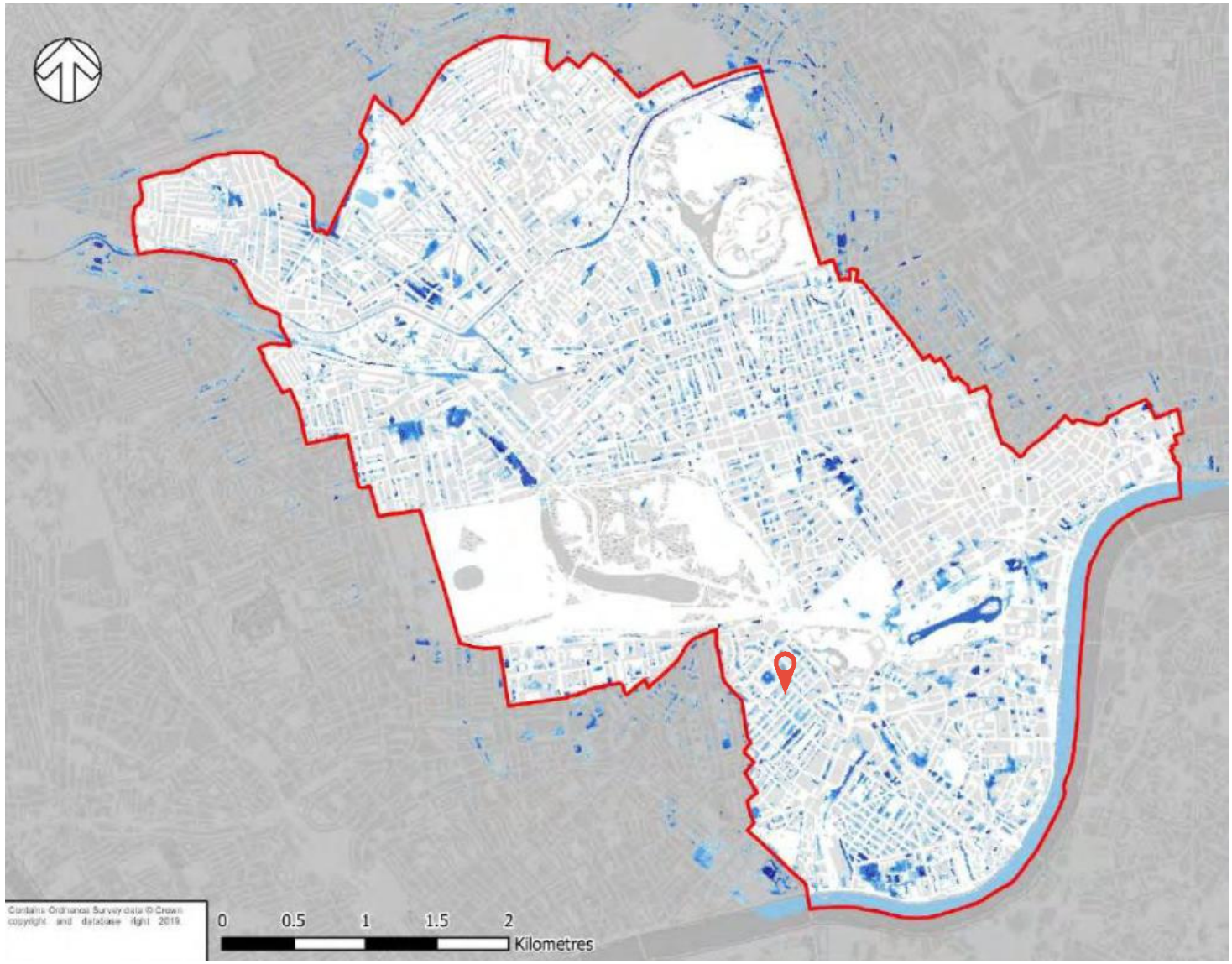
Depth (m)

- 0.075 - 0.100
- 0.101 - 0.200
- 0.201 - 0.300
- 0.301 - 0.500
- 0.501 - 0.750
- 0.751 - 1.500
- 1.501 - 2.764

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 10: 1% Annual Probability of Surface Water Flooding with 20% Climate Change (SFRA)	**GWPR5680**

ground&water



Site Location

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 11: 1% Annual Probability of Surface Water Flooding with 40% Climate Change (SFRA)	**GWPR5680**

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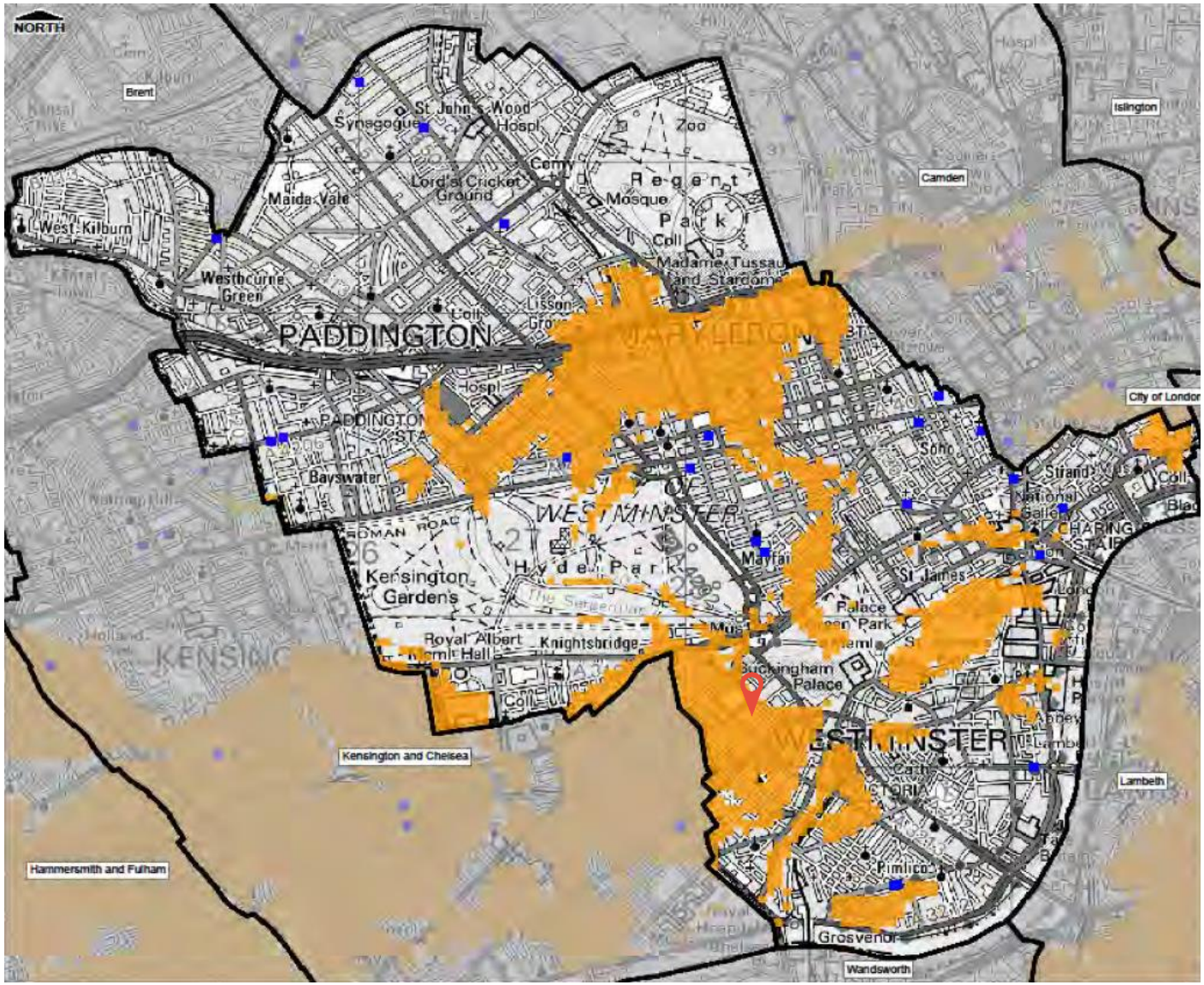

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 12: Increased Potential For Elevated Groundwater (SFRA)	**GWPR5680**

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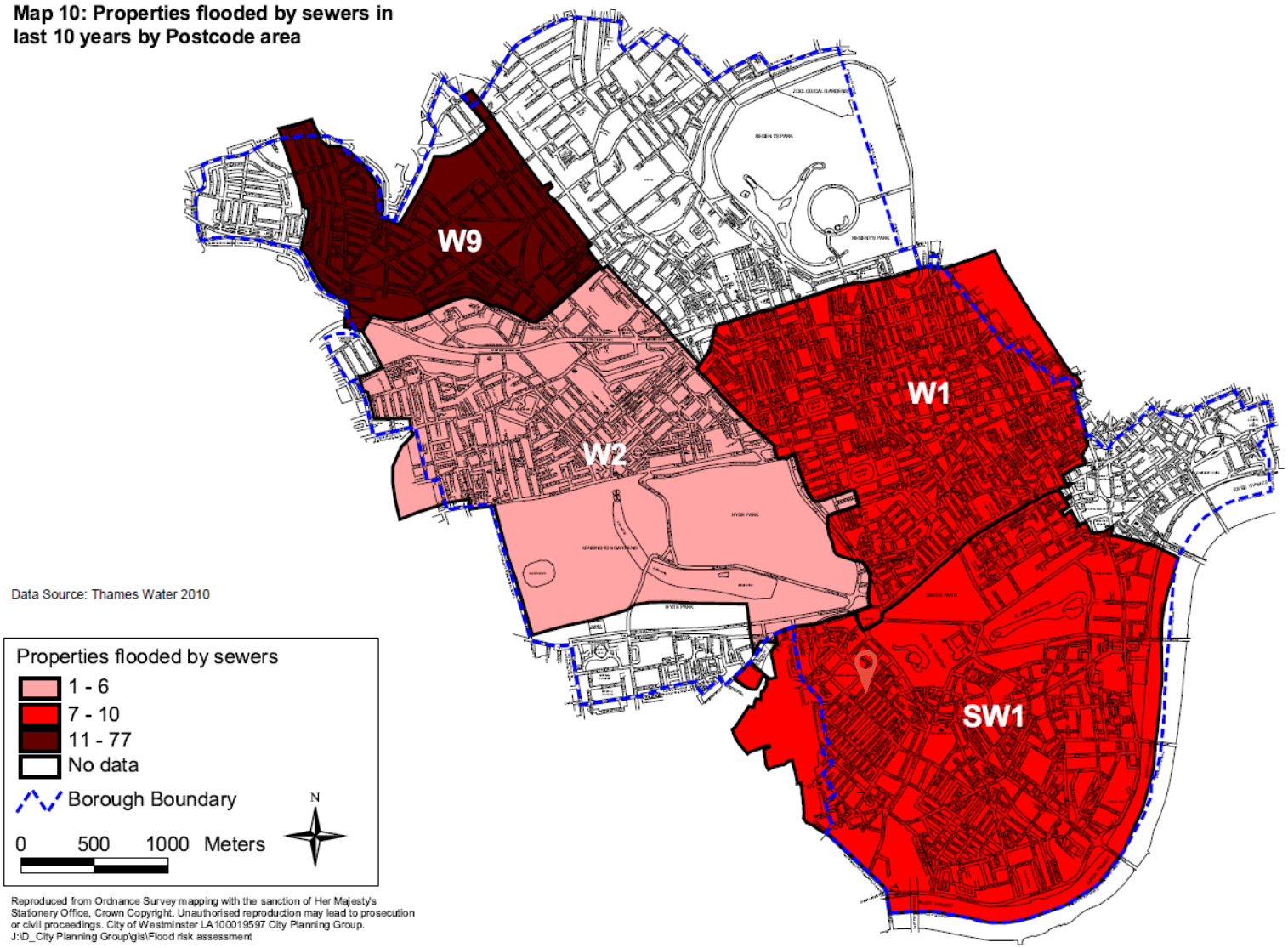
Map 10: Properties flooded by sewers in last 10 years by Postcode area



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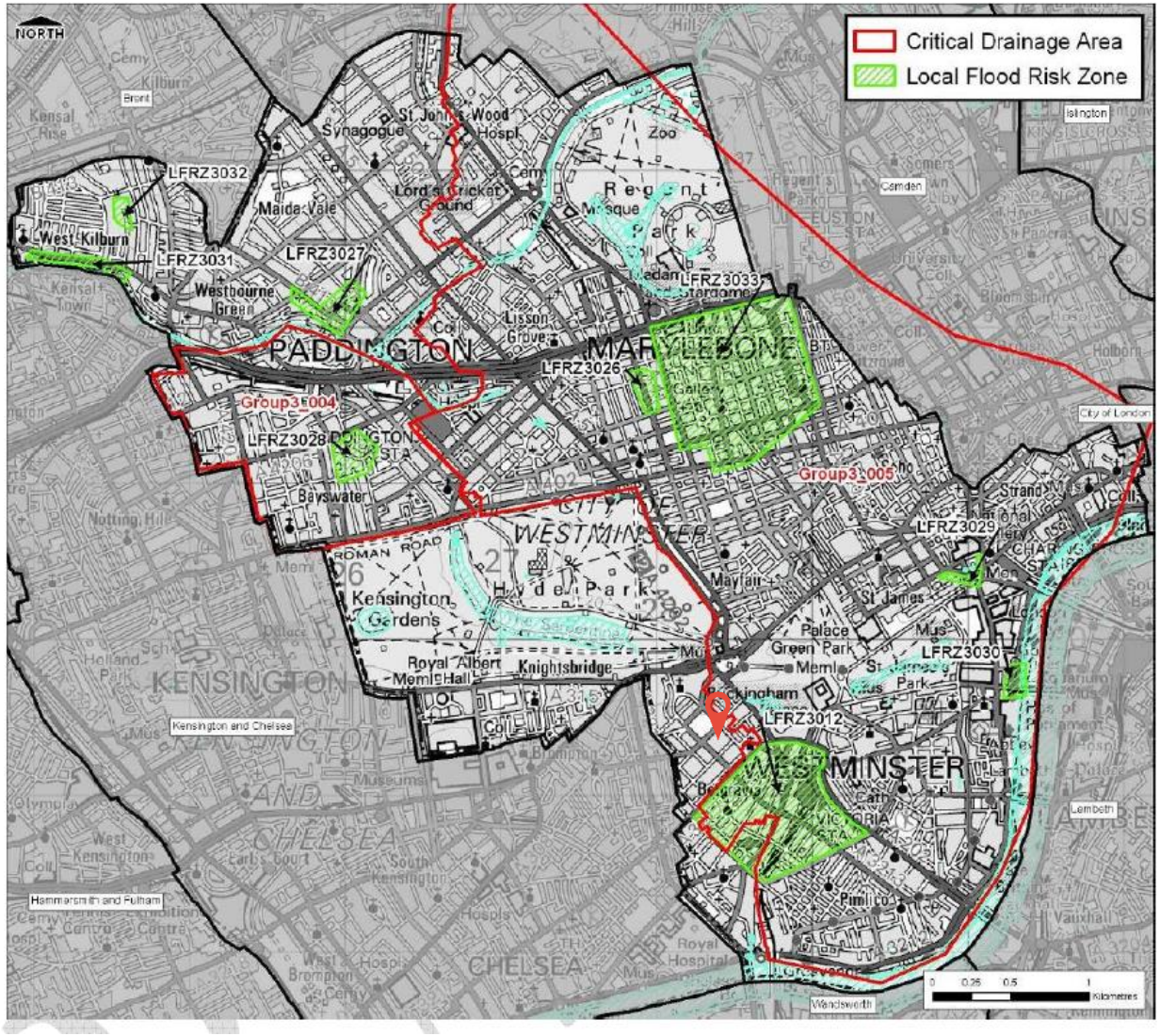
Site Location

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 13: Properties Flooded by Sewers in Last 10 Years (SFRA)	**GWPR5680**

ground&water



Site Location

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 14: Critical Drainage Area Map	**GWPR5680**

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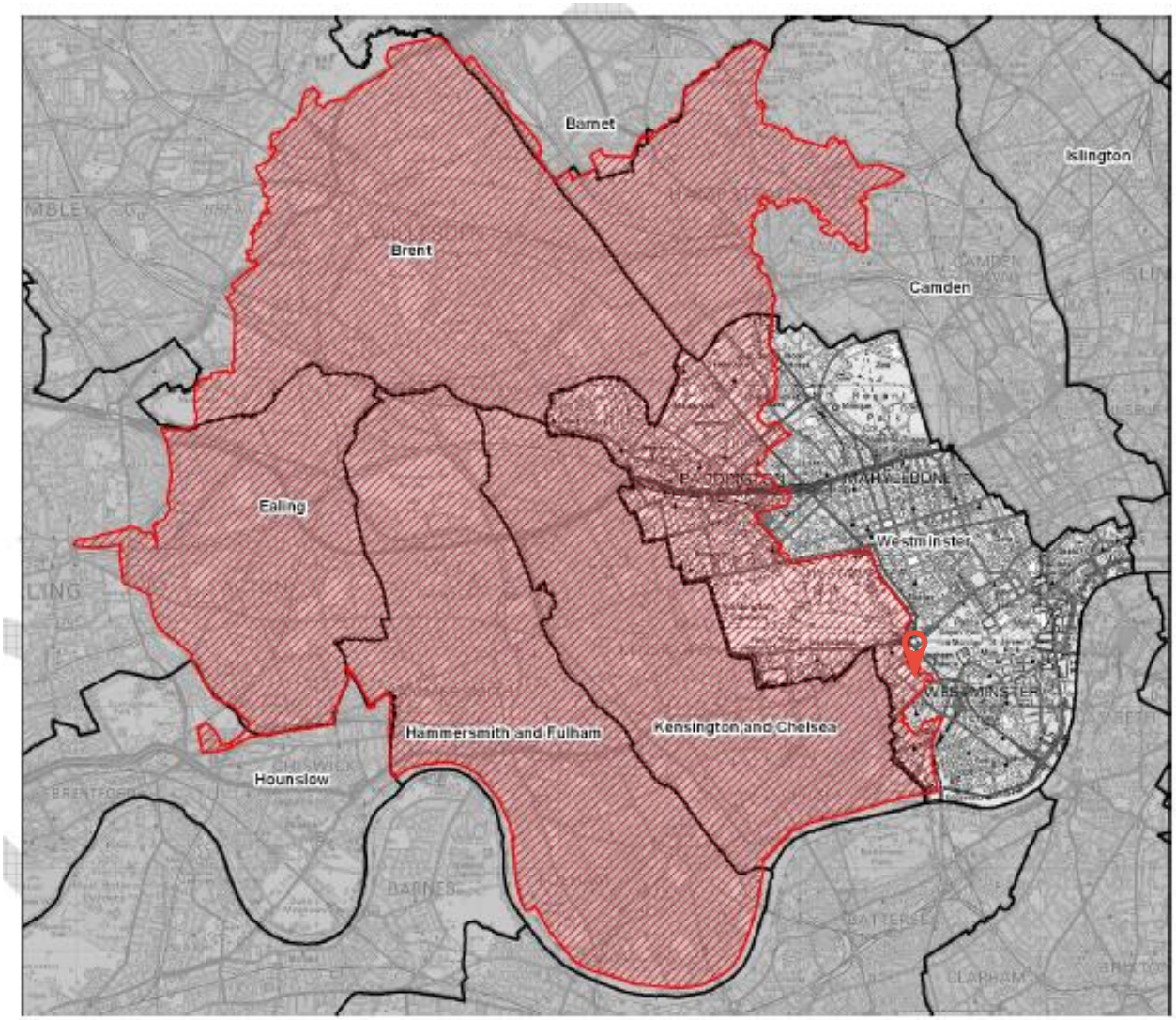

Site Location

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 15: Counters Creed CDA Catchment	**GWPR5680**

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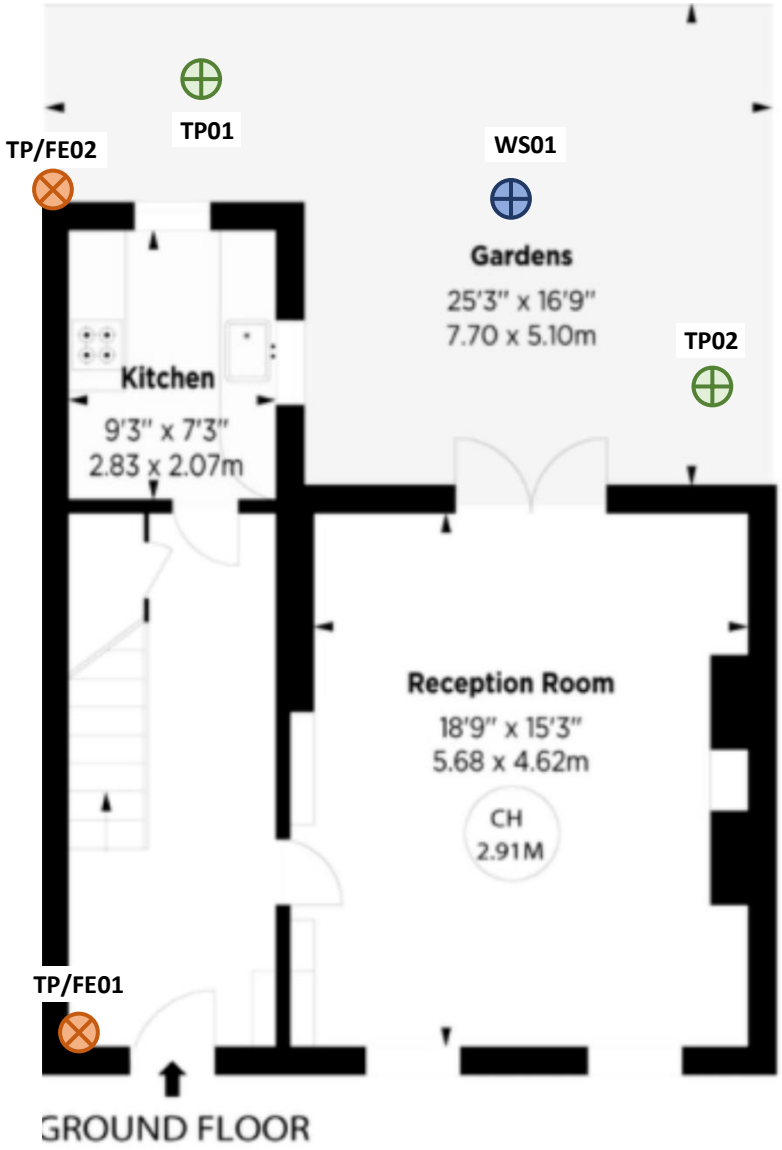

Site boundary

Trial Pit Foundation Exposures

Windowless Sampler Trial Hole

Trial Pits for contamination soil sampling

Not to Scale

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 16: Trial Hole Location Plan	**GWPR5680**

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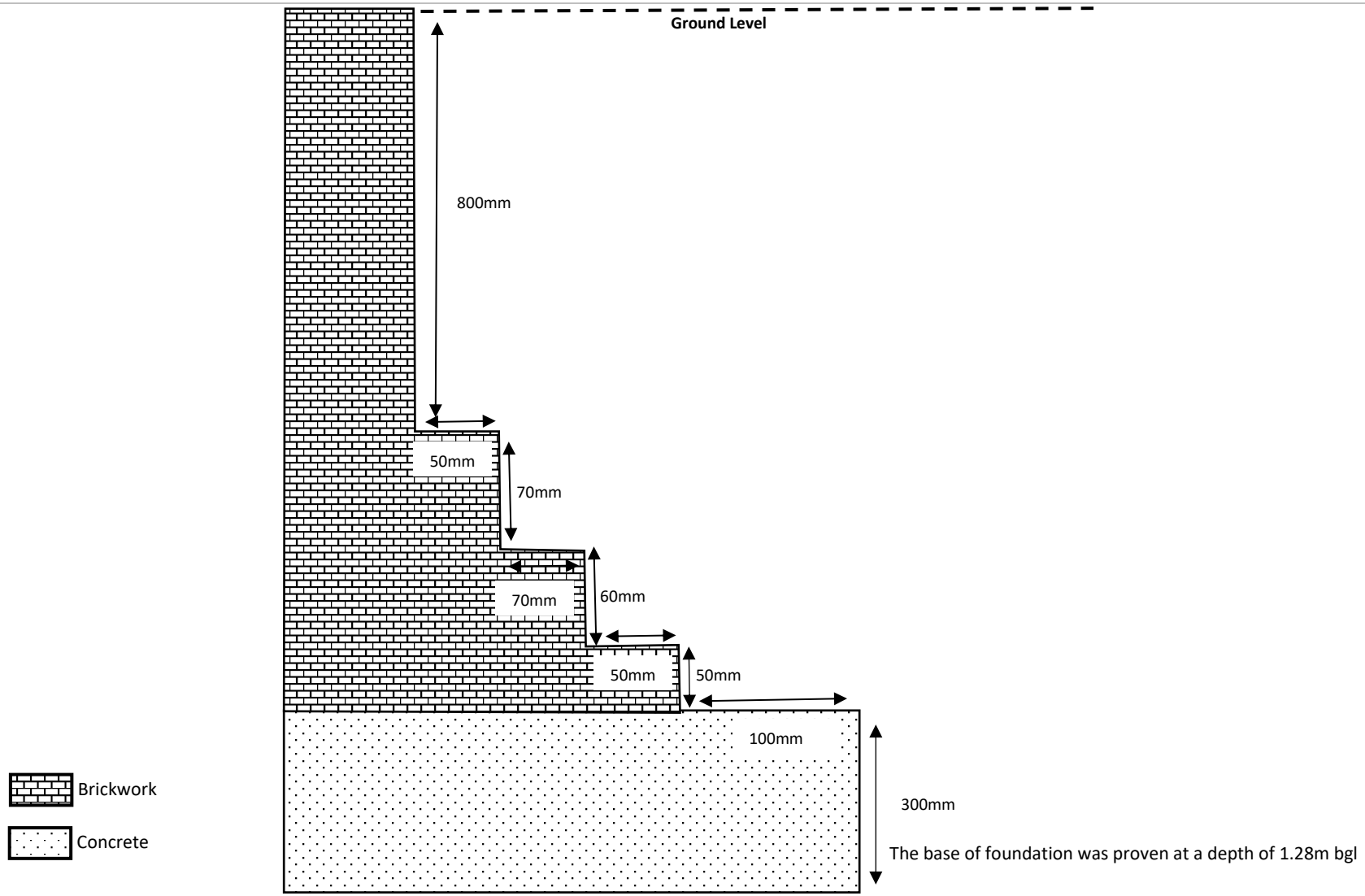
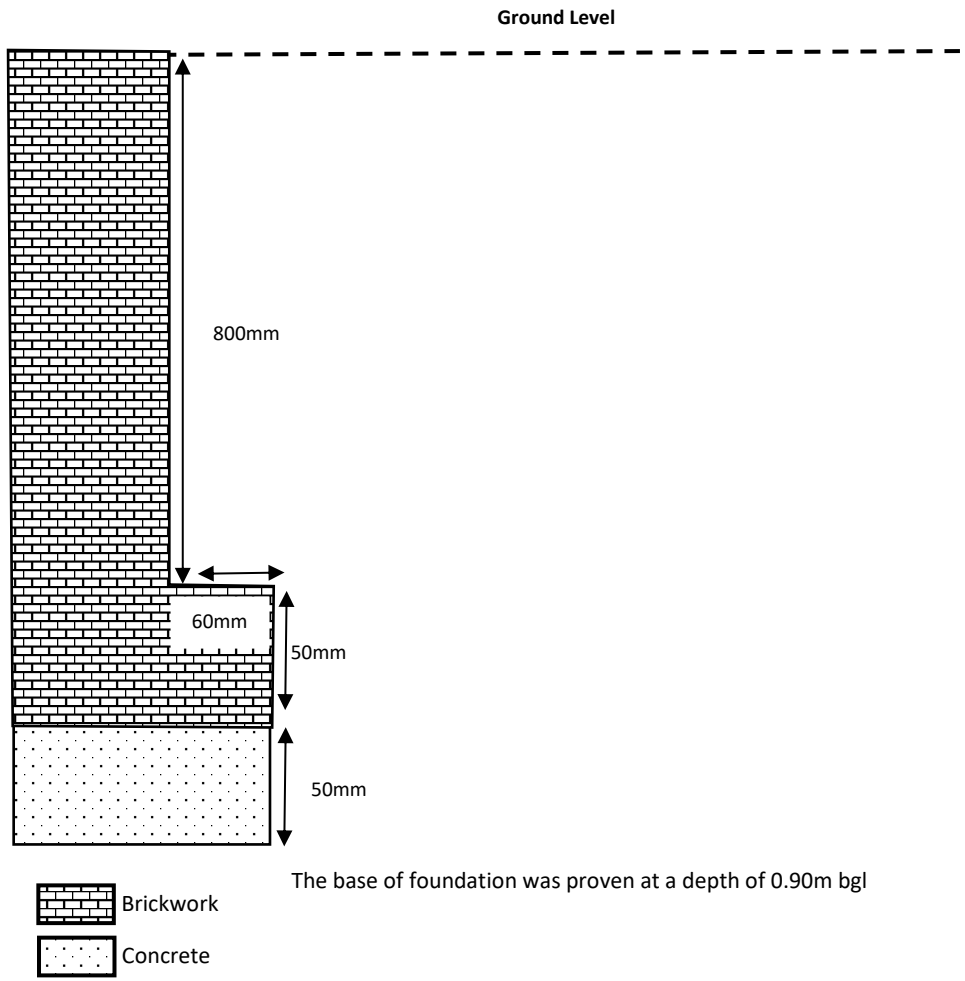
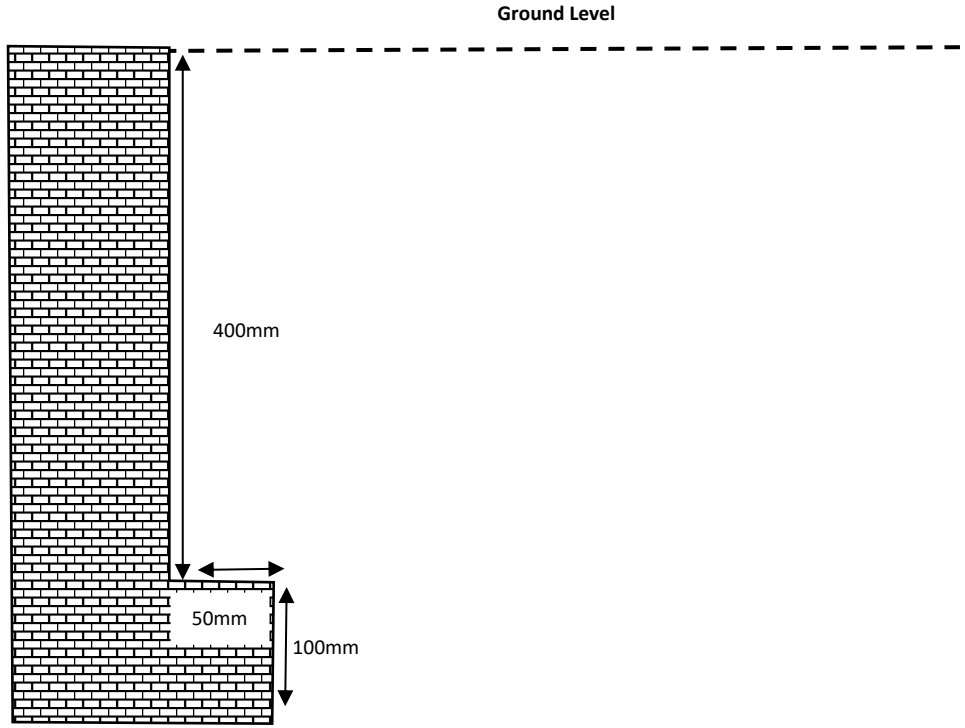


34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 17: TP/FE01 (South-East Wall)	**GWPR5680**



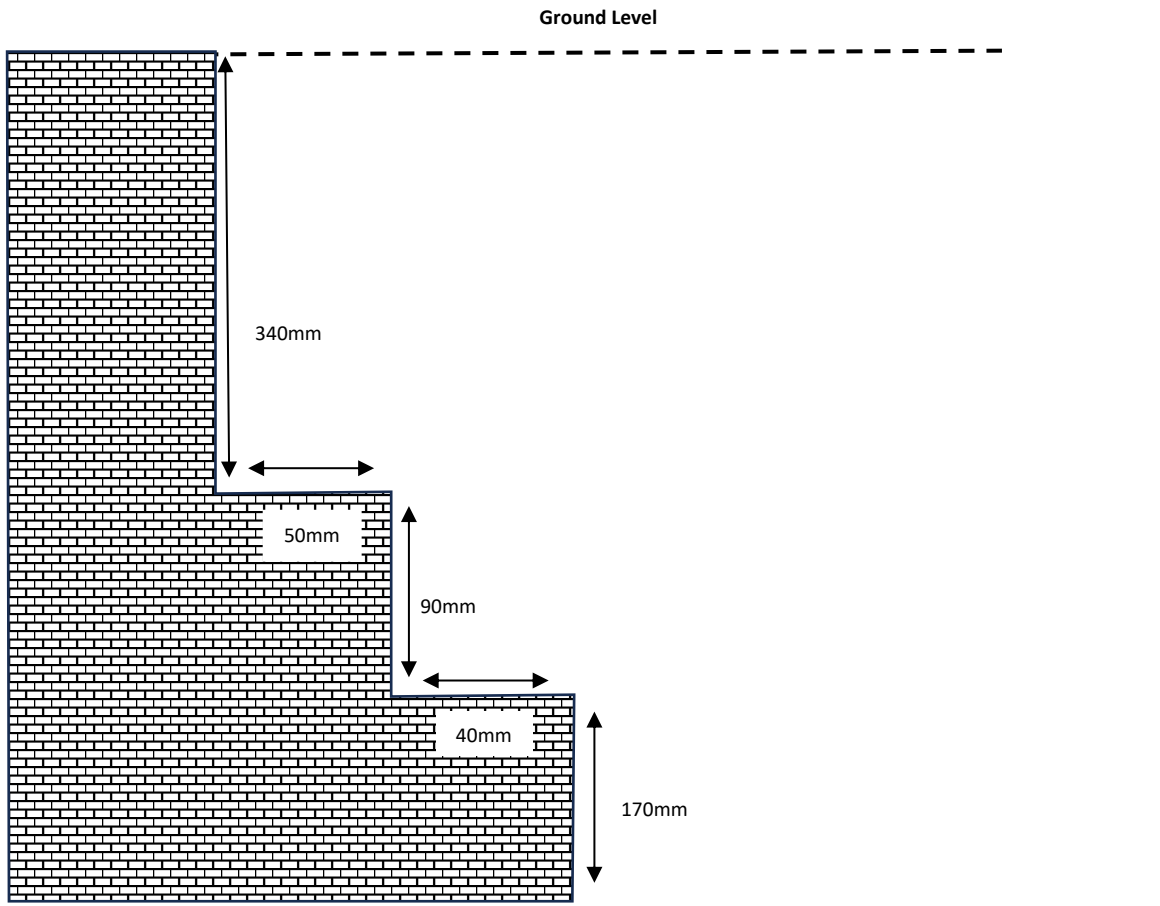
The base of foundation was proven at a depth of 0.90m bgl

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 18: TP/FE01 (South-West Wall)	**GWPR5680**



The base of foundation was proven at a depth of 0.50m bgl

34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 19: TP/FE02 (North-West Wall)	**GWPR5680**



34 Belgrave Mews South London SW1X 8BT	
Leconfield Property Group	**December 2023**
Figure 20: TP/FE02 (North-East Wall)	**GWPR5680**

APPENDIX A: Conditions and Limitations

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
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The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly, any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the

context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to 34 Belgrave Mews South London SW1X 8BT.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

APPENDIX B: Technical Glossary

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
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TECHNICAL GLOSSARY

The list of possible definitions within the report may be seen below. Please note that some definitions may not be relevant to this report.

HYDROGEOLOGY:

A **Principal Aquifer** is a layer of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary (A) Aquifers consist of deposits with permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.

Secondary (B) Aquifers consist of deposits with predominantly lower permeability layers with may stoke and yield limited amounts of groundwater due to localised features such as fissures, think permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary Aquifers (Undifferentiated) are assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both a minor aquifer and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive Strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

FLOOD ZONES:

Environment Agency Flood Zone 2, defined as; land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.

Environment Agency Flood Zone 3 shows the extent of a river flood with a 1 in 100 (1%0 or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year.

Environment Agency Flood Zone 3 area that benefits from flood defences, defined as; land and property in this flood zone would have a high probability of flooding without the local flood defences. These protect the area against a river flood with a 1% chance of happening each year, or a flood from the sea with a 0.5% chance of happening each year.

GROUNDWATER SOURCE PROTECTION ZONES (SPZS):

Inner Zone (SPZ1): This zone is 50 day travel time of pollutant to source with a 50 metres default minimum radius.

Outer Zone (SPZ2): This zone is 400 day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken.

Total Catchment (SPZ3): This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.

Zone of Special Interest (SPZ4): This zone is where local conditions require additional protection.

IN-SITU STRENGTH GEOTECHNICAL TESTING:

Windowless Sample and/or Cable Percussion and/or Rotary Boreholes provide samples of the ground for assessment but they do not give any engineering data. The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50mm and an inside diameter of 35mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5kg falling through a distance of 760mm. The sample tube is driven 150mm into the ground and then the number of blows needed for the tube to penetrate each 75mm up to a depth of 450mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

Dynamic Probing involves the driving of a metal cone into the ground via a series of steel rods. These rods are driven from the surface by a hammer system that lifts and drops a 63.5kg (SHDP) hammer onto the top of the rods through a set height, thus ensuring a consistent energy input. The number of hammer blows that are required to drive the cone down by each 100mm increment are recorded. These blow counts then provide a comparative assessment from which correlations have been published, based on dynamic energy, which permits engineering parameters to be generated. (The Dynamic Probe 'Super Heavy' (SHDP) Tests were conducted in accordance with BS 1377; 1990; Part 9, Clause 3.2).

APPENDIX C: Trial Hole Logs

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
0333 600 1221 enquiries@groundandwater.co.uk **groundandwater.co.uk**

Registered Office: Kineton House, 31 Horse Fair, Banbury, Oxfordshire OX16 0AE Registered in England No. 07032001

Percussion Drilling Log

Project Name: 34 Belgrave Mews South, London SW1X 8BT	Client: Leconfield Property Group	Date: 08/11/2023
Location: 34 Belgrave Mews South, London SW1X 8BT	Contractor:	
Project No. : GWPR5680	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS01	BH		AS	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30			MADE GROUND. Pale grey very gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-rounded flint (70%), concrete (20%) and brick (10%).
					0.70			MADE GROUND. Dark brown gravelly very sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded. Sand is fine to coarse flint (60%), brick (30%) and calcareous material (10%).
		1.20	SPT	N=20 (2,3/3,5,6,6)	1.30			Dark orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER)
		2.00	SPT	N=50 (6,10/10,16,18,6)				Dark orangish brown very gravelly fine to coarse SAND. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER)
		3.00	SPT	N=50 (8,12/50 for 225mm)				
		4.00	SPT	N=30 (12,12/13,7,6,4)	4.10			Dark greyish brown silty CLAY. (LONDON CLAY FORMATION)
		5.00	SPT	N=16 (3,3/3,4,4,5)				
					5.45			End of Borehole at 5.450m

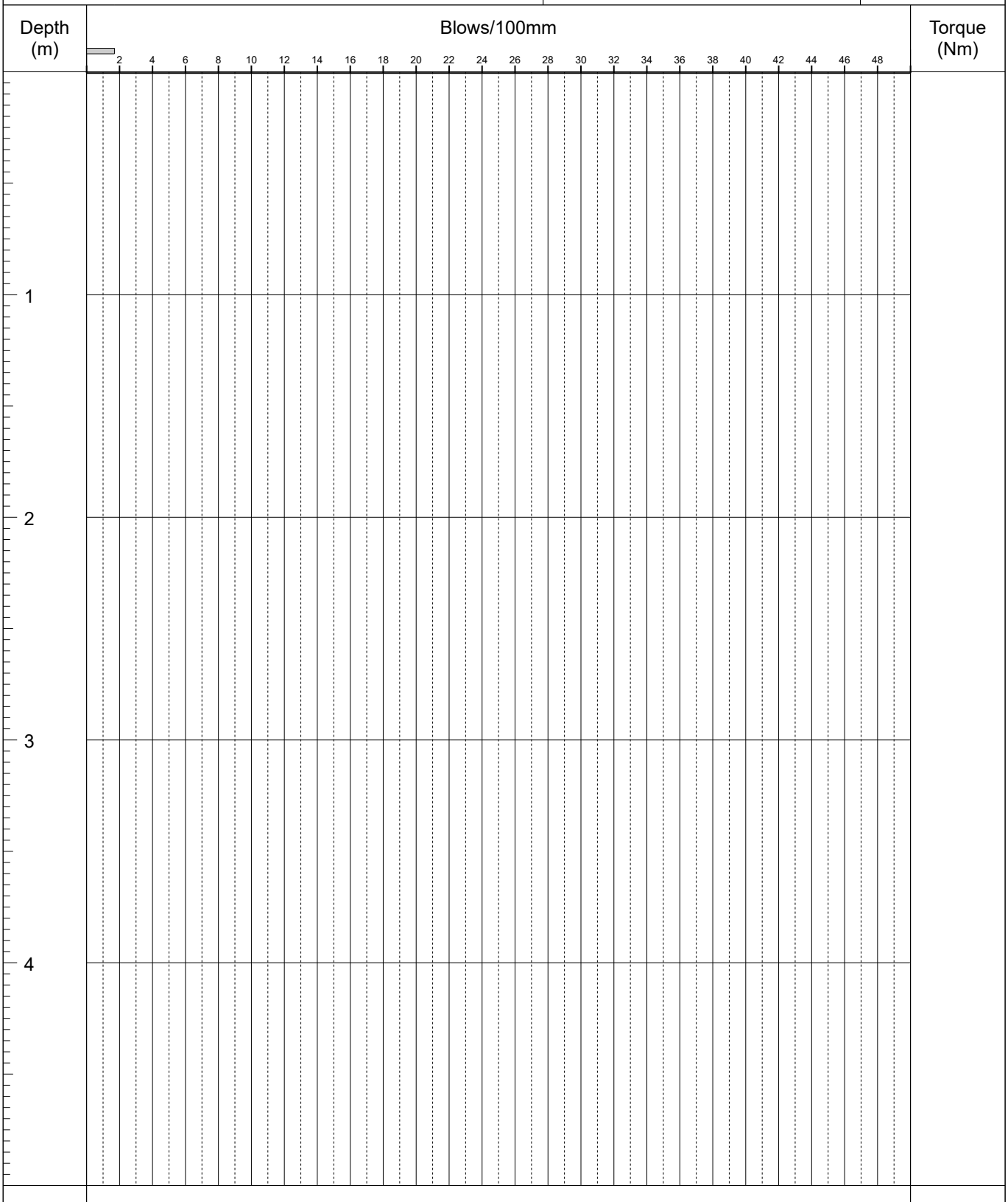
Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Fresh roots were noted to 0.80m bgl. No groundwater strikes were observed..

Probe Log

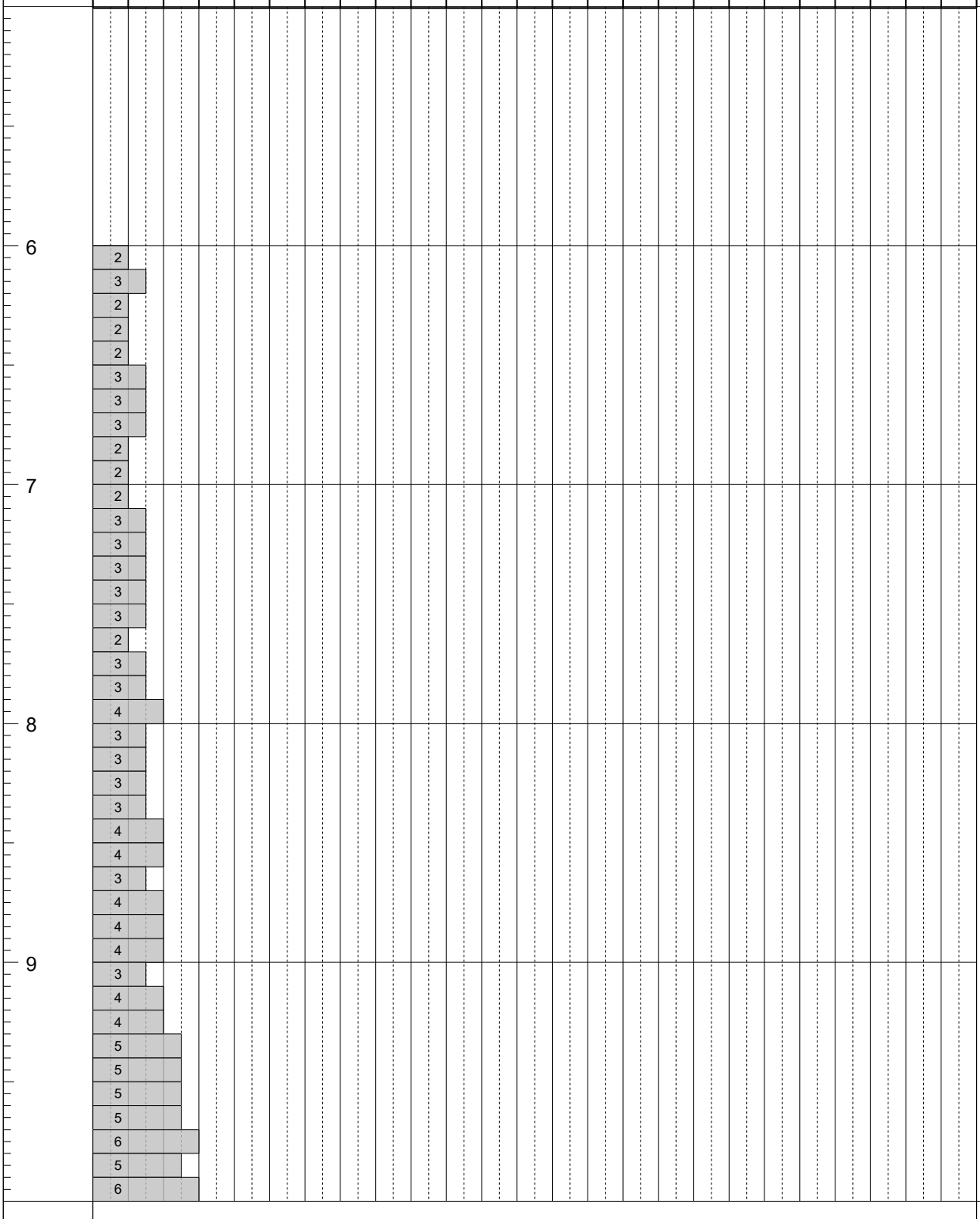
			Probe No DP01 Sheet 1 of 2
Project Name: 34 Belgrave Mews South, London SW1X 8BT	Project No. GWPR5680	Co-ords:	Hole Type DP
Location: 34 Belgrave Mews South, London SW1X 8BT		Level:	Scale 1:25
Client: Leconfield Property Group		Dates: 08/11/2023	Logged By



Remarks:	Fall Height	100	Cone Base Diameter	
	Hammer Wt	64	Final Depth	10.00
	Probe Type	DPSH- A		

Probe Log

			Probe No DP01 Sheet 2 of 2
Project Name: 34 Belgrave Mews South, London SW1X 8BT	Project No. GWPR5680	Co-ords:	Hole Type DP
Location: 34 Belgrave Mews South, London SW1X 8BT		Level:	Scale 1:25
Client: Leconfield Property Group		Dates: 08/11/2023	Logged By



Remarks:	Fall Height	100	Cone Base Diameter	
	Hammer Wt	64	Final Depth	10.00
	Probe Type	DPSH- A		

Trial Pit Log

Project Name: 34 Belgrave Mews South, London SW1X 8BT	Client: Leconfield Property Group	Date: 08/11/2023
Location: 34 Belgrave Mews South, London SW1X 8BT	Contractor:	
Project No. : GWPR5680	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP/FE01	TP		AS	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								MADE GROUND. Orangish brown very gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-rounded flint (50%) and concrete (50%).
					0.90			Dark orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER)
					1.40			End of Borehole at 1.400m

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

No fresh roots or groundwater strikes were noted.

Trial Pit Log

Project Name: 34 Belgrave Mews South, London SW1X 8BT	Client: Leconfield Property Group	Date: 08/11/2023
Location: 34 Belgrave Mews South, London SW1X 8BT	Contractor:	
Project No. : GWPR5680	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP/FE02	TP		AS	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								MADE GROUND. Pale grey very gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-rounded flint (70%), concrete (20%) and brick (10%).
					0.30			Dark orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER)
					0.80			End of Borehole at 0.800m

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

No fresh roots or groundwater strikes were noted.

Trial Pit Log

Project Name: 34 Belgrave Mews South, London SW1X 8BT	Client: Leconfield Property Group	Date: 08/11/2023
Location: 34 Belgrave Mews South, London SW1X 8BT	Contractor:	
Project No. : GWPR5680	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP01	TP		AS	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								MADE GROUND. Dark brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to rounded flint (50%), concrete (30%) and brick (20%)
					0.40			Dark orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER)
					1.00			End of Borehole at 1.000m

1 2 3 4 5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

No fresh roots or groundwater strikes were noted.

Trial Pit Log

Project Name: 34 Belgrave Mews South, London SW1X 8BT	Client: Leconfield Property Group	Date: 08/11/2023
Location: 34 Belgrave Mews South, London SW1X 8BT	Contractor:	
Project No. : GWPR5680	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP02	TP		AS	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								MADE GROUND. Pale grey very gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-rounded flint (30%), concrete (60%) and brick (10%).
					0.30			MADE GROUND. Dark reddish brown sandy fine to coarse sub-rounded GRAVEL of brick (100%). Sand is fine to coarse.
					0.70			Dark orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER)
					1.00			End of Borehole at 1.000m

1 2 3 4 5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

No fresh roots or groundwater strikes were noted.

APPENDIX D: Geotechnical Laboratory Testing

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
0333 600 1221 enquiries@groundandwater.co.uk **groundandwater.co.uk**

Registered Office: Kineton House, 31 Horse Fair, Banbury, Oxfordshire OX16 0AE Registered in England No. 07032001

Laboratory Report

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES A PHENNA GROUP COMPANY

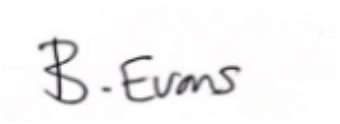
Contract Number: 69649

Client Ref: **GWPR5680**
Client PO: **GWPR5680**

Date Received: **17-11-2023**
Date Completed: **29-11-2023**
Report Date: **29-11-2023**

Client: **Ground and Water Limited**
Unit 2, The Long Barn,
Norton Farm,
Selbourne Road,
Alton,
Hampshire
GU34 3NB

This report has been checked and approved by:



Brendan Evans
Office Administrator

Contract Title: **34 Belgrave Mews South London SW1X 8BT**
For the attention of: **Aubyn Shortland**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	1
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	1
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	3
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)
Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)
Wayne Honey (Human Resources/ Health and Safety Manager)

GEO Site & Testing Services Ltd
Units 3-4, Heol Aur, Dafen, Llanelli, Carmarthenshire, Wales SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377:1990 - Part 2 : 4.4 & 5.3)**	
Contract Number	69649	
Project Name	34 Belgrave Mews South London SW1X 8BT	
Date Tested	28/11/2023	
	DESCRIPTIONS	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
WS01		D	5.00	-		Grey CLAY
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
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				-		
				-		
				-		
				-		
				-		

Operator
Aaron Hodge

GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES

NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.4 & 5.3)

Contract Number	69649	
Project Name	34 Belgrave Mews South London SW1X 8BT	
Date Tested	28/11/2023	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
WS01		D	5.00	-		26	73	23	50	100	CV Very High Plasticity
				-							
				-							
				-							
				-							
				-							
				-							
				-							
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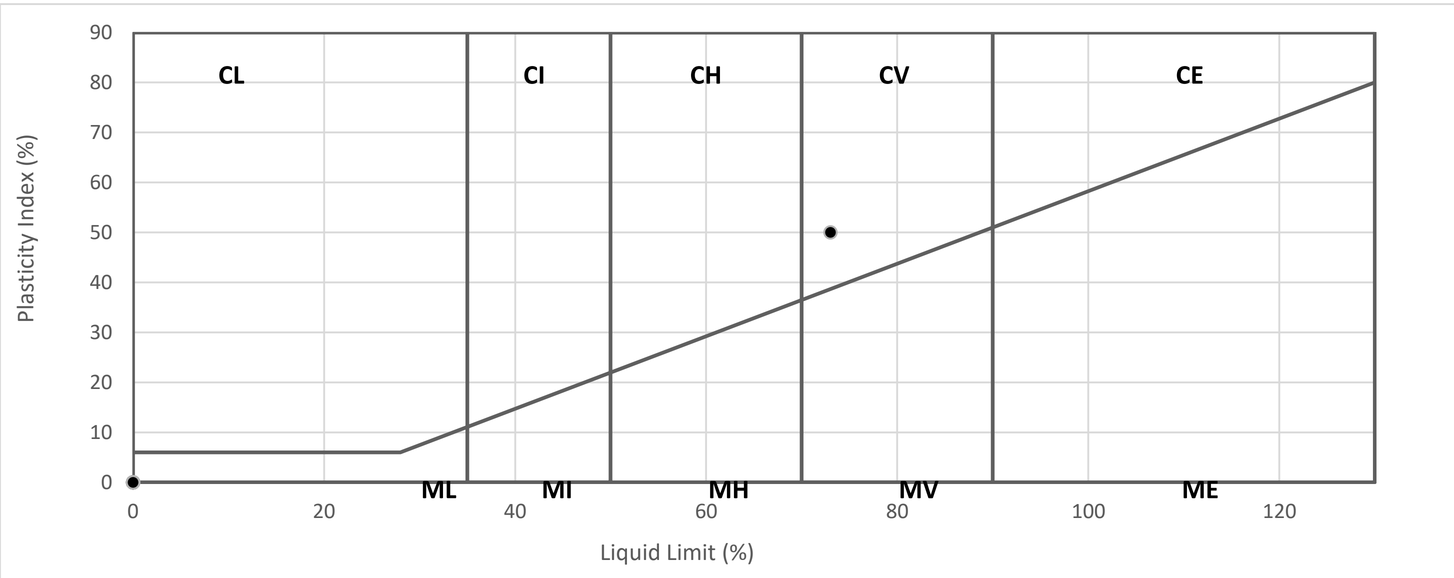
				-							
				-							
				-							
				-							

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

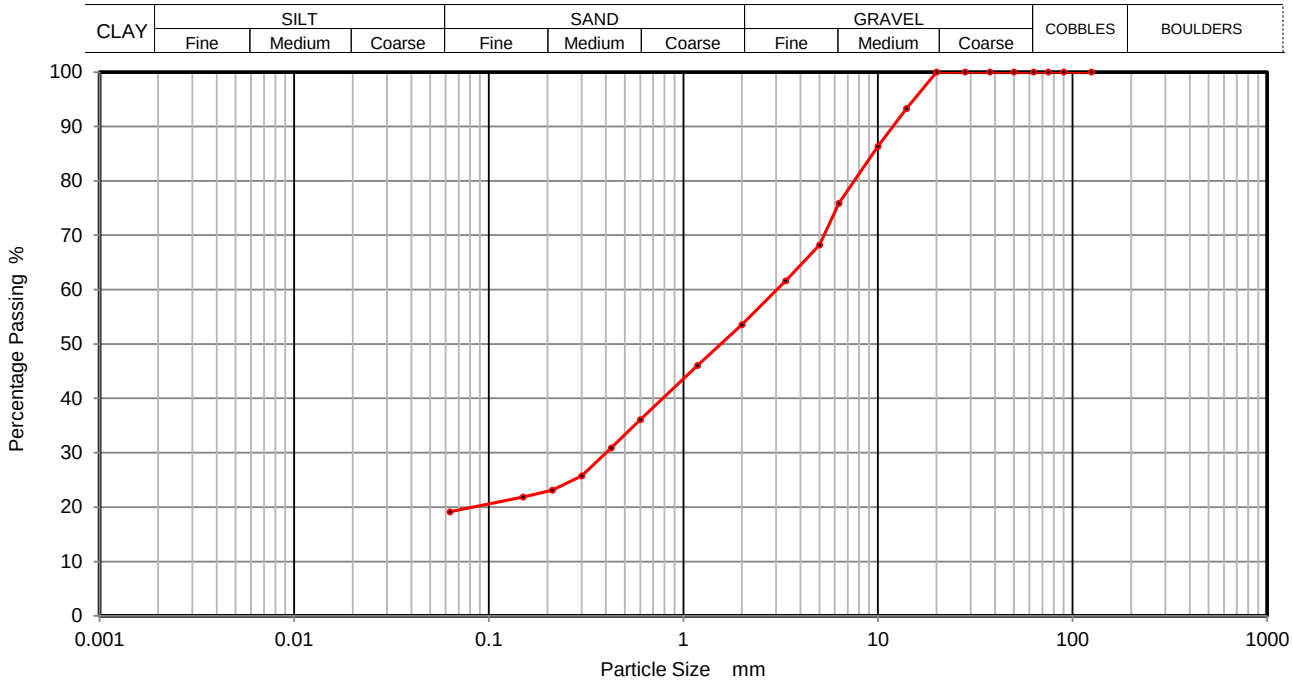
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:2015+A1:2020



Operator
Aaron Hodge

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2**	Contract Number	69649
		Borehole/Pit No.	WS01
Project Name	34 Belgrave Mews South London SW1X 8BT	Sample No.	
Soil Description	Brown silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	1.20
		Depth Base	
Date Tested	27/11/2023	Sample Type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	93		
10	86		
6.3	76		
5	68		
3.35	62		
2	54		
1.18	46		
0.6	36		
0.425	31		
0.3	26		
0.212	23		
0.15	22		
0.063	19		

Sample Proportions	% dry mass
Cobbles	0
Gravel	46
Sand	35
Silt and Clay	19

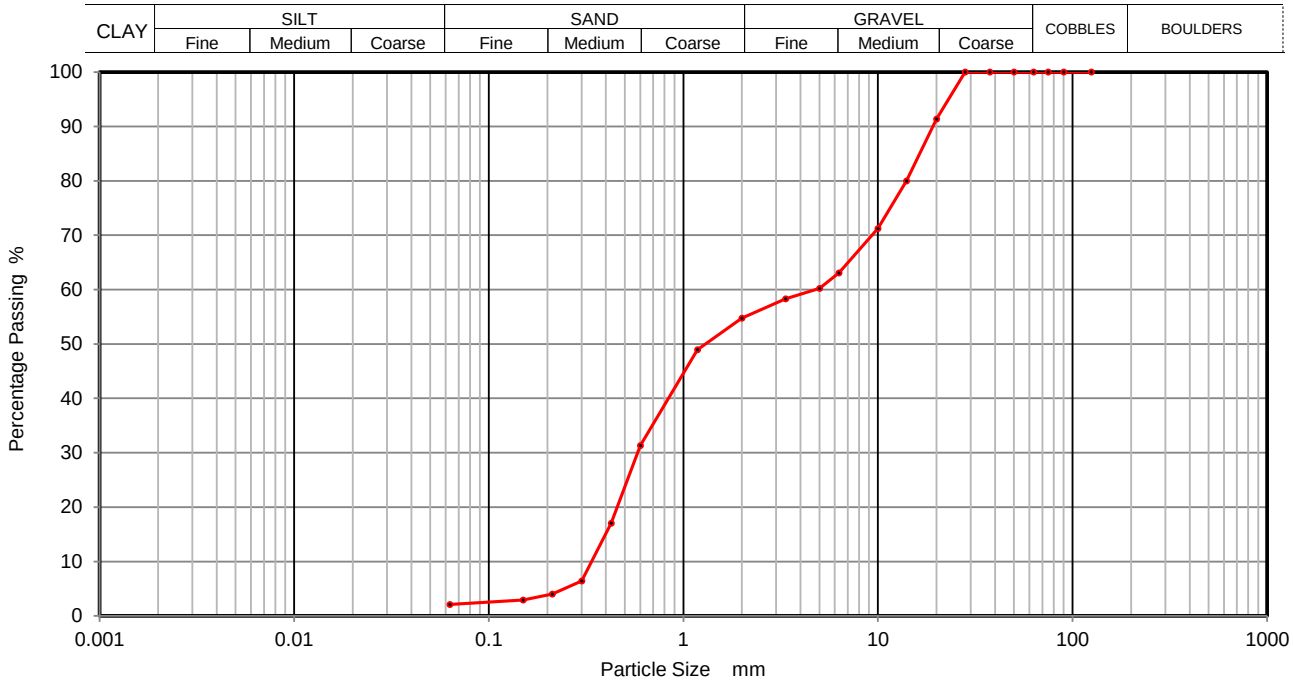
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	69649
		Borehole/Pit No.	WS01
Project Name	34 Belgrave Mews South London SW1X 8BT	Sample No.	
Soil Description	Brown slightly silty/ clayey fine to coarse gravelly fine to coarse SAND	Depth Top	2.50
		Depth Base	
Date Tested	27/11/2023	Sample Type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	91		
14	80		
10	71		
6.3	63		
5	60		
3.35	58		
2	55		
1.18	49		
0.6	31		
0.425	17		
0.3	6		
0.212	4		
0.15	3		
0.063	2		

Sample Proportions	% dry mass
Cobbles	0
Gravel	45
Sand	53
Silt and Clay	2

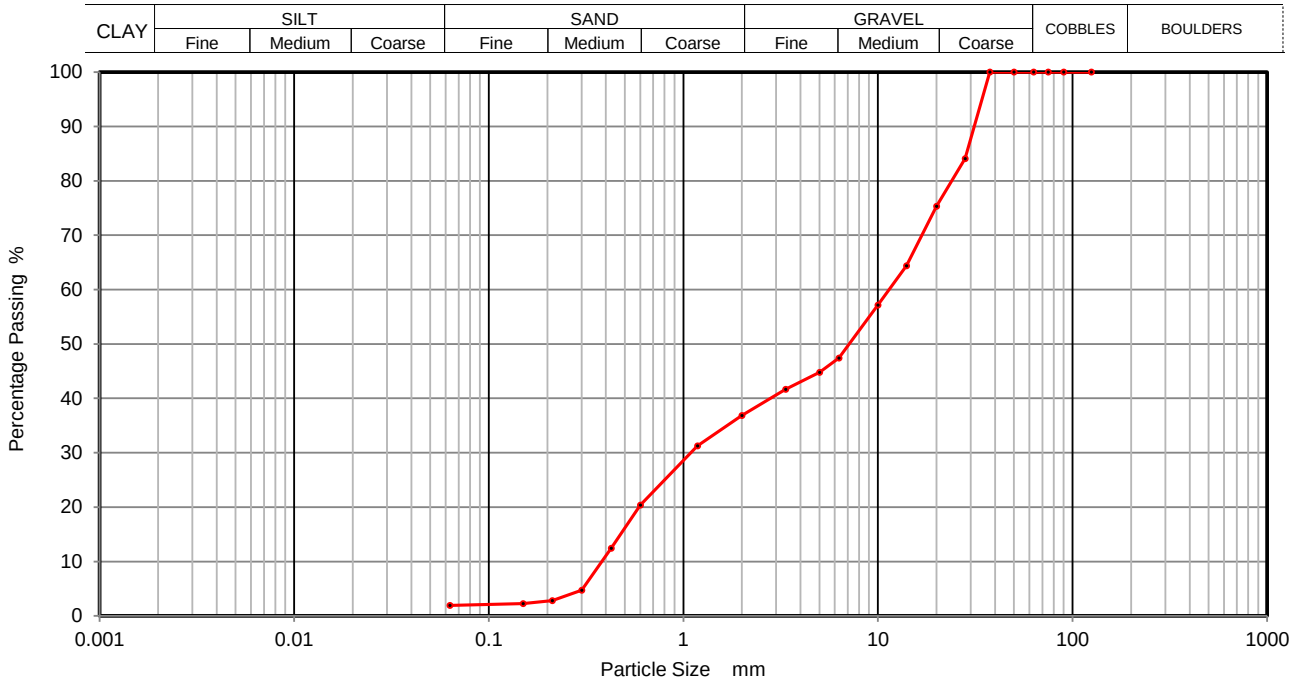
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	69649
		Borehole/Pit No.	WS01
Project Name	34 Belgrave Mews South London SW1X 8BT	Sample No.	
Soil Description	Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	3.50
		Depth Base	
Date Tested	27/11/2023	Sample Type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	84		
20	75		
14	64		
10	57		
6.3	47		
5	45		
3.35	42		
2	37		
1.18	31		
0.6	20		
0.425	12		
0.3	5		
0.212	3		
0.15	2		
0.063	2		

Sample Proportions	% dry mass
Cobbles	0
Gravel	63
Sand	35
Silt and Clay	2

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

UKAS TESTING 2788

APPENDIX E: Chemical Laboratory Testing

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
0333 600 1221 enquiries@groundandwater.co.uk **groundandwater.co.uk**

Registered Office: Kineton House, 31 Horse Fair, Banbury, Oxfordshire OX16 0AE Registered in England No. 07032001

Units 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528777
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Ground and Water Ltd
Head Office
2 The Long Barn
Norton Farm, Selborne Road
Alton
Hampshire
GU34 3NB

Attention: Aubyn Shortland

CERTIFICATE OF ANALYSIS

Date of report Generation:	27 November 2023
Customer:	Ground and Water Ltd
Sample Delivery Group (SDG):	231115-69
Your Reference:	GWPR5680
Location:	34 Belgrave Mews South London SW1X 8BT
Report No:	712292
Order Number:	GWPR5680

We received 6 samples on Wednesday November 15, 2023 and 6 of these samples were scheduled for analysis which was completed on Monday November 27, 2023. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.

Approved By:

Sonia McWhan
Operations Manager

1291

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
28943867	TP01		0.20	08/11/2023
28943870	TP02		0.50	08/11/2023
28943863	WS01		0.50	08/11/2023
28943855	WS01		1.70	08/11/2023
28943860	WS01		3.50	08/11/2023
28943857	WS01		4.50	08/11/2023

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	28943867	28943870	28943863	28943855	28943860	28943857
			Customer Sample Reference	TP01	TP02	WS01	WS01	WS01	WS01
			AGS Reference						
			Depth (m)	0.20	0.50	0.50	1.70	3.50	4.50
			Container	1kg TUB with Handle (ALE210)	250g Amber Jar (ALE210)	1kg TUB with Handle (ALE210)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE210)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE210)	1kg TUB with Handle (ALE210)	1kg TUB with Handle (ALE210)
			Sample Type	S	S	S	S	S	S	S	S	S	S	S
Ammoniacal N as NH4 in 2:1 extract	All	NDPs: 0 Tests: 2									X		X
ANC at pH4 and ANC at pH 6	All	NDPs: 0 Tests: 1					X						
Anions by Kone (soil)	All	NDPs: 0 Tests: 6		X		X	X			X	X	X	
Anions by Kone (w)	All	NDPs: 0 Tests: 1				X							
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 3	X		X	X							
Boron Water Soluble	All	NDPs: 0 Tests: 3		X		X	X						
CEN Readings	All	NDPs: 0 Tests: 1				X							
Coronene	All	NDPs: 0 Tests: 1					X						
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 3		X		X	X						
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1				X							
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 1				X							
EPH by GCxGC-FID	All	NDPs: 0 Tests: 1					X						
EPH CWG GC (S)	All	NDPs: 0 Tests: 2			X		X						
Fluoride	All	NDPs: 0 Tests: 1				X							
GRO by GC-FID (S)	All	NDPs: 0 Tests: 2			X			X					

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Results Legend
X Test
N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			28943867		28943870		28943863		28943855	28943860	28943857		
Customer Sample Reference			TP01		TP02		WS01		WS01	WS01	WS01		
AGS Reference													
Depth (m)			0.20		0.50		0.50		1.70	3.50	4.50		
Container			1kg TUB with Handle (ALE230)	250g Amber Jar (ALE210)	1kg TUB with Handle (ALE230)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE230)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE230)	1kg TUB with Handle (ALE230)	1kg TUB with Handle (ALE230)
Sample Type			S	S	S	S	S	S	S	S	S	S	S
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 3		X		X			X				
Loss on Ignition in soils	All	NDPs: 0 Tests: 1							X				
Magnesium (BRE)	All	NDPs: 0 Tests: 2									X		X
Mercury Dissolved	All	NDPs: 0 Tests: 1						X					
Metals in solid samples by OES	All	NDPs: 0 Tests: 3		X		X			X				
NO3, NO2 and TON by KONE (s)	All	NDPs: 0 Tests: 2									X		X
PAH 16 & 17 Calc	All	NDPs: 0 Tests: 1							X				
PAH by GCMS	All	NDPs: 0 Tests: 3		X		X			X				
PCBs by GCMS	All	NDPs: 0 Tests: 1							X				
pH	All	NDPs: 0 Tests: 6		X		X			X		X	X	X
pH Value of Filtered Water	All	NDPs: 0 Tests: 1						X					
Phenols by HPLC (S)	All	NDPs: 0 Tests: 3		X		X			X				
Phenols by HPLC (W)	All	NDPs: 0 Tests: 1						X					
Sample description	All	NDPs: 0 Tests: 6		X		X			X		X	X	X
Total Organic Carbon	All	NDPs: 0 Tests: 3		X		X			X				

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	28943867		28943870			28943863		28943855	28943860	28943857
			Customer Sample Reference	TP01		TP02			WS01		WS01	WS01	WS01
			AGS Reference										
			Depth (m)	0.20		0.50			0.50		1.70	3.50	4.50
			Container	1kg TUB with Handle (ALE230)	250g Amber Jar (ALE210)	1kg TUB with Handle (ALE230)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE230)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE230)	1kg TUB with Handle (ALE230)	1kg TUB with Handle (ALE230)
			Sample Type	S	S	S	S	S	S	S	S	S	S	S
Total Sulphate	All	NDPs: 0 Tests: 2										X		X
Total Sulphur	All	NDPs: 0 Tests: 2										X		X
TPH CWG GC (S)	All	NDPs: 0 Tests: 2					X			X				
VOC MS (S)	All	NDPs: 0 Tests: 2						X			X			

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
28943867	TP01	0.20	Light Brown	Sandy Clay Loam	Stones	None
28943870	TP02	0.50	Red	Sandy Loam	Stones	Crushed Brick
28943855	WS01	1.70	Light Brown	Sand	Stones	None
28943857	WS01	4.50	Dark Brown	Silty Clay Loam	Stones	Crushed Brick
28943860	WS01	3.50	Light Brown	Sand	Stones	Crushed Brick
28943863	WS01	0.50	Dark Brown	Sandy Clay Loam	Stones	Brick

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP01	TP02	WS01	WS01	WS01	WS01
			Depth (m)	0.20	0.50	0.50	1.70	3.50	4.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	08/11/2023	08/11/2023	08/11/2023	08/11/2023	08/11/2023	08/11/2023
			Sampled Time	00:00	00:00	00:00	00:00	00:00	00:00
			Date Received	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023
			SDG Ref	231115-69	231115-69	231115-69	231115-69	231115-69	231115-69
			Lab Sample No.(s)	28943867	28943870	28943863	28943855	28943860	28943857
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		13	13	16	5.2	4.6	19
Loss on ignition	<0.7 %	TM018				3.08 M			
Phenol	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M			
Cresols	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M			
Xylenols	<0.015 mg/kg	TM062 (S)		<0.015 M	<0.015 M	<0.015 M			
Phenols, Total Detected monohydric	<0.035 mg/kg	TM062 (S)		<0.035 M	<0.035 M	<0.035 M			
Organic Carbon, Total	<0.2 %	TM132		0.573 M	0.777 M	0.92 M			
Sulphur, Total	<0.02 %	TM132					<0.02 #		<0.02 #
Soil Organic Matter (SOM)	<0.35 %	TM132		0.988 #	1.34 #	1.59 #			
pH	1 pH Units	TM133		10 M	10.4 M	9.53 M	8.95 M	8.73 M	8.42 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 M	<0.6 M	<0.6 M			
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 M			
PCB congener 28	<0.003 mg/kg	TM168				<0.003 M			
PCB congener 52	<0.003 mg/kg	TM168				<0.003 M			
PCB congener 101	<0.003 mg/kg	TM168				<0.003 M			
PCB congener 118	<0.003 mg/kg	TM168				<0.003 M			
PCB congener 138	<0.003 mg/kg	TM168				<0.003 M			
PCB congener 153	<0.003 mg/kg	TM168				<0.003 M			
PCB congener 180	<0.003 mg/kg	TM168				<0.003 M			
Sum of detected PCB 7 Congeners	<0.021 mg/kg	TM168				<0.021			
Arsenic	<0.6 mg/kg	TM181		10.9 M	11.2 M	12.9 M			
Cadmium	<0.02 mg/kg	TM181		<0.02 M	<0.02 M	<0.02 M			
Chromium	<0.9 mg/kg	TM181		17.3 M	10.4 M	16 M			
Copper	<1.4 mg/kg	TM181		13.3 M	13.1 M	24.5 M			
Lead	<0.7 mg/kg	TM181		41.2 M	107 M	403 M			
Mercury	<0.1 mg/kg	TM181		0.172 M	<0.1 M	0.414 M			
Nickel	<0.2 mg/kg	TM181		16.6 M	11.8 M	16.8 M			
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #			
Vanadium	<0.2 mg/kg	TM181		38.3 #	27.1 #	43.5 #			
Zinc	<1.9 mg/kg	TM181		44.6 M	27.8 M	45.9 M			
ANC @ pH 4	<0.03 mol/kg	TM182				0.1			
ANC @ pH 6	<0.03 mol/kg	TM182				<0.03			

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Results Legend
ISO17025 accredited.
M mCERTS accredited.
aq Aqueous / settled sample.
diss.filt Dissolved / filtered sample.
tot.unfilt Total / unfiltered sample.
* Subcontracted - refer to subcontractor report for accreditation status.
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F) Trigger breach confirmed
1-4+5@ Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP01	TP02	WS01	WS01	WS01	WS01
			Depth (m)	0.20	0.50	0.50	1.70	3.50	4.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	08/11/2023	08/11/2023	08/11/2023	08/11/2023	08/11/2023	08/11/2023
			Sampled Time	00:00	00:00	00:00	00:00	00:00	00:00
			Date Received	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023
			SDG Ref	231115-69	231115-69	231115-69	231115-69	231115-69	231115-69
			Lab Sample No.(s)	28943867	28943870	28943863	28943855	28943860	28943857
			AGS Reference						
Sulphate, acid soluble (total)	<0.0048 %	TM221					0.00607 M		0.0173 M
Boron, water soluble	<1 mg/kg	TM222	<1 M	<1 M	<1 M				
Water Soluble Sulphate as SO4 2:1 Extract	<0.004 g/l	TM243	0.0509 M	0.232 M	0.0472 M			0.014 M	
Soluble Sulphate 2:1 extract as SO4 BRE	<0.004 g/l	TM243					0.0152 M		0.0719 M
Chloride 2:1 water/soil extract BRE	<0.0025 g/l	TM243					0.0046 M		0.0088 M
Nitrate as NO3, 2:1 water soluble (BRE)	<0.0003 g/l	TM243					0.00117		0.00213
Ammoniacal N as NH4 in 2:1 extract BRE	<0.0003 g/l	TM248					0.00363		0.00213
Magnesium (BRE)	<0.008 g/l	TM282					<0.008		<0.008
PAH Total 17 (inc Coronene) Moisture Corrected	<10 mg/kg	TM410				<10			
Coronene	<0.2 mg/kg	TM410				<0.2			
EPH Surrogate % recovery**	%	TM415				91.9			
Mineral Oil >C10-C40 (EH_2D_AL)	<5 mg/kg	TM415				<5			

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Customer Sample Ref.	TP01	TP02	WS01			
Depth (m)	0.20	0.50	0.50			
Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)			
Date Sampled	08/11/2023	08/11/2023	08/11/2023			
Sampled Time	00:00	00:00	00:00			
Date Received	15/11/2023	15/11/2023	15/11/2023			
SDG Ref	231115-69	231115-69	231115-69			
Lab Sample No.(s)	28943867	28943870	28943863			
AGS Reference						

Component	LOD/Units	Method						
Naphthalene-d8 % recovery**	%	TM218	88.6	87	92.8			
Acenaphthene-d10 % recovery**	%	TM218	88.9	85.5	85.4			
Phenanthrene-d10 % recovery**	%	TM218	93.2	82	74.2			
Chrysene-d12 % recovery**	%	TM218	93.1	79.1	70.2			
Perylene-d12 % recovery**	%	TM218	90.5	80.3	74.2			
Naphthalene	<0.009 mg/kg	TM218	<0.009 M	0.0231 M	0.0255 M			
Acenaphthylene	<0.012 mg/kg	TM218	<0.012 M	<0.012 M	<0.012 M			
Acenaphthene	<0.008 mg/kg	TM218	<0.008 M	<0.008 M	<0.008 M			
Fluorene	<0.01 mg/kg	TM218	<0.01 M	<0.01 M	<0.01 M			
Phenanthrene	<0.015 mg/kg	TM218	<0.015 M	0.019 M	0.0456 M			
Anthracene	<0.016 mg/kg	TM218	<0.016 M	<0.016 M	<0.016 M			
Fluoranthene	<0.017 mg/kg	TM218	<0.017 M	<0.017 M	0.0301 M			
Pyrene	<0.015 mg/kg	TM218	<0.015 M	<0.015 M	0.0235 M			
Benz(a)anthracene	<0.014 mg/kg	TM218	<0.014 M	<0.014 M	<0.014 M			
Chrysene	<0.01 mg/kg	TM218	<0.01 M	<0.01 M	<0.01 M			
Benzo(b)fluoranthene	<0.015 mg/kg	TM218	<0.015 M	<0.015 M	<0.015 M			
Benzo(k)fluoranthene	<0.014 mg/kg	TM218	<0.014 M	<0.014 M	<0.014 M			
Benzo(a)pyrene	<0.015 mg/kg	TM218	<0.015 M	<0.015 M	<0.015 M			
Indeno(1,2,3-cd)pyrene	<0.018 mg/kg	TM218	<0.018 M	<0.018 M	<0.018 M			
Dibenzo(a,h)anthracene	<0.023 mg/kg	TM218	<0.023 M	<0.023 M	<0.023 M			
Benzo(g,h,i)perylene	<0.024 mg/kg	TM218	<0.024 M	<0.024 M	<0.024 M			
PAH, Total Detected USEPA 16	<0.118 mg/kg	TM218	<0.118	<0.118	0.125			

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.							
			TP02	WS01						
			Depth (m)	0.50	0.50					
			Sample Type	Soil/Solid (S)	Soil/Solid (S)					
			Date Sampled	08/11/2023	08/11/2023					
			Sampled Time	00:00	00:00					
			Date Received	15/11/2023	15/11/2023					
			SDG Ref	231115-69	231115-69					
			Lab Sample No.(s)	28943870	28943863					
			AGS Reference							
GRO Surrogate % recovery**	%	TM089	101	98.6						
Aliphatics >C5-C6 (HS_1D_AL)	<0.01 mg/kg	TM089	<0.01	<0.01						
Aliphatics >C6-C8 (HS_1D_AL)	<0.01 mg/kg	TM089	<0.01	<0.01						
Aliphatics >C8-C10 (HS_1D_AL)	<0.01 mg/kg	TM089	<0.01	<0.01						
Aliphatics >C10-C12 (EH_2D_AL_#1)	<1 mg/kg	TM414	<1 #	<1 #						
Aliphatics >C12-C16 (EH_2D_AL_#1)	<1 mg/kg	TM414	<1 #	<1 #						
Aliphatics >C16-C21 (EH_2D_AL_#1)	<1 mg/kg	TM414	<1 #	<1 #						
Aliphatics >C21-C35 (EH_2D_AL_#1)	<1 mg/kg	TM414	<1 #	<1 #						
Aliphatics >C35-C44 (EH_2D_AL_#1)	<1 mg/kg	TM414	<1	<1						
Total Aliphatics >C10-C44 (EH_2D_AR_#1)	<5 mg/kg	TM414	<5	<5						
Total Aliphatics & Aromatics >C10-C44 (EH_2D_Total_#1)	<10 mg/kg	TM414	<10	<10						
Aromatics >EC5-EC7 (HS_1D_AR)	<0.01 mg/kg	TM089	<0.01	<0.01						
Aromatics >EC7-EC8 (HS_1D_AR)	<0.01 mg/kg	TM089	<0.01	<0.01						
Aromatics >EC8-EC10 (HS_1D_AR)	<0.01 mg/kg	TM089	<0.01	<0.01						
Aromatics > EC10-EC12 (EH_2D_AR_#1)	<1 mg/kg	TM414	<1 #	<1 #						
Aromatics > EC12-EC16 (EH_2D_AR_#1)	<1 mg/kg	TM414	<1 #	<1 #						
Aromatics > EC16-EC21 (EH_2D_AR_#1)	<1 mg/kg	TM414	<1 #	<1 #						
Aromatics > EC21-EC35 (EH_2D_AR_#1)	<1 mg/kg	TM414	<1 #	<1 #						
Aromatics >EC35-EC44 (EH_2D_AR_#1)	<1 mg/kg	TM414	<1	<1						
Aromatics > EC40-EC44 (EH_2D_AR_#1)	<1 mg/kg	TM414	<1	<1						
Total Aromatics > EC10-EC44 (EH_2D_AR_#1)	<5 mg/kg	TM414	<5	<5						
Total Aliphatics & Aromatics >C5-C44 (EH_2D_Total_#1+HS_1D_Total)	<10 mg/kg	TM414	<10	<10						
Total Aliphatics >C5-C10 (HS_1D_AL_TOTAL)	<0.05 mg/kg	TM089	<0.05	<0.05						
Total Aromatics >EC5-EC10 (HS_1D_AR_TOTAL)	<0.05 mg/kg	TM089	<0.05	<0.05						
GRO >C5-C10 (HS_1D_TOTAL)	<0.02 mg/kg	TM089	<0.02	<0.02						

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.							
			TP02	WS01						
			Depth (m)	0.50	0.50					
			Sample Type	Soil/Solid (S)	Soil/Solid (S)					
			Date Sampled	08/11/2023	08/11/2023					
			Sampled Time	00:00	00:00					
			Date Received	15/11/2023	15/11/2023					
			SDG Ref	231115-69	231115-69					
			Lab Sample No.(s)	28943870	28943863					
			AGS Reference							
Dibromofluoromethane**	%	TM116	110	113						
Toluene-d8**	%	TM116	99.1	101						
4-Bromofluorobenzene**	%	TM116	77.5	83.9						
Methyl Tertiary Butyl Ether	<0.0005 mg/kg	TM116	<0.0005 M	<0.0005 M						
Benzene	<0.001 mg/kg	TM116	<0.001 M	<0.001 M						
Toluene	<0.001 mg/kg	TM116	0.00377 M	0.00146 M						
Ethylbenzene	<0.001 mg/kg	TM116	<0.001 M	<0.001 M						
p/m-Xylene	<0.002 mg/kg	TM116	<0.002 #	<0.002 #						
o-Xylene	<0.002 mg/kg	TM116	<0.002 M	<0.002 M						
Sum of Detected Xylenes	<0.02 mg/kg	TM116	<0.02	<0.02						
Sum of BTEX	<0.007 mg/kg	TM116	<0.007	<0.007						

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Asbestos Identification - Solid Samples

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
*	Subcontracted test.
(F)	Trigger breach confirmed
1-5&♦§@	Sample deviation (see appendix)

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Asbestos Actinolite	Asbestos Anthophyllite	Asbestos Tremolite	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP01 0.20 SOLID 08/11/2023 00:00:00 15/11/2023 05:00:00 231115-69 28943867 TM048	21/11/2023	Agnieszka Chelmowska	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP02 0.50 SOLID 08/11/2023 00:00:00 15/11/2023 05:00:00 231115-69 28943870 TM048	21/11/2023	Agnieszka Chelmowska	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	WS01 0.50 SOLID 08/11/2023 00:00:00 15/11/2023 05:00:00 231115-69 28943863 TM048	21/11/2023	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG: 231115-69 | Report Number: 712292 | Superseded Report:
Client Ref.: GWPR5680 | Location: 34 Belgrave Mews South London SW1X 8BT

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	34 Belgrave Mews South Londo
Mass Sample taken (kg)	0.138	**Natural Moisture Content (%)**	54.5
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	64.7
Particle Size <4mm	>95%		

Case	
SDG	231115-69
Lab Sample Number(s)	28943863
Sampled Date	08-Nov-2023
Customer Sample Ref.	WS01
Depth (m)	0.50

Solid Waste Analysis	**Result**	**Landfill Waste Acceptance Criteria Limits**		
		Inert Waste Landfill	**Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon (%)	0.92	3	5	6
Loss on Ignition (%)	3.08	-	-	10
Sum of BTEX (mg/kg)	<0.007	6	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	9.53	-	>6	-
ANC to pH 6 (mol/kg)	<0.03	-	-	-
ANC to pH 4 (mol/kg)	0.1	-	-	-

Eluate Analysis	**C_2 Concⁿ in 10:1 eluate (mg/l)**		**A_2 10:1 concⁿ leached (mg/kg)**		**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Arsenic	0.0108	<0.0005	0.108	<0.005	0.5	2	25
Barium	0.161	<0.0002	1.61	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.00213	<0.0003	0.0213	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	<0.0004	<0.0004	<0.004	<0.004	0.4	10	40
Lead	0.000888	<0.0002	0.00888	<0.002	0.5	10	50
Antimony	0.00105	<0.001	0.0105	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.00142	<0.001	0.0142	<0.01	4	50	200
Chloride	2.2	<2	22	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	8.4	<2	84	<20	1000	20000	50000
Total Dissolved Solids	62.3	<10	623	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	<3	<3	<30	<30	500	800	1000

Leach Test Information

Date Prepared	15-Nov-2023
pH (pH Units)	8.89
Conductivity (µS/cm)	83
Volume Leachant (Litres)	0.852

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Leachates prepared in accordance with BS EN 12457 will be carried out at room temperature (20±5°C)
Stated limits are for guidance only and ALS Laboratories (UK) Limited cannot be held responsible for any discrepancies with current legislation

27/11/2023 08:27:10

Table of Results - Appendix

Method No	Description
PM024	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM089	Determination of Gasoline Range Hydrocarbons (GRO) by Headspace GC-FID (C4-C12)
TM151	Determination of Hexavalent Chromium using Kone analyser
TM181	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES
TM104	Determination of Fluoride using the Kone Analyser
TM182	Determination of Acid Neutralisation Capacity (ANC) Using Autotitration in Soils
TM183	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM414	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID
PM115	Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step
TM018	Determination of Loss on Ignition
TM090	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water
TM116	Determination of Volatile Organic Compounds by Headspace / GC-MS
TM132	ELTRA CS800 Operators Guide
TM133	Determination of pH in Soil and Water using the GLpH pH Meter
TM221	Determination of Acid Extractable Sulphate in Soils by ICP OES
TM243	Mixed Anions In Soils By Kone
TM259	Determination of Phenols in Waters and Leachates by HPLC
TM410	Determination of Coronene in soils by GCMS
TM048	Identification of Asbestos in Bulk Material
TM062 (S)	Determination of Phenols in Soils by HPLC
TM152	Analysis of Aqueous Samples by ICP-MS
TM153	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser
TM168	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils
TM218	The determination of PAH in soil samples by GC-MS
TM222	Determination of Hot Water Soluble Boron in Soils (10:1 Water:Soil) by ICP OES.
TM248	Determination of Ammonium BRE (2:1 Extract) on solids
TM256	Determination of pH, EC, TDS and Alkalinity in Aqueous samples
TM282	Extraction of Magnesium by BRE Method
TM415	Determination of Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Test Completion Dates

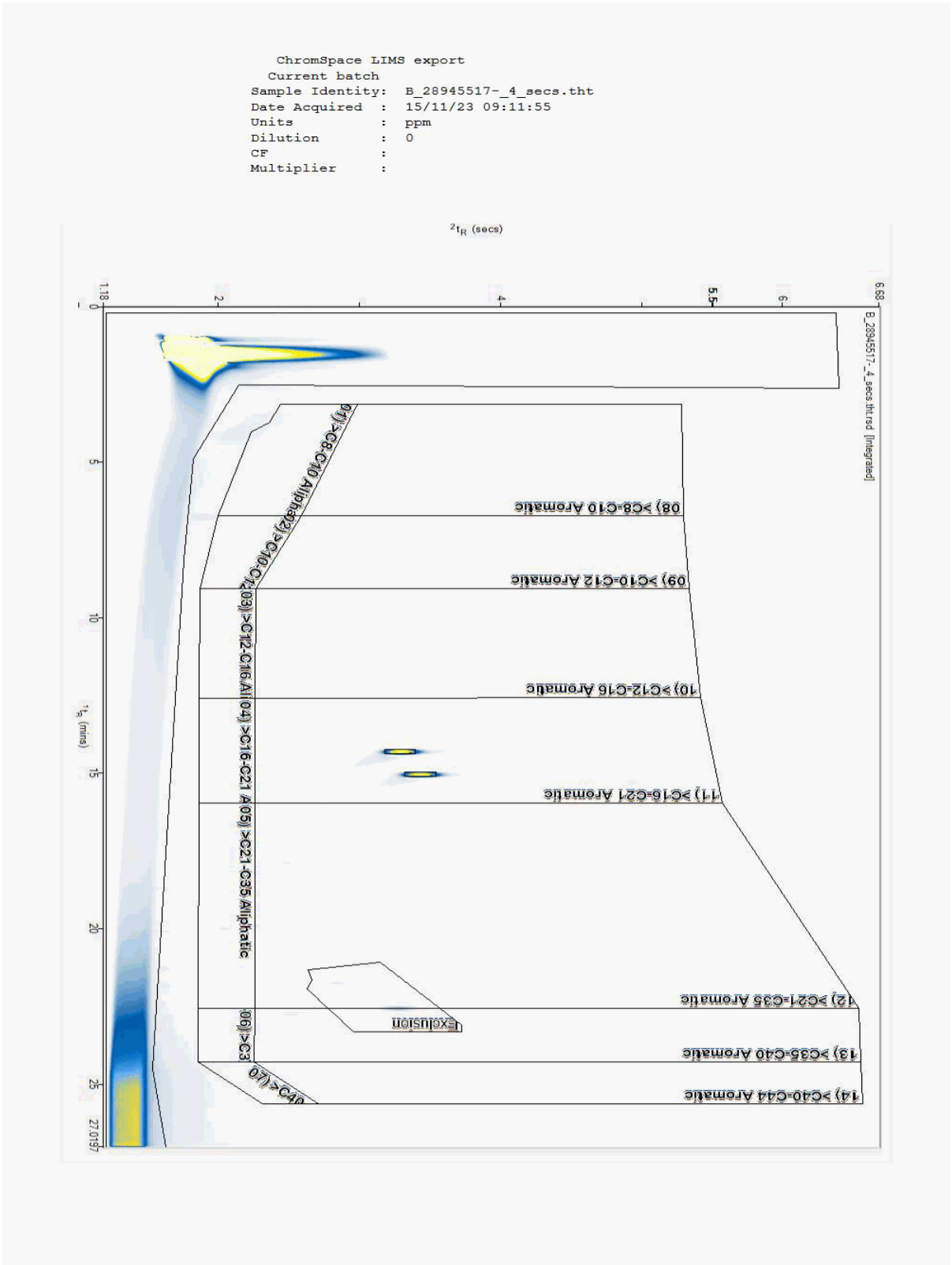
Lab Sample No(s)	28943867	28943870	28943855	28943857	28943860	28943863
Customer Sample Ref.	TP01	TP02	WS01	WS01	WS01	WS01
AGS Ref.						
Depth	0.20	0.50	1.70	4.50	3.50	0.50
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Ammoniacal N as NH4 in 2:1 extract			16-Nov-2023	16-Nov-2023		
ANC at pH4 and ANC at pH 6						21-Nov-2023
Anions by Kone (soil)	20-Nov-2023	20-Nov-2023	17-Nov-2023	20-Nov-2023	17-Nov-2023	20-Nov-2023
Anions by Kone (w)						20-Nov-2023
Asbestos ID in Solid Samples	21-Nov-2023	21-Nov-2023				21-Nov-2023
Boron Water Soluble	20-Nov-2023	20-Nov-2023				20-Nov-2023
CEN 10:1 Leachate (1 Stage)						16-Nov-2023
CEN Readings						20-Nov-2023
Coronene						23-Nov-2023
Cyanide Comp/Free/Total/Thiocyanate	21-Nov-2023	21-Nov-2023				21-Nov-2023
Dissolved Metals by ICP-MS						20-Nov-2023
Dissolved Organic/Inorganic Carbon						27-Nov-2023
EPH by GCxGC-FID						17-Nov-2023
EPH CWG GC (S)		22-Nov-2023				17-Nov-2023
Fluoride						20-Nov-2023
GRO by GC-FID (S)		16-Nov-2023				16-Nov-2023
Hexavalent Chromium (s)	17-Nov-2023	17-Nov-2023				17-Nov-2023
Loss on Ignition in soils						17-Nov-2023
Magnesium (BRE)			20-Nov-2023	20-Nov-2023		
Mercury Dissolved						22-Nov-2023
Metals in solid samples by OES	20-Nov-2023	20-Nov-2023				20-Nov-2023
Moisture at 105C						15-Nov-2023
NO3, NO2 and TON by KONE (s)			17-Nov-2023	21-Nov-2023		
PAH 16 & 17 Calc						23-Nov-2023
PAH by GCMS	20-Nov-2023	20-Nov-2023				20-Nov-2023
PCBs by GCMS						20-Nov-2023
pH	21-Nov-2023	21-Nov-2023	20-Nov-2023	21-Nov-2023	21-Nov-2023	21-Nov-2023
pH Value of Filtered Water						20-Nov-2023
Phenols by HPLC (S)	17-Nov-2023	17-Nov-2023				17-Nov-2023
Phenols by HPLC (W)						20-Nov-2023
Sample description	15-Nov-2023	15-Nov-2023	15-Nov-2023	15-Nov-2023	15-Nov-2023	15-Nov-2023
Total Organic Carbon	20-Nov-2023	20-Nov-2023				20-Nov-2023
Total Sulphate			21-Nov-2023	21-Nov-2023		
Total Sulphur			21-Nov-2023	21-Nov-2023		
TPH CWG GC (S)		22-Nov-2023				17-Nov-2023
VOC MS (S)		16-Nov-2023				16-Nov-2023

CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 28945517 **Depth :** 0.50
Sample ID : TP02

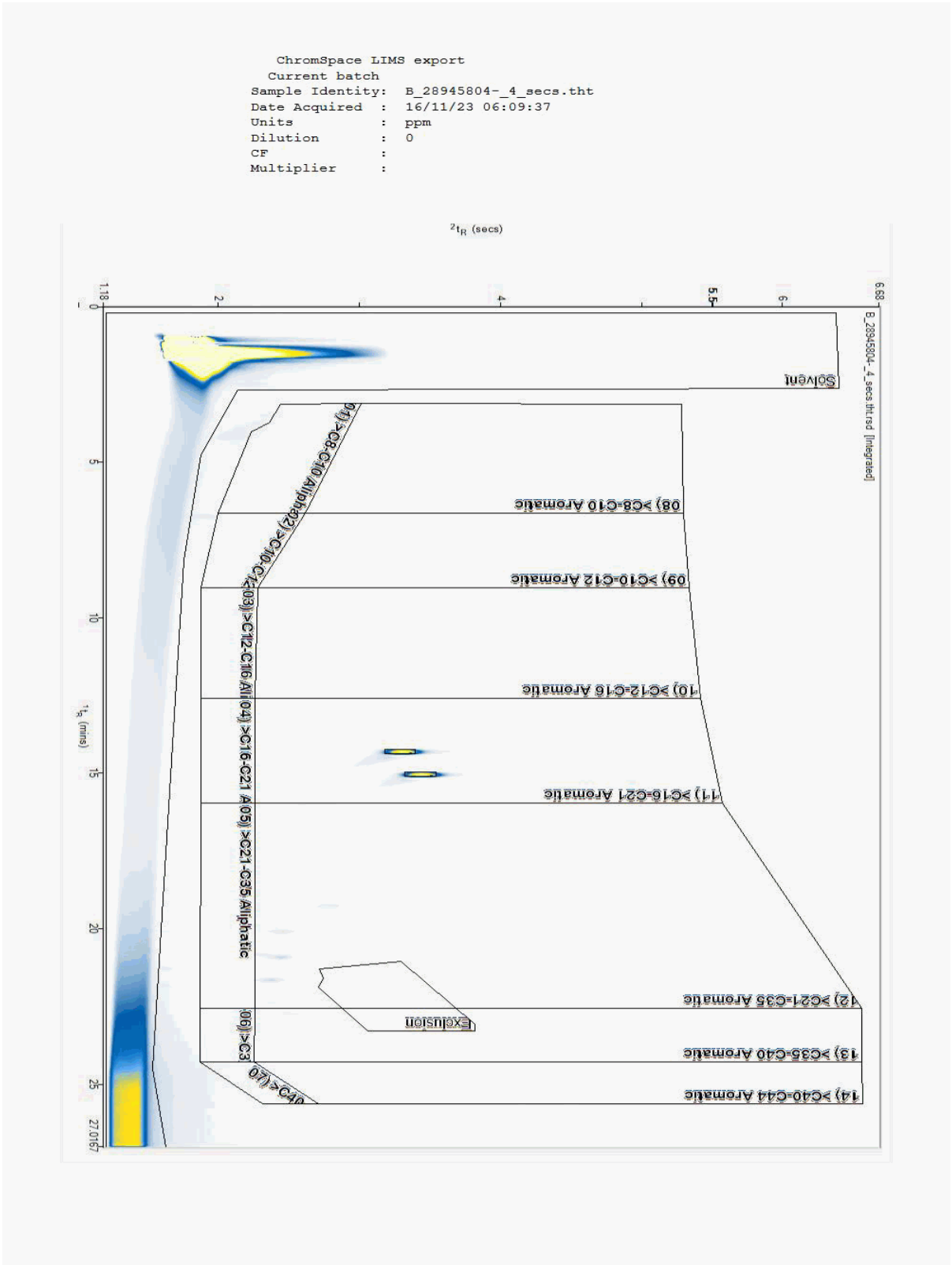


CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 28945804 **Depth :** 0.50
Sample ID : WS01

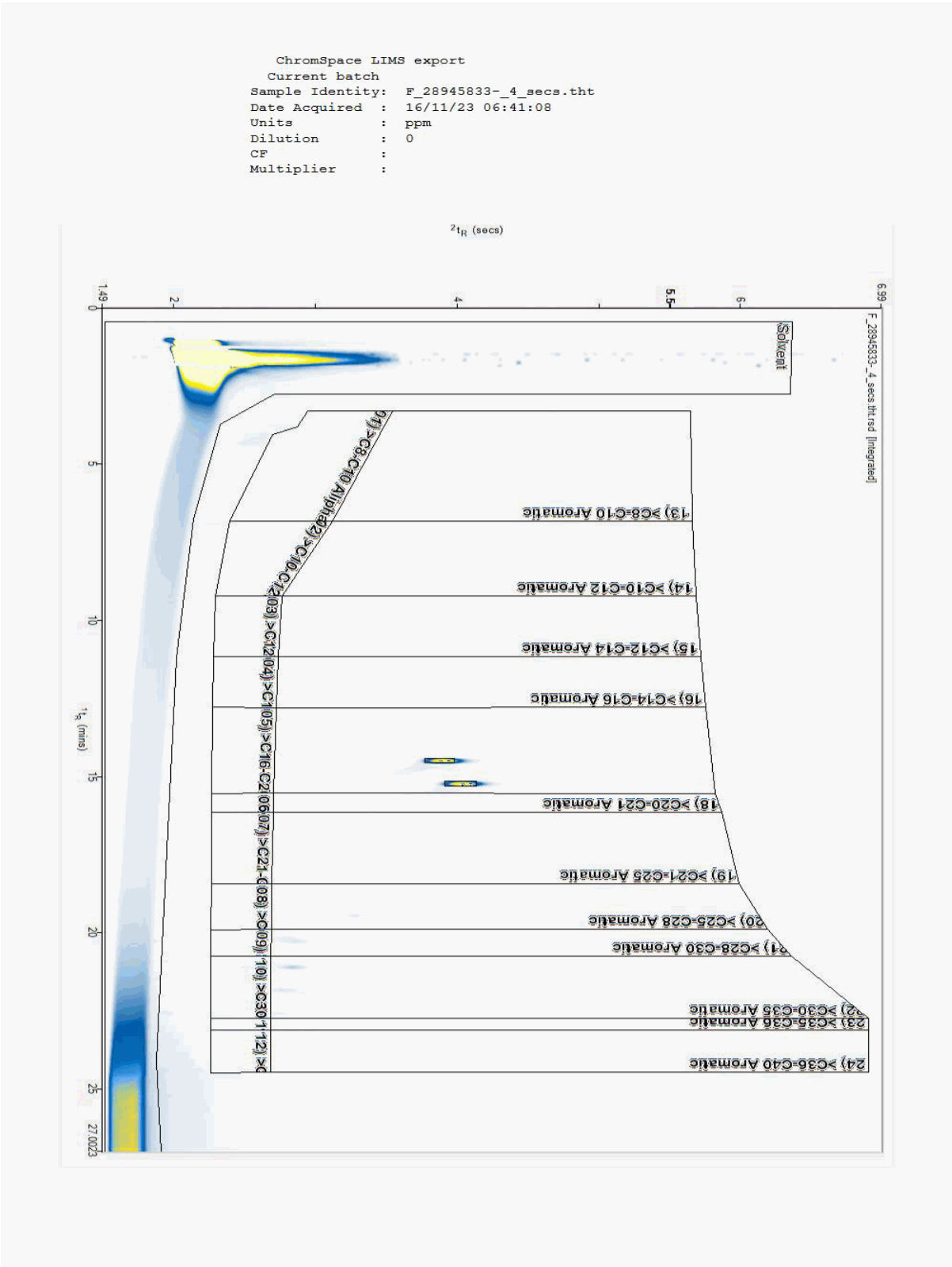


CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Chromatogram

Analysis: EPH by GCxGC-FID **Sample No :** 28945833 **Depth :** 0.50
Sample ID : WS01

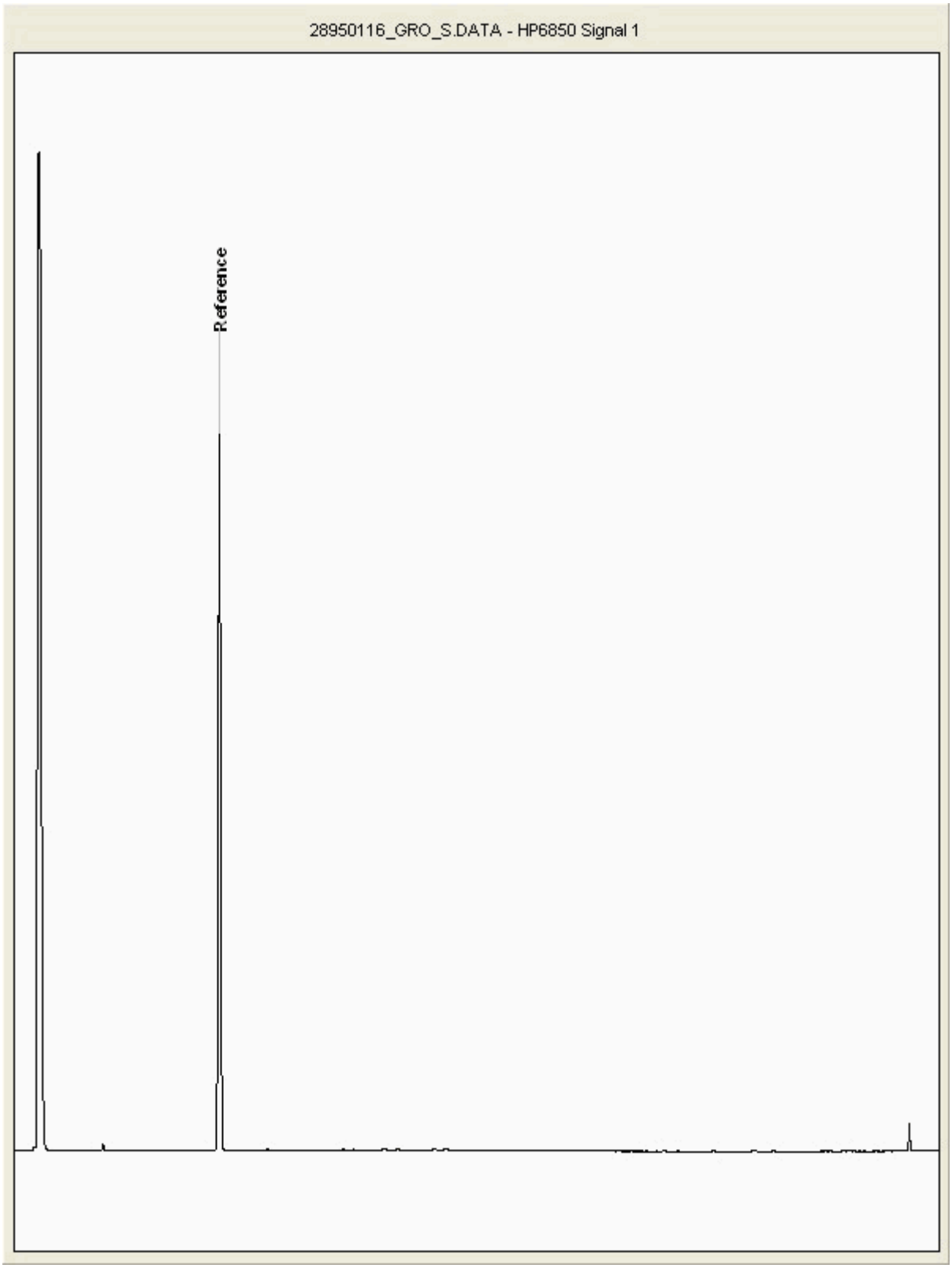


CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Chromatogram

Analysis: GRO by GC-FID (S) **Sample No :** 28950116 **Depth :** 0.50
Sample ID : WS01

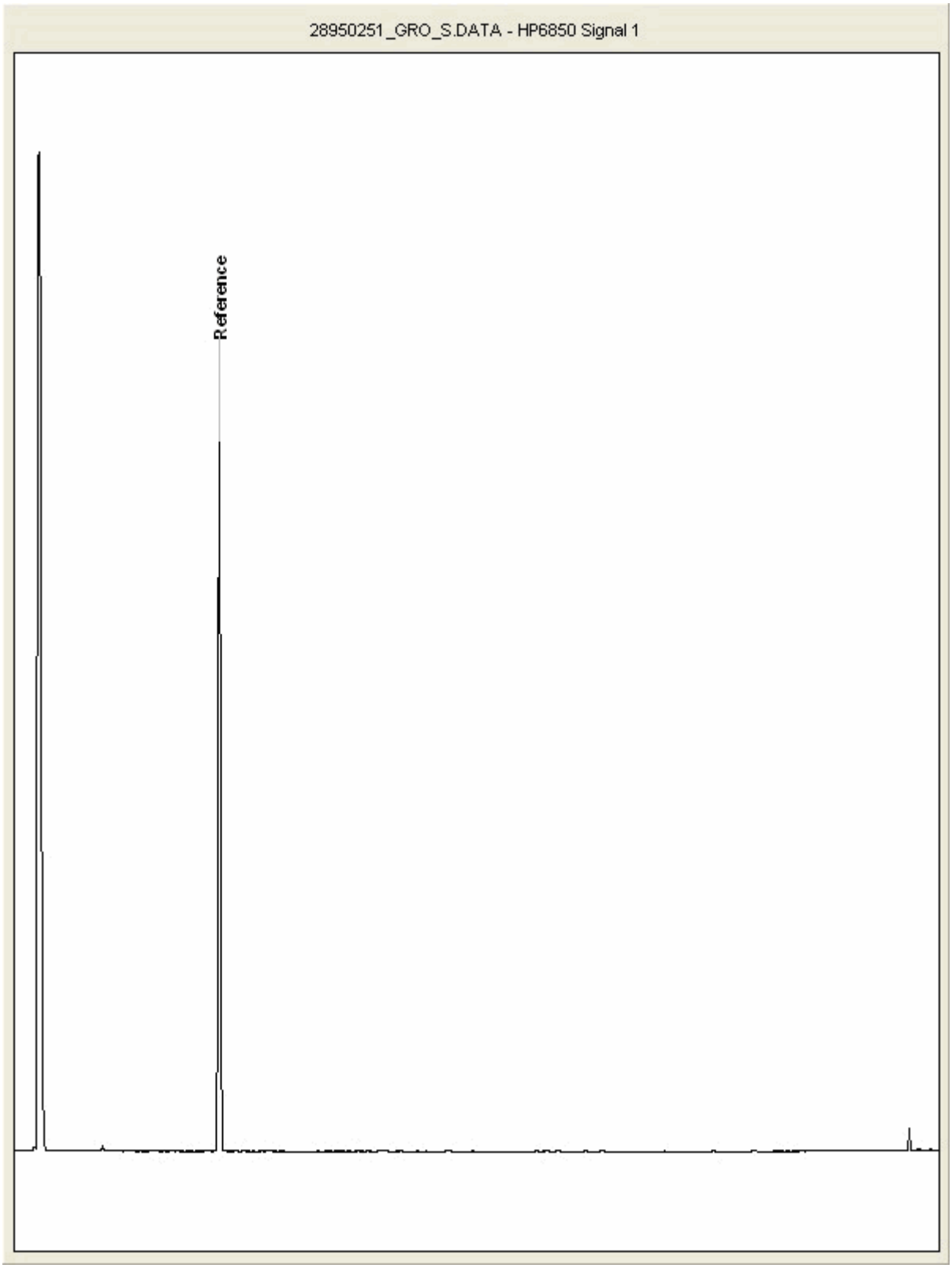


CERTIFICATE OF ANALYSIS

SDG: 231115-69 **Report Number:** 712292 **Superseded Report:**
Client Ref.: GWPR5680 **Location:** 34 Belgrave Mews South London SW1X 8BT

Chromatogram

Analysis: GRO by GC-FID (S) **Sample No :** 28950251 **Depth :** 0.50
Sample ID : TP02



Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of 15 days after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials andd soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

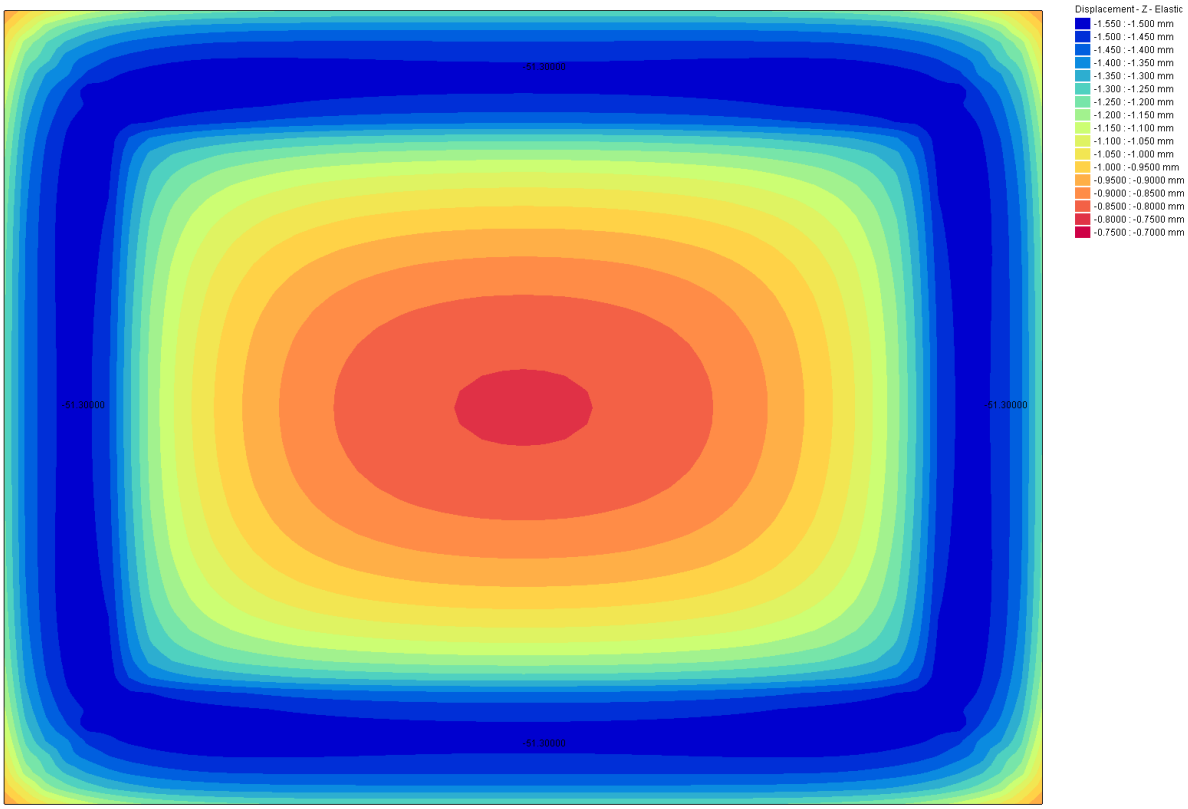
The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

APPENDIX F: Settlement and Heave Analysis Modelling

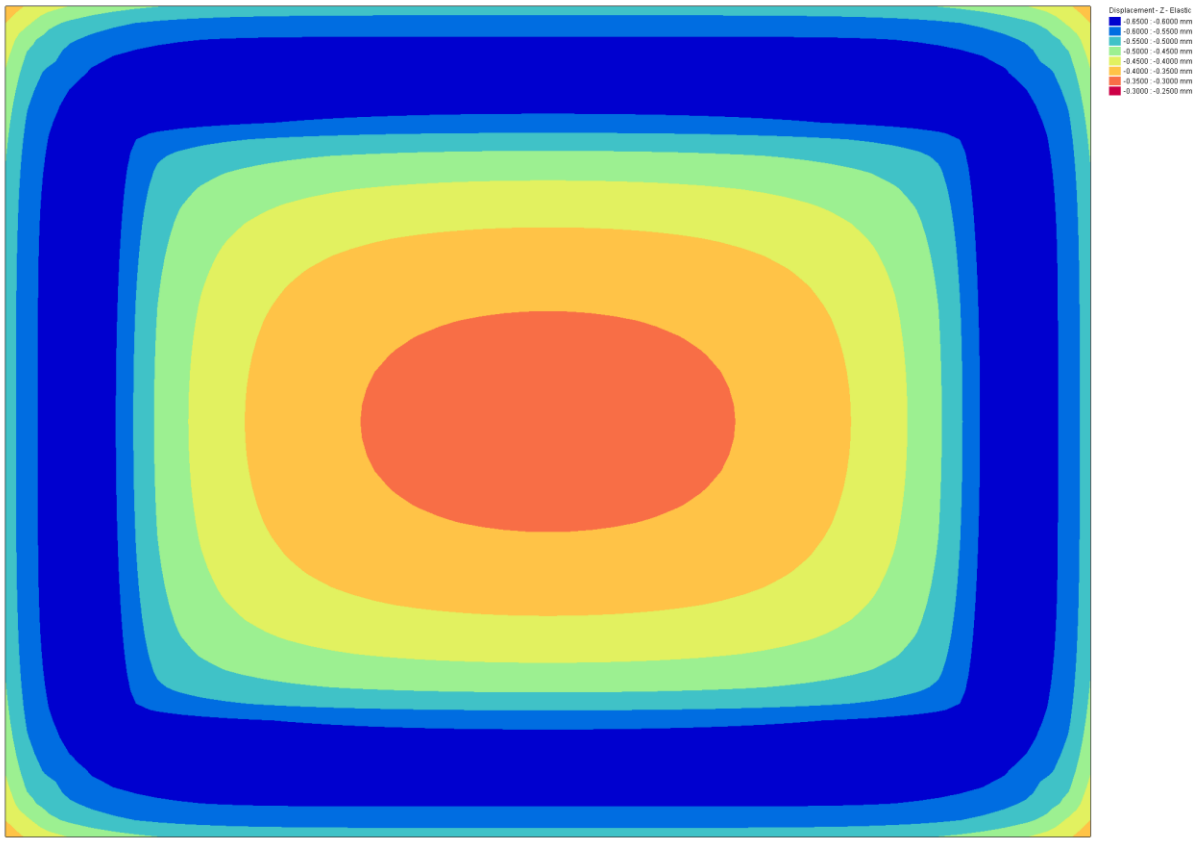
2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
0333 600 1221 enquiries@groundandwater.co.uk **groundandwater.co.uk**

Registered Office: Kineton House, 31 Horse Fair, Banbury, Oxfordshire OX16 0AE Registered in England No. 07032001

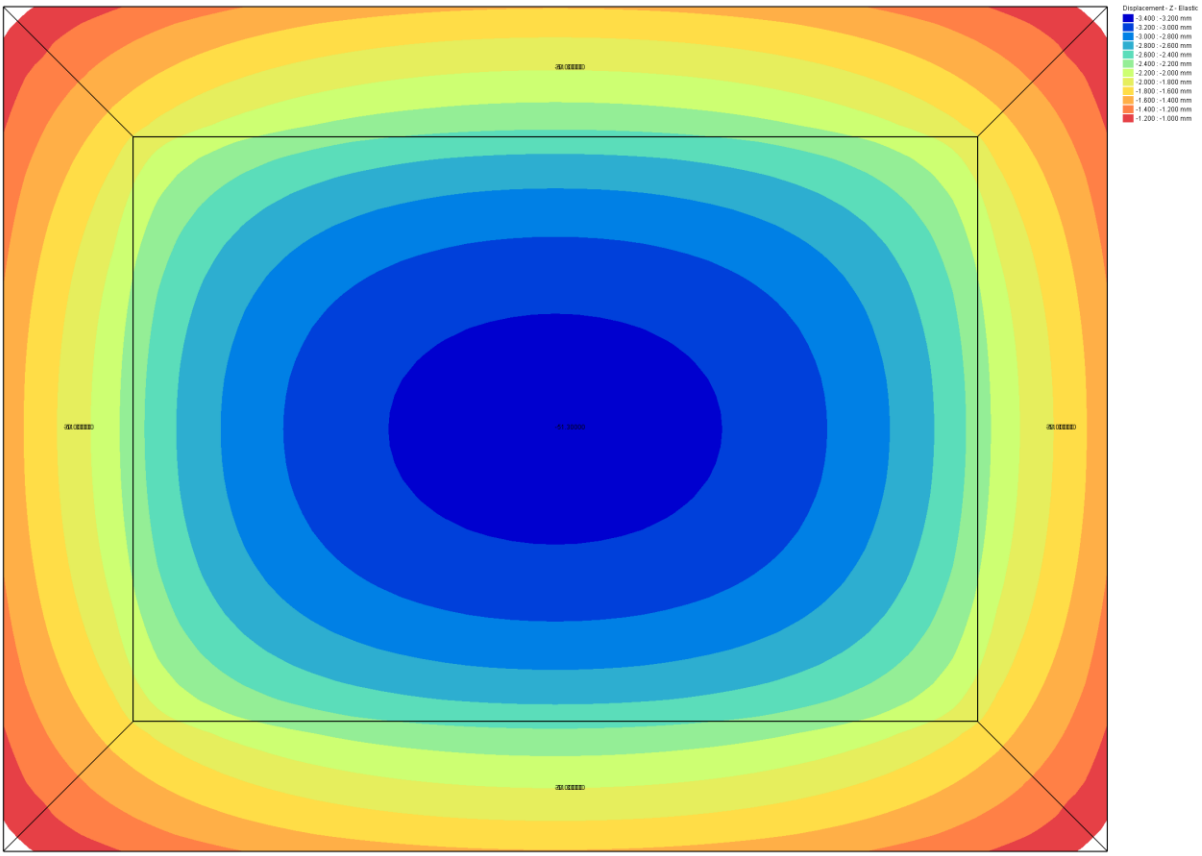
Vertical Displacement Contour Plot – Model 1



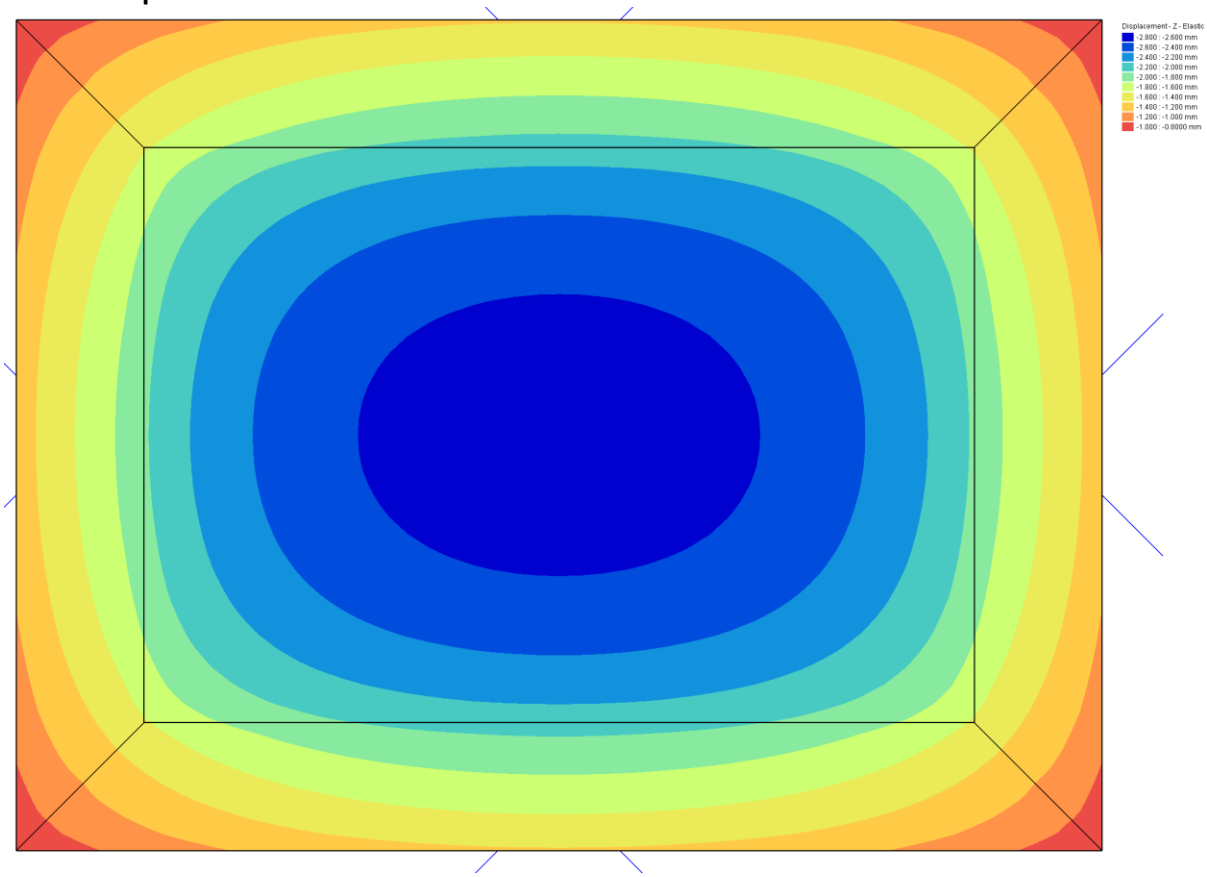
Vertical Displacement Contour Plot – Model 2



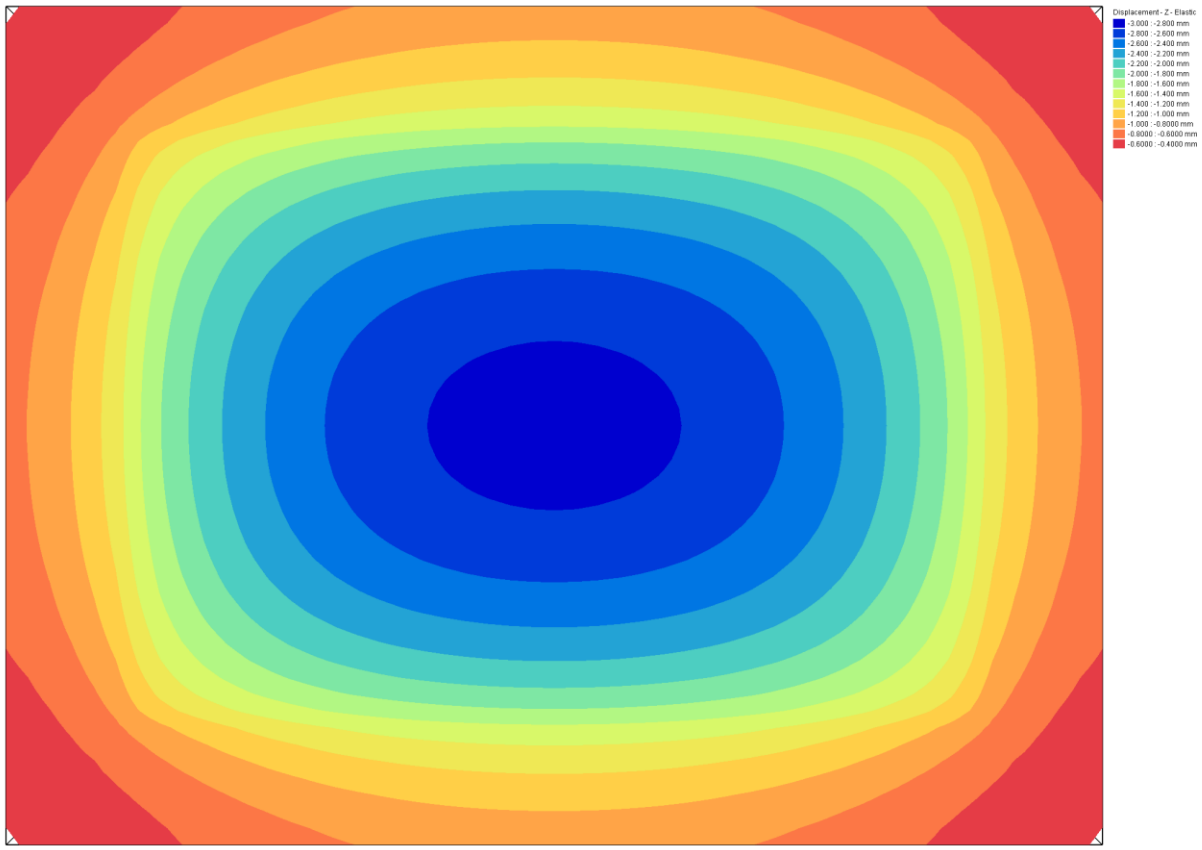
Vertical Displacement Contour Plot – Model 3



Vertical Displacement Contour Plot – Model 4



Vertical Displacement Contour Plot – Model 5

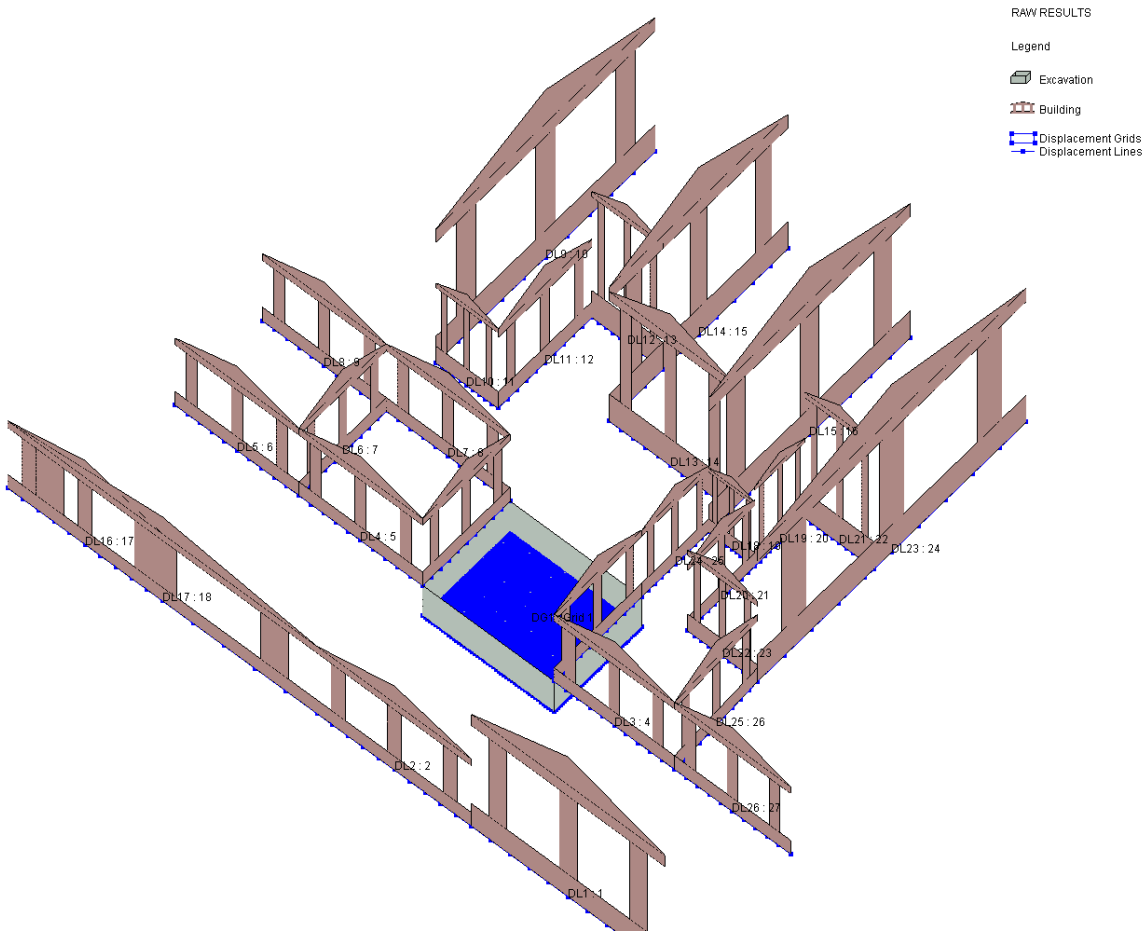


APPENDIX G: Ground Movement Analysis and Damage Categorization Modelling

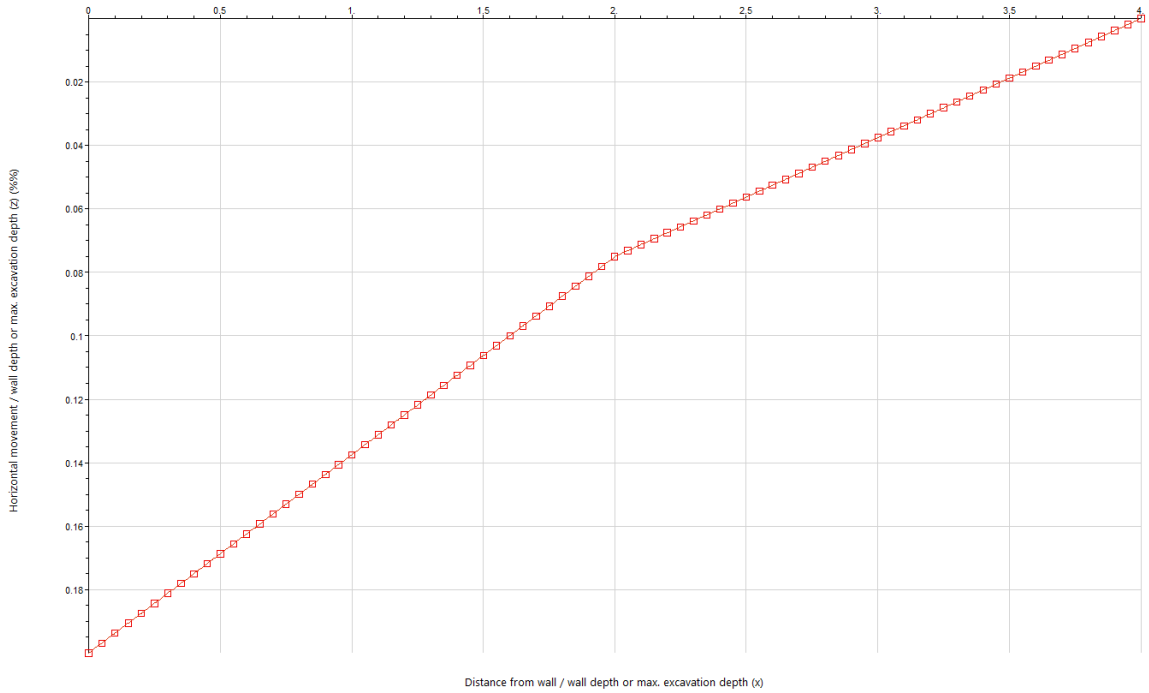
2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
0333 600 1221 enquiries@groundandwater.co.uk **groundandwater.co.uk**

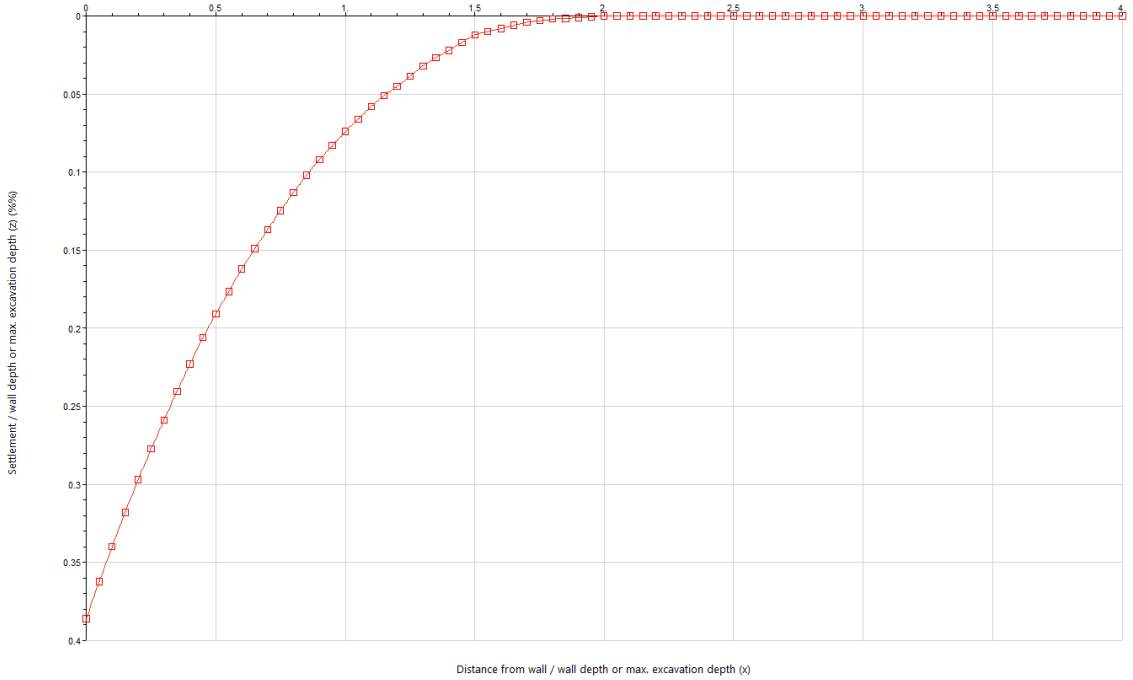
Registered Office: Kineton House, 31 Horse Fair, Banbury, Oxfordshire OX16 0AE Registered in England No. 07032001

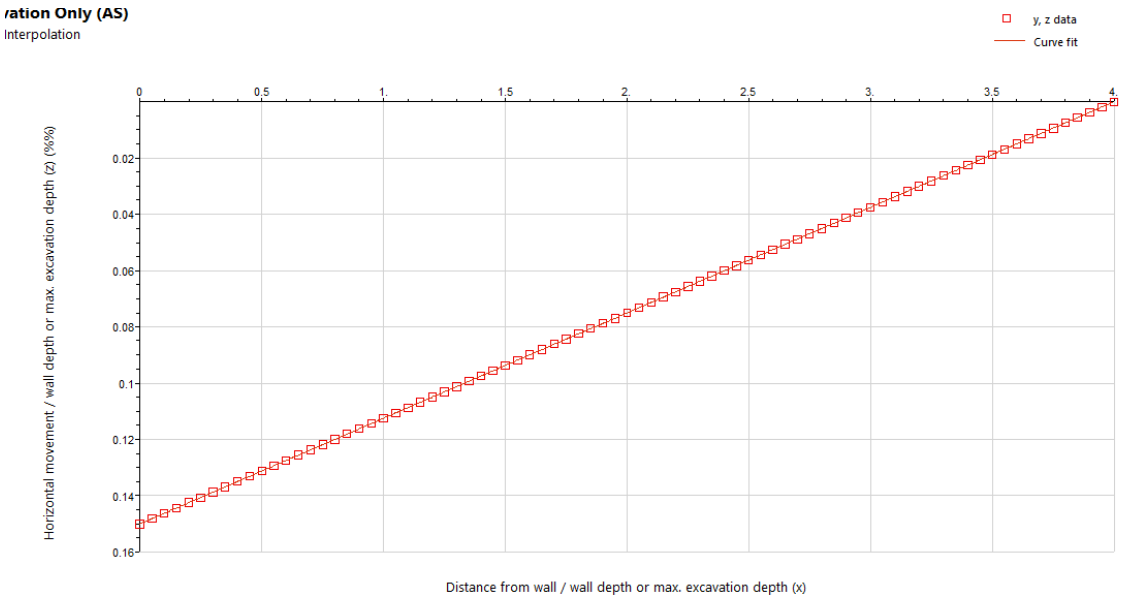
Excavations and Walls



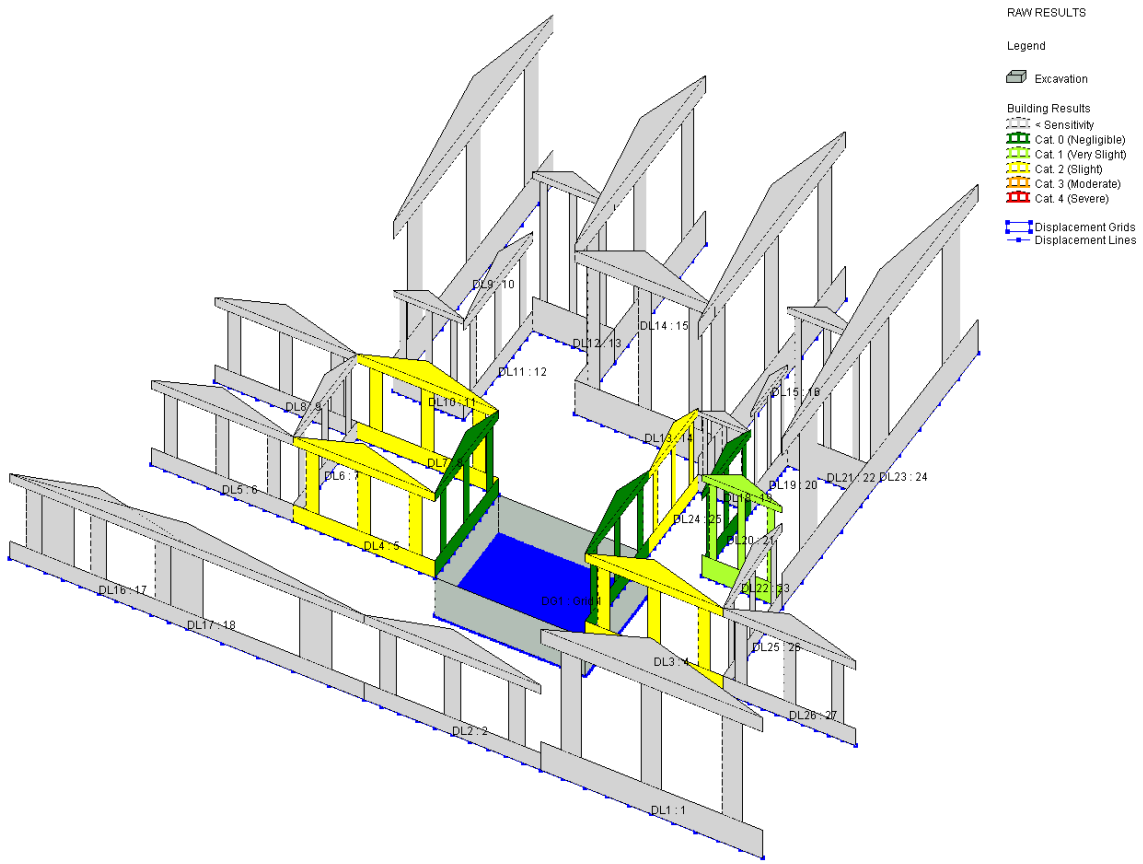
Movement Curves



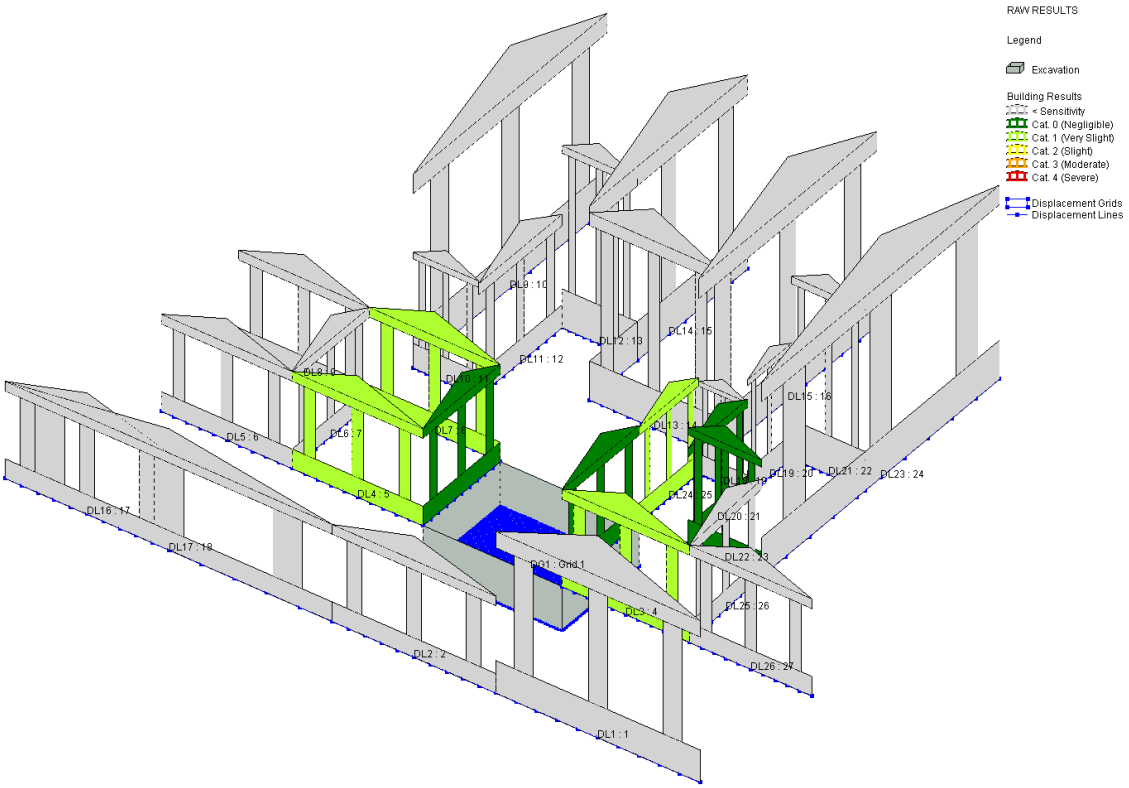



ıation Only (AS)
Interpolation
y, z data
Curve fit
Horizontal movement / wall depth or max. excavation depth (z) (%%)
Distance from wall / wall depth or max. excavation depth (x)

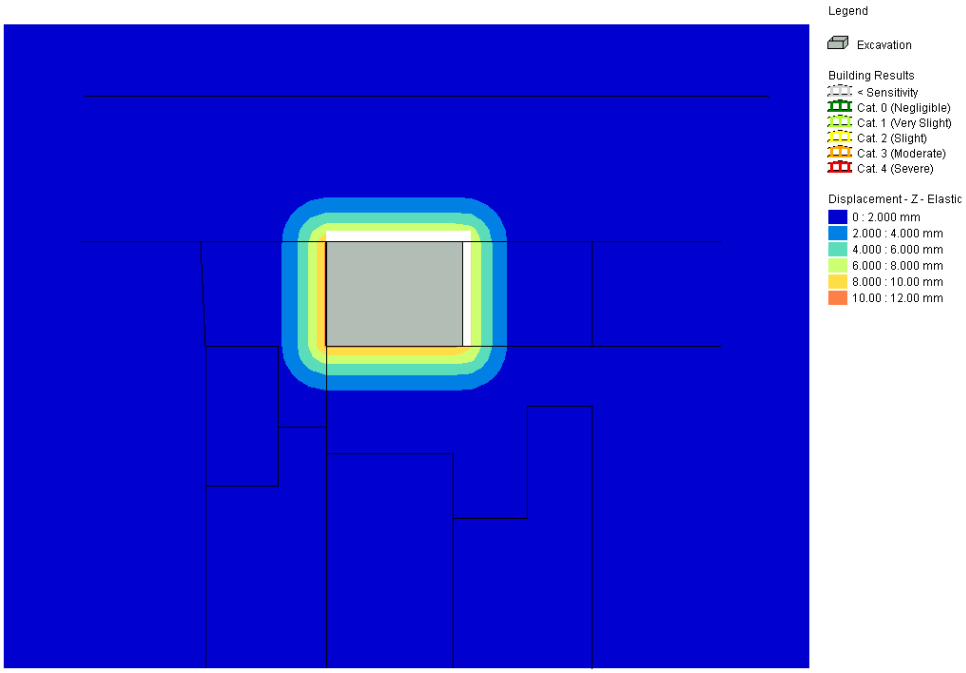
Model 1


RAW RESULTS
Legend
Excavation
Building Results
< Sensitivity
Cat. 0 (Negligible)
Cat. 1 (Very Slight)
Cat. 2 (Slight)
Cat. 3 (Moderate)
Cat. 4 (Severe)
Displacement Grids
Displacement Lines

Model 2


RAW RESULTS
Legend
Excavation
Building Results
< Sensitivity
Cat. 0 (Negligible)
Cat. 1 (Very Slight)
Cat. 2 (Slight)
Cat. 3 (Moderate)
Cat. 4 (Severe)
Displacement Grids
Displacement Lines
DL1 : 1
DL2 : 2
DL3 : 4
DL4 : 5
DL5 : 6
DL6 : 7
DL8 : 9
DL9 : 10
DL11 : 12
DL12 : 13
DL14 : 15
DL15 : 16
DL16 : 17
DL17 : 18
DL19 : 20
DL21 : 22
DL23 : 24
DL24 : 25
DL20 : 21
DL22 : 23
DL25 : 26
DL26 : 27

Model 2 Horizontal Movement



Model 2 Vertical Movement