

75 Bayham Street (2),
London, NW1 0AA

Basement Impact Assessment
Audit

For
London Borough of Camden

Project Number: 12466-14

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Campbell Reith Hill LLP
Friars Bridge Court
41-45 Blackfriars Road
London
SE1 8NZ

T: +44 (0)20 7340 1700
F: +44 (0)20 7340 1777
E: london@campbellreith.com
W: www.campbellreith.com

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Author	F Drammeh, MEng (Hons)
Project Partner	E M Brown, BSc MSc CGeol FGS
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1.0 NON-TECHNICAL SUMMARY

- 1.1. CampbellReith was instructed by London Borough of Camden, (LBC) to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for 75 Bayham Street (Camden Planning Reference 2016/4482/P). The basement is considered to fall within Category B as defined by the Terms of Reference.
- 1.2. The Audit reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.
- 1.3. CampbellReith was able to access LBC's Planning Portal and gain access to the latest revision of submitted documentation and reviewed it against an agreed audit check list.
- 1.4. The BIA is an update to a previously approved scheme which was audited at the time (Camden Planning Reference 2015/6036/P).
- 1.5. The original BIA was undertaken by Michael Alexander Consulting Engineers. Revisions and supporting documents have now been provided by LBH Wembley. The authors are appropriately qualified.
- 1.6. The proposal includes the construction of a basement beneath an existing building which is to be extended and renovated. It is proposed to undertake the basement construction by underpinning to a maximum depth of 4.85m below existing ground floor level. The underpinning is proposed to be undertaken in two stages.
- 1.7. The original BIA submissions did not include all the necessary existing and proposed plans, sections and elevations to assess the BIA. These have now been provided. Structural calculations, sketches and drawings indicating the construction sequence and temporary works have been provided. In order to maintain structural stability, it is proposed to adopt a system of jacks and hydraulic props to limit both vertical and horizontal movements.
- 1.8. The presence or absence of basements or foundation depths beneath the neighbouring properties was not established in the original BIA submission. In the revised submissions, foundation depths have been established by trial pitting. Where assumptions have been made for stability assessments, these are deemed to be conservative.
- 1.9. Further ground investigation to enable the derivation of geotechnical parameters and to establish the groundwater level was recommended in the original BIA. In the revised submissions, LBH Wembley have adopted geotechnical parameters and groundwater conditions based on the original site investigation, which are considered appropriate. LBH Wembley have

recommended these conditions are confirmed by the Contractor in advance of the construction works, which should be implemented.

- 1.10. Anticipated ground movements, including heave, were presented in the original BIA submissions. A maximum of Category 2 damage (Slight) was predicted for neighbouring properties. Mitigation measures were proposed to limit the damage to Category 1. Whilst these were not originally accepted, with revisions proposed in July 2017, including the use of vertical jacking and hydraulic horizontal propping, these are now accepted.
- 1.11. An outline works programme is included. Details should be provided by the appointed Contractor at a later date.
- 1.12. It is accepted there are no slope stability or wider hydrogeological issues and the site is not an area prone to flooding.
- 1.13. Queries and matters that required further information or clarification are discussed in Section 4 and summarised in Appendix 2. Considering the revised submissions the BIA meets the criteria of CPG4.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 10 October 2016 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 75 Bayham Street, London NW1 0AA (Camden Planning Reference 2016/4482/P).

2.2. The Audit was carried out in accordance with the Terms of Reference set by LBC. It reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development.

2.3. A BIA is required for all planning applications with basements in Camden in general accordance with policies and technical procedures contained within

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
- Camden Planning Guidance (CPG) 4: Basements and Lightwells.
- Camden Development Policy (DP) 27: Basements and Lightwells.
- Camden Development Policy (DP) 23: Water

2.4. The BIA should demonstrate that schemes:

- a) maintain the structural stability of the building and neighbouring properties;
- b) avoid adversely affecting drainage and run off or causing other damage to the water environment; and,
- c) avoid cumulative impacts upon structural stability or the water environment in the local area.

and evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and to make recommendations for the detailed design.

2.5. LBC's Audit Instruction described the planning proposal as *'Variation of condition 3 (Plans) of planning permission ref: 2015/6036/P for the Conversion of B8 to B1, extension at rear at first floor level, extension of roof to create an additional floor space at second floor level to the rear of building and excavation of basement. Replacement of front doors and windows on the west elevation dated 26/04/2016. Namely the; Removal of proposed rear extension, alteration of roof to existing rear-end building, removal roof terrace screening and installation of roof plant with associated riser all at second floor level; Alterations to the glazing at the entrance and new rooflights at ground, first and second floor levels and; new timber sash windows to first and*

second floor rear elevation. Minor increase in depth below ground for basement by 500mm. Removal of condition 5 (roof terrace screening)'.

- 2.6. The Audit instruction also confirmed 75 Bayham Street is not listed nor is it a neighbour to listed buildings. The site is located in the Camden Town Conservation Area.
- 2.7. CampbellReith accessed LBC's Planning Portal on 20 October 2016 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (BIA) Issue 2.0: Michael Alexander Consulting Engineers, September 2016.
- Geotechnical, Hydrogeological & Ground Movement Assessment: LBH Wembley, September 2016.
- Innes Associates Planning Application Drawings consisting of:

Proposed basement plan: 1030_23_P5_[MMA] [Proposed Basement Plan](2).

Proposed sections: 1030_15_P3_[MMA] [Proposed Section AA](2), 1030_16_P4_[MMA] [Proposed Section BB](2), 1030_17_P6_[MMA] [Proposed Section CC](2) and 1030_18_P4_[MMA] [Proposed Section DD](2).

Proposed western elevation: 1030_14_P6_[MMA] [Proposed West Elevation](2).

Current scheme basement depth: 1030_17_P6: Section CC (proposed) dated August 2016.

Previous scheme basement depth: 1030_17_P6: Section CC (proposed) dated April 2016.

- 2.8. Additional information was received on 24 and 27 January 2017 in response to queries raised following the initial audit:

- Audit response tracker: Michael Alexander Consulting Engineers, January 2017.
- Basement Impact Assessment (BIA) Issue 2.1: Michael Alexander Consulting Engineers, January 2017.
- Geotechnical, Hydrogeological & Ground Movement Assessment: LBH Wembley, January 2017.
- Movement Monitoring Specification: Michael Alexander Consulting Engineers, January 2017.

- Jack Wolley Architect Existing Drawings consisting of:

Site location plan (1030_01_P1).

Existing plans (1030_10_P1, 1030_09_P2, 1030_11_P2, 1030_02_P1).

Existing sections (1030_05_P1, 1030_06_P1, 1030_07_P1, 1030_08_P1).

Existing elevations (1030_03_P1, 1030_04_P2).

2.9. Additional information was received between February and July 2017 and these are included in Appendix 3 with the exception of the LBH due to file security issues:

- Outline Method Statement for New Basement Construction, Project No. P3096-OFF, dated 4th April 2017 by Michael Alexander Consulting Engineers.
- Outline Method Statement for New Basement Construction, Project No. P3096-OFF, dated 18th May 2017 by Michael Alexander Consulting Engineers.
- Measurement Monitoring Specifications, Project No. P3096, dated 18th May 2017 by Michael Alexander Consulting Engineers.
- LBH Wembley Comments to Campbell Reith Audit Tracker, 18th May 2017.
- Geotechnical, Hydrogeological & Ground Movement Assessment: LBH Wembley, Version 2.1, May 2017.
- Summary of BIA Audit Issues, July 2017, by LBH Wembley.
- Amended Underpinning Sequence Drawing Showing Position of Propping, Project P3096, Drawing BIA 111, Revision P4, dated 6th July 2017, by Michael Alexander Consulting Engineers.
- Extract of Email LBH Wembley to CampbellReith, 13th July 2017.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	See Audit paragraph 4.1.
Is data required by Cl.233 of the GSD presented?	Yes	Michael Alexander BIA and LBH Wembley Geotechnical, Hydrogeological & Ground Movement Assessment (GHGMA).
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	See BIA and GHGMA.
Are suitable plan/maps included?	Yes	BIA includes the relevant map extracts and proposed drawings provided. Existing drawings which were not included in the initial submission now provided.
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	As above.
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 4.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	The 'No' response to Q1b was considered incorrect as no groundwater monitoring was undertaken at the time (see Audit paragraph 4.8), however, this issue was subsequently addressed.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	See BIA Section 5.0.
Is a conceptual model presented?	Yes	Ground conditions are presented in Section 4 of the GHGMA. Stability impacts discussed in revised submissions Feb – July 2017.

Item	Yes/No/NA	Comment
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 4.02.
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	N/A	No issues identified from screening although Q1b should have been carried forward. This was subsequently addressed in Section 3.04 and Appendix E of the BIA.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	N/A	No issues identified. Attenuation via Green Roof proposed. No increase in impermeable site area identified.
Is factual ground investigation data provided?	Yes	GHGMA Report.
Is monitoring data presented?	N/A	Groundwater not encountered. Trial excavations to be undertaken prior to construction to confirm assessment.
Is the ground investigation informed by a desk study?	Yes	GHGMA Sections 2 and 3.
Has a site walkover been undertaken?	Yes	Not explicitly stated although this is assumed from the descriptions in both reports and the site photographs included in the BIA.
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	Revised in GHGMA V2.1
Is a geotechnical interpretation presented?	Yes	GHGMA Section 6.
Does the geotechnical interpretation include information on retaining wall design?	Yes	Revised in GHGMA V2.1
Are reports on other investigations required by screening and scoping presented?	Yes	GIR.
Are the baseline conditions described, based on the GSD?	Yes	See BIA and GHGMA.

Item	Yes/No/NA	Comment
Do the base line conditions consider adjacent or nearby basements?	Yes	Revised in GHGMA V2.1
Is an Impact Assessment provided?	Yes	BIA Sections 3.04 and 4.04.
Are estimates of ground movement and structural impact presented?	Yes	Section 4.04.6 of the BIA based on assessment given in the GHGMA.
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	Yes	See BIA Sections 3.04 and 4.04.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	Updated in revised submissions.
Has the need for monitoring during construction been considered?	Yes	Updated in revised submissions.
Have the residual (after mitigation) impacts been clearly identified?	Yes	Revised GHGMA Section 7.4.1.
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	Yes	Updated in revised submissions.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	Updated in revised submissions.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	Updated in revised submissions.
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Updated in revised submissions.
Are non-technical summaries provided?	No	However, stability impact mitigation clearly stated in LBH Wembley email 13 th July.

4.0 DISCUSSION

- 4.1. The original BIA was undertaken by Michael Alexander Consulting Engineers, and the reviewer has CEng MStructE qualifications. The authors of the supporting documents and updated submissions from LBH Wembley, including the Geotechnical, Hydrogeological and Ground Movement Assessment (GHGMA), are appropriately qualified, in accordance with the criteria of CPG4.
- 4.2. The BIA is an update to a previously submitted and approved scheme (Camden Planning reference 2015/6036/P) which was audited at the time. The main revision to the previous scheme is the increase in depth of the proposed single storey basement.
- 4.3. The existing three storey building comprises offices to the upper floors with a warehouse to the rear. The proposal is for the renovation, remodelling and extension of the existing buildings to create offices varying from two to four storeys above ground with a single storey basement. The basement is indicated to be 4.25m deep (previously 3.75m), which requires underpinned foundations to be constructed to 4.85m depth. Existing plans, sections and elevations which were not previously submitted for review have now been provided following a request after the initial audit.
- 4.4. The basement is to be formed by underpinning the existing party walls. Outline construction sequence sketches indicating two levels of underpinning together with temporary propping were included in the original BIA. Following several rounds of discussions between the BIA authors and the Auditor, the temporary works have been outlined in more detail. Information provided now includes an underpinning bay sequence, a plan view of the proposed basement with temporary propping indicated and an outline construction method statement. In order to limit ground movements and mitigate potential damage to adjacent structures, hydraulic jacking and propping are now incorporated into the temporary works scheme, as discussed further in 4.15 to 4.17. Structural calculations are considered adequate and included in the BIA Appendix.
- 4.5. The proposed reinforced concrete underpins are considered 'special foundations' under the Party Wall act and are subject to the neighbours' agreement.
- 4.6. Relevant map extracts with the site location indicated were included to support the responses to the screening questions.
- 4.7. A 'No' response was given to Question 1b of the hydrogeology screening which relates to whether or not the basement will extend beneath the water table. The justification stated no groundwater was encountered during the site investigation. It should be noted that not encountering groundwater during drilling/excavation does not guarantee its absence. In the revised submissions, it is now stated that no groundwater is expected within the impermeable

London Clay. The possibility of encountering perched water is acknowledged in the impact assessment and it is stated in the construction method statement that trial pit excavations will be undertaken by the Contractor prior to the commencement of site works. It further states that perched water, if encountered, is to be collected in sumps. Given the limited depth of Made Ground, this is considered reasonable, and the Engineer should satisfy themselves that suitable groundwater control measures are implemented following the Contractor's trial excavations.

- 4.8. The response to Question 9 of the land stability screening stated there is an area of worked ground beneath the other side of Bayham Street. However, the map extract provided with the site location indicated appeared to show the worked ground beneath the site itself. This issue was carried forward to scoping and ground investigation.
- 4.9. A ground investigation was undertaken which comprised three window sample holes and trial pits, which included inspection of neighbouring property foundations. The investigation encountered Made Ground to a maximum depth of 1.80m in the window sample holes underlain by London Clay. Groundwater was not encountered during the investigation and groundwater monitoring was not undertaken.
- 4.10. Trial pits undertaken adjacent to No 73 and 77 Bayham Street indicate brick foundations to 1.80 and 2.00m '*below floor level*' respectively. It is stated in Section 4.5 of the GHGMA that the remaining party walls appear to have shallow foundations at depths of 0.50 to 0.80m '*below floor level*'.
- 4.11. The presence or absence of basements beneath the neighbouring properties was not fully established. It was stated in the land stability screening that '*No 73 appears to have a lower ground floor. It is understood from drawings that the Pratt Mews properties do not have basements and it is unclear if any of the other adjoining properties have basements*'. Section 7.2 of LBH Wembley's report stated that '*it is thought No. 77 has a basement to approx. 1.80m with 73 to approx. 1.50m*'. It was stated in Section 4.04.5 of the BIA that '*where the floor levels to the adjoining properties are not known, this information will be requested through the Party Wall process*'. It is stated further trial pitting adjacent to the street will be undertaken prior to the works to confirm these have similar depths and profiles to the adjoining walls. This recommendation is considered to be prudent.
- 4.12. Retaining wall parameters were included in Section 6 of the GHGMA. Stiffness values (Young's Modulus) are presented within the GMA, within the assessment of heave. The ground investigation did not include any strength testing and the London Clay is described as 'soft to firm' to 4.50m with indication that it is soft to at least 3.00m in one of the holes. It is accepted the depth of excavation (4.85m) is likely to be within the soils described as 'stiff'. It is recommended that geotechnical parameters are confirmed by insitu testing within the Contractor's trial holes to be excavated in advance of the construction works.

- 4.13. Heave movements using the modified Boussinesq's Elastic Theory were included in Section 7 of LBH Wembley report together with contour plots. Movements of up to 10mm are indicated around the edges of the excavation in the short term reducing to 5mm in the long term. Heave mitigation measures are recommended which includes a suspended basement slab with compressible material beneath and a recommendation that the underpins be constructed with an enlarged toe.
- 4.14. Section 8 of LBH Wembley's report stated that movement due to underpinning is dependent on good workmanship and temporary propping. It further stated that if the above is achieved, horizontal movements can be adequately limited and hence the scale of damage. It was stated that damage can be limited to: Category 2 (Slight) if overall lateral movements can be limited to less than 10mm: and, Category 1 (Very Slight) if movements can be limited to 5mm. This was not considered to be adequately demonstrated as practically achievable and several rounds of discussions were undertaken between the BIA authors and the Auditor.
- 4.15. The ground movement assessment has been reconsidered in the revised GHGMA, supported by additional mitigation measures to be implemented during construction. In order to limit settlement, it is proposed to install flat jacks between existing foundations and underpins. These will be linked to structural monitoring results, taken twice per day, and any settlements will be compensated by adjusting the jacks, with the intention of eradicating net vertical movement. Similarly, conventional temporary horizontal props will be replaced by active, hydraulic propping, with the intention of eradicating net horizontal movements within the first stage of underpinning.
- 4.16. LBH Wembley state that: *"There is no more robust (or expensive) a solution to mitigate the uncertainty of the scale of movement than that which is being applied to this Bayham Street site. Here, all the movement vertical movement (sic), whatever that may prove to be, is to be entirely eradicated through jacking. Similarly, all the first stage horizontal movement is to be removed through jacking of horizontal props."*
- 4.17. With the inclusion of the temporary works scheme proposed, damage impacts should be maintained to the lowest practicable, which should be within Category 1 (Very Slight), and which are accepted. The mitigation measures proposed, and the necessary structural monitoring scheme required to control the works, should be incorporated into the final design and construction of the basement.
- 4.18. Section 4.04.3 of the BIA considered the impact of the proposals on the adjacent roadway and any utilities running beneath. It was stated that services will be located prior to excavation and temporary propping will be utilised to minimise the damage.

- 4.19. A movement monitoring specification was provided with proposed monitoring points and trigger levels. It is stated in Section 1.01 of the specification that the movements shall be measured to an accuracy of +/-2mm.
- 4.20. An outline works programme has been provided.
- 4.21. It is stated in the hydrology screening that there will be no increase in the paved areas and that the surface flows will be routed as existing into the combined sewer in Bayham Street. In response to a query in the initial audit regarding the lack of attenuation SUDS options to reduce the discharge flows, the revised BIA states that the underground drainage will be collected into sump pits and then pumped to the combined public sewer. It is further stated that the new green roof at the rear of the building will attenuate the total rainwater flow reducing the overall peak run-off to the combined sewer.
- 4.22. It is accepted that there are no slope stability concerns or wider hydrogeological issues as a result of the proposed development and that the site is not located in an area subject to flooding.

5.0 CONCLUSIONS

- 5.1. With the inclusion of the updated submissions, the BIA authors have appropriate qualifications.
- 5.2. The original BIA submissions did not include all the necessary existing and proposed plans, sections and elevations to assess the BIA. These have now been provided.
- 5.3. Structural calculations and construction sequence sketches which were considered adequate were included in the initial submission. With the inclusion of the updated submissions, suitable temporary works information has been presented.
- 5.4. In the revised submissions, geotechnical parameters and groundwater conditions based on the site investigation are adopted, which are considered appropriate. The authors recommend these conditions are confirmed by the Contractor in advance of the construction works, which should be implemented.
- 5.5. The depth of foundations to the neighbouring properties has been partially established via trial pits, and conservative assumptions have been made where these have not been established. Prior to works commencing, any assumed neighbouring foundation level should be confirmed.
- 5.6. Mitigation measures are proposed to limit ground movements and consequential damage impacts to neighbouring properties to Category 1 (Very Slight). These include the use of vertical jacking and hydraulic horizontal propping.
- 5.7. The impact of the construction on the roadway and utilities beneath is considered with mitigation proposed.
- 5.8. Proposals for movement monitoring have been presented. Monitoring must be implemented to in order to control the temporary works and limit movements / damage impacts to within those predicted.
- 5.9. An outline works programme is included.
- 5.10. It is accepted there are no slope stability or wider hydrogeological issues and the site is not an area prone to flooding.
- 5.11. Queries and matters that required further information or clarification are summarised in Appendix 2. Considering the revised submissions, the BIA meets the criteria of CPG4.

Appendix 1: Resident's Consultation Comments

None

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	BIA format	Incomplete scheme drawings. Existing plans, sections and elevations not provided	Closed	February 2017
2	Stability	Plan view showing layout of the proposed basement with indicative temporary propping not provided	Closed	July 2017
3	Stability	Underpinning bay sequence not provided	Closed.	February 2017
4	Stability	GMA to be refined as discussed in Audit paragraph 4.15	Closed	July 2017
5	Stability	Details of mitigation measures to limit damage not provided	Closed	July 2017
6	Stability	Movement monitoring outline proposals not provided	Closed	May 2017
7	Stability	Retaining wall parameters incomplete	Closed – parameters to be confirmed as part of the Contractor's advance works	May 2017
8	Stability/Hydrogeology	Groundwater level not established although mitigation proposed.	Closed – to be confirmed as part of the Contractor's advance works	May 2017
9	Hydrology/Drainage	Drainage strategy considering the implementation of attenuation SUDS, should be presented or a statement indicating why this cannot be implemented should be presented if considered impracticable.	Closed	February 2017

Appendix 3: Supplementary Supporting Documents - Omitted

- Outline Method Statement for New Basement Construction, Project No. P3096-OFF, dated 4th April 2017 by Michael Alexander Consulting Engineers.
- Outline Method Statement for New Basement Construction, Project No. P3096-OFF, dated 18th May 2017 by Michael Alexander Consulting Engineers.
- Measurement Monitoring Specifications, Project No. P3096, dated 18th May 2017 by Michael Alexander Consulting Engineers.
 - LBH Wembley Comments to CampbellReith Audit Tracker, 18th May 2017.
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London

Friars Bridge Court
41- 45 Blackfriars Road
London, SE1 8NZ

T: +44 (0)20 7340 1700
E: london@campbellreith.com

Birmingham

Chantry House
High Street, Coleshill
Birmingham B46 3BP

T: +44 (0)1675 467 484
E: birmingham@campbellreith.com

Surrey

Raven House
29 Linkfield Lane, Redhill
Surrey RH1 1SS

T: +44 (0)1737 784 500
E: surrey@campbellreith.com

Manchester

No. 1 Marsden Street
Manchester
M2 1HW

T: +44 (0)161 819 3060
E: manchester@campbellreith.com

Bristol

Wessex House
Pixash Lane, Keynsham
Bristol BS31 1TP

T: +44 (0)117 916 1066
E: bristol@campbellreith.com

UAE

Office 705, Warsan Building
Hessa Street (East)
PO Box 28064, Dubai, UAE

T: +971 4 453 4735
E: uae@campbellreith.com

Campbell Reith Hill LLP. Registered in England & Wales. Limited Liability Partnership No OC300082
A list of Members is available at our Registered Office at: Friars Bridge Court, 41- 45 Blackfriars Road, London SE1 8NZ
VAT No 974 8892 43