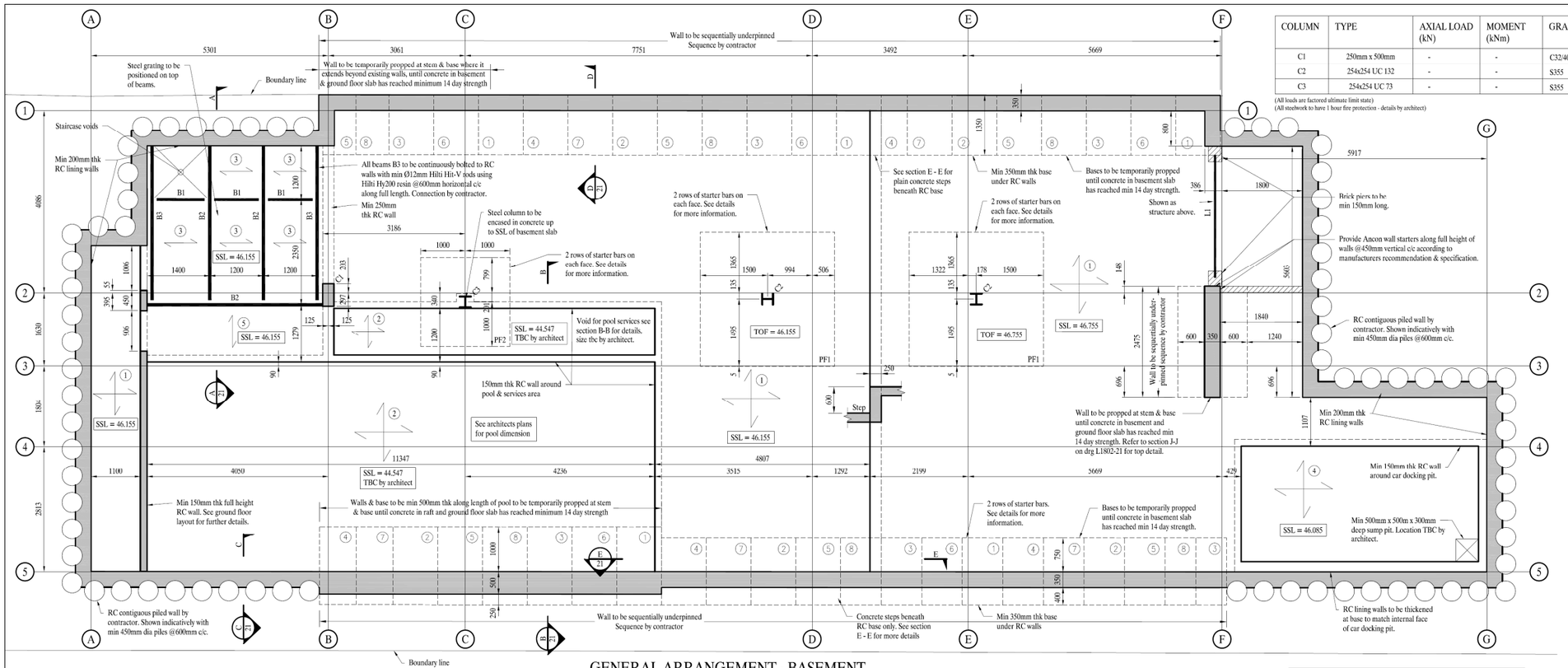
Appendix B

Pringuer-James Consulting Engineers
Basement Impact Assessment

Preliminary Drawings



COLUMN	TYPE	AXIAL LOAD (kN)	MOMENT (kNm)	GRADE
C1	250mm x 500mm	-	-	C32/40
C2	254x254 UC 132	-	-	S355
C3	254x254 UC 73	-	-	S355

(All loads are factored ultimate limit state)
(All steelwork to have 1 hour fire protection - details by architect)

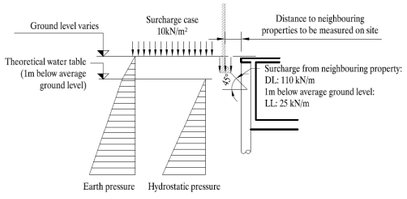
GENERAL ARRANGEMENT - BASEMENT

Scale 1:50

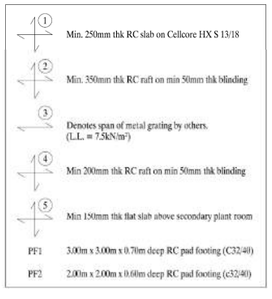
Lintel Schedule		
Lintel number	Type	Comment
L1	2 No. R3 Naylor lintel	To be proposed during installation

PILING GENERAL NOTES:

1. This drawing is to be read in conjunction with Pringuer-James Specification for Foundation and Basement Enclosure Wall Piles, and all other contract documentation.
2. For details of extent of existing buildings refer to architects survey drawings of the existing building. These are issued for information only. The design team do not take any responsibility for the accuracy or completeness of the information contained on these drawings.
3. For Geotechnical data refer to the Site Investigation Reports by TBC.
4. All dimensions are in millimetres and levels in metres o.d. unless noted otherwise.
5. All piles are on grid lines except where noted.
6. The drawings should not be scaled. Any discrepancies in dimensions are to be referred to the Structural Engineer or the Contract Administrator.
7. For piles adjacent to deep excavation (i.e. manholes) particular attention should be given to the design of the piles in both temporary and permanent conditions. e.g. no shaft friction capacity should be taken for piles adjacent to excavation for the height of the excavation.
8. A minimum concrete compressive strength for reinforced bearing piles to be C28/35. (35N/mm² at 28 days)
9. The Contractor's attention is drawn to the requirement for connection of lightning protection earthing to pile reinforcement. For location and details of lightning protection, refer to Services Engineers' drawings and specification.
10. The contractor is to visit the site and must note all visible obstructions to his work. The Contractor must allow for these obstructions when considering the piling equipment and must allow for any protection works he considers appropriate.
11. It is the Contractors responsibility to ensure that the setting out of the piles complies with the requirements of the specification.
12. a) Minimum reinforcement to concrete piles should not be less than :-
    Minimum number of longitudinal bars - 5 no.
    Minimum diameter of longitudinal bars - H16
    Minimum diameter of links/helix - 10mm
    The minimum pitch centres of pile reinforcement shall not be less than 200mm centres to allow the placing of slab, pilecap or capping beam reinforcement through pile reinforcement, the minimum length of reinforcement cage shall not be less than 6 metres from the top of the pile.
12. b) The length of the reinforcement cage shall be determined by the piling Contractor to adequately reinforce the pile to the length required to resist the forces applied.
12. c) Tensile resistance of the pile concrete shall be ignored. where piles are subject to net uplift forces reinforcement cage to be full length of the pile.
12. d) Where piles are subject to net tensile forces the piling contractor shall in his design limit the sum of the elongation of the pile and upward deflection of the pile to a maximum of 5 mm.
13. Live loads on piles vary from zero to the maximum stated at each location and this should be taken into account in any settlement calculations.
14. The piling Contractor is to design and detail the piling works based upon the geotechnical data relating to the site. The piles shall be designed for a maximum absolute settlement of 10 mm and a maximum relative settlement of 5 mm. Maximum relative settlement for any other dimensions will be taken pro-rata. The piling Contractor shall take into account all factors that may effect pile/soil interaction and pile capacity -
    a) loss of skin friction due to close proximity of excavation for drain runs and chambers, etc. - refer to Services Engineers drawings.
    b) Effect of temporary works in the ground adjacent to piles. refer to the contractor for details.
    c) Negative skin friction from the insitu soil strata and backfill material.
    d) Close proximity between piles and piles in groups.
15. In the permanent design case the concrete piles shall be designed to resist the following vertical and horizontal loads which can be combined appropriately to produce the most onerous loading combination.
    a) Vertical loads - the most onerous upwards and downwards vertical loads shall be determined by appropriately combining the vertical loads in the pile load table.
    b) Moments due to eccentric vertical loading of piles. - Piles shall be designed to resist moments due to
    pile / column eccentricity - determined from the worst case combination of :-
    i) Design eccentricity of walls ± 100mm relative to the specified location of the piles.
    ii) Eccentricity due to the most adverse combination of construction tolerances. of both piles and the supported structure.
    c) Additional horizontal loads on contiguos pile wall :-
    i) Lateral earth pressure imposed by the retained height of soil to existing pavement level. This loading may increase due to local excavations for drainage, lift pits etc.
    ii) Permanent case hydrostatic water pressure to comply with BS 8102 in addition a water table at 1.0m below the average pavement level shall be taken to comply with BS 8102 where a load factor of 1.05 maybe applied to this load for the design of pile reinforcement only.
    iii) Lateral earth pressure due to external surface surcharge load, taken as :- on boundaries adjoining the highway/footpath surcharge loads of 10kN/m² and any additional loading advised by the contractor and the city engineer.
    iv) Lateral pressure from neighboring properties taken 1m below average pavement level and applied with safety factors as stated in BS EN 1990 for the design of reinforcement only.
    iiv) The local authority's highway engineer specifies an accidental wheel load of 100kN
16. In the temporary construction stage case the concrete piles shall be designed to resist the following vertical and horizontal loads which can be combined appropriately to produce the most onerous loading combinations.
    a) Vertical loads worst case combination of :-
    i) Vertical loads given in note 15.
    ii) Additional loads due to temporary works, construction method and sequence for sub and super structure and any site temporary loading. Refer to the contractor for details.
    b) Moments due to eccentric vertical loadings of piles.
    i) Loading as given in note 15.
    ii) Additional loads due to temporary works, construction method and sequence for sub and super structure and any site temporary loading. Refer to the contractor.
    c) Horizontal loadings worst case combination of:-
    i) Loading as given in note 15.
    ii) Horizontal loadings due to temporary works (e.g. propping to perimeter basement walls etc.). Incidental loading due to construction sequence, methods and plant for substructure construction e.g. differential excavation and plant surcharge and accidental loading. Refer to the contractor.
iii) For contig pile wall, hydrostatic pressure at temporary construction stage may be taken as the perched water level from the soil investigation report adjusted to give annual maximum level
iv) Embankment wall loads to adjacent property.
v) Deflections due to horizontal forces shall be limited to 20mm at ground level.
17. The pile reinforcement projecting from contig piles into the capping beam above should be designed to resist the forces and moments from any insitu concrete retaining wall above the pile. The contractor shall determine these interface moments and forces by considering the concrete retaining walls as an extension of the secant pile wall. The pile reinforcement shall extend a lap length anchorage length into the capping beams. The projecting pile reinforcement length shall take due account of the depth of the capping beam (capping beam depth). For larger dia. pile reinforcement, cranked bars and mechanical reinforcement couplers may be required to provide the anchorage to the pile reinforcement. Where cranked bars and mechanical couplers are required, these shall be the responsibility of the contractor to design and install. The minimum pile reinforcement projecting into capping beams shall not be less than 650mm.
a) Superstructure column loads are applied to the contig piles via the capping beams. Columns may be eccentric to the contig piles. The contractor shall design the contig piles within a 2.0m length of contig wall centred on the column to resist all the forces and moments generated by the column. Unless noted otherwise.
b) The contractor shall design the contig pile wall to limit maximum deflection in the contig pile wall and continuation retaining wall above such that no damage is caused to the existing retained buildings or adjoining buildings or the highway. The contractor is required to submit and obtain approval to his design via the party wall surveyor from the surveyors and engineers representing parties with interest in adjoining buildings. He should also submit and obtain approval to his design from :- as note 16 above
i) The City Highway Engineer.
ii) The Engineer for the existing retained buildings where appropriate.
iii) The Building Inspector.
18. See Contract Administrator drawings for setting out of the building grid lines. Wherever dimensions differ from those shown on the 'CA' drawings the dimensions given by the 'CA' shall take precedence.
19. All design loads are unfactored loadings unless stated otherwise.
20. The contractor shall determine the piling platform levels and advise the structural engineer accordingly.
21. The contig piling layout shown on the drawing is indicative only. The contractor is responsible for the final design and setting out of all piles.
22. The contractor is responsible for all trimming, cutting, recesses and drilling into piles and ensuring that piles are not damaged in the process.



TYPICAL CONTIGUOUS PILE WALL LOADINGS



BEAM	TYPE	SHEAR (kN)	MOMENT (kNm)	END MOMENT (kNm)	GRADE	Comments
B1	152x152x37 UC	-	-	-	S275	+46.105
B2	203x203x46 UC	-	-	-	S275	+46.105
B3	150x75x18 PFC	-	-	-	S275	+46.105

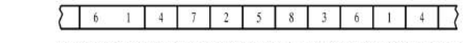
(All shear and moment values are ultimate limit state and if a value is not stated, the minimum shear value should be 100kN and the moment value should be 15kNm)

UNDERPINNING NOTES :-

1. The bearing strata shall be approved by the Engineer and the Local Authority's Building Inspector before casting foundations. Any additional excavation shall be replaced with a grade C16/20 concrete. In the event of extensive additional excavation being required, the Engineer must be informed immediately and fresh instructions obtained.
2. Concrete mix for foundations shall be grade C32/40 with a minimum of 300kg of ordinary portland cement per cubic metre and a maximum water/cement ratio of 0.60. Concrete shall be left for at least 24 hours before dry packing. The concrete of the underpins shall be stopped off 75mm below the underside of the existing walls.
3. The underside of the underpinning is to be dug to a strata capable of sustaining a permissible ground bearing pressure of 180 kN/m².
4. The underside of the existing strip foundation shall be trimmed and cleaned of all mud and debris before dry packing. The underpinning shall be carried out in short sections of about 1 metre in length in the sequence of construction as typically detailed by contractor. The dry pack shall be a 1:3 sharp sand/cement well rammed home in horizontal layers not exceeding 75mm thick. Dry packing shall be left for at least 48 hours before commencing excavation for any adjacent underpins.
5. The central area of excavation shall not be carried out until the perimeter underpinning has been completed.
6. Backfilling behind retaining walls shall be a grade C16/20 concrete using ordinary Portland cement.
7. The Contractor is to keep a record of the sequence and dimensions of the underpinning actually carried out including relevant details of excavation, casting concrete and pinning up for each section.
8. Excavated material intended for backfilling is to be kept protected from drying out or wetting and is to be placed in maximum 150mm layers, carefully compacted with a pneumatic or electric percussion tool with compacting plate.
9. Foundations have been designed to impose a bearing pressure of 180 kN/m². The bearing strata shall be approved by the Local Authority's Building Inspector before laying blinding or casting foundations. Any additional excavation shall be replaced with a nominal 1:8 mix concrete. But in the event of extensive additional excavation being required, the Engineer must be informed immediately and fresh instructions obtained.

Note:

Contractor to submit detailed method statement including temporary works and sequence of underpinning, for approval to prior to commencement.



TYPICAL BASEMENT WALL CASTING SEQUENCE

NOTE :-

The sequence numbering is for identification purposes only. The sequence of basement wall bays is to be agreed on site with the district surveyor, but at all times the minimum requirement for the time lapse between the construction of adjacent bays must be adhered to. See Basement Wall Notes for minimum sequence requirements.

Notes :

1 General
All Structural Engineering drawings are to be read with the specification and with all relevant Architects drawings and specifications.

Do not scale from any Structural Engineers drawing. All dimensions are in millimetres and levels in metres.

All waterproofing (DPM & DPC) works to Architects details.

All fire protection works to Architects details unless specifically noted otherwise.

Abbreviations:-
SSL - Structural slab level
C/S - Column Stops
UNO - Unless Noted Otherwise
FFL - Finished floor level
C/C - Column Capped
OSA - Or Similar Approved

The Contractor is responsible for the design, installation and maintenance of all necessary temporary works to ensure the strength and stability of the building throughout the course of the works. Drawings and calculations detailing all temporary works shall be submitted to the Engineer for comment prior to commencement of the works.

The existing structural information shown on these drawings is based on visual inspection of the building and upon limited opening up works. All details of the existing construction are subject to confirmation by the Contractor during the works on site.

2 Steel
All steelwork to be grade S275 to BS EN 10025. (UNO)

The steel structure is execution Class 2 (EXC2). It is highly recommend that the Steel Contractor(s) / Fabricator(s) appointed for the project are members of the BCSA. Otherwise, the Main Contractor or Client should complete the detailed design for those elements shown on the design drawings and produce co-ordinated drawings showing all connection details etc.

The steelwork fabricator shall produce and submit two copies of dimensioned fabrication drawings to the *Engineer for comment*. The Engineer requires ten working days to return and comment.

All bolted connections are to include a minimum of two M16 bolts per member unless specifically indicated otherwise on details. All connection details to be designed by Contractor.

All bolts are to be grade 8.8 sheradized to BS 4921, class1. All bolts, nuts and washers are to be to BS 5950: Part 2 clause 2.2. Washers are to be placed beneath rotated item.

All welds to be minimum 6mm leg length continuous fillet welds unless specifically noted otherwise.

All steelwork coatings to be as specification and below. Coatings to be provided by Sherwin Williams Protective & Marine Coatings or similar approved. All coatings to be light grey in colour; red oxide is NOT to be used.

LOCATION	CATEGORY	PAINT SYSTEM
Internal damp/cavities	C2 - Low	C400/3 Ecosy Zinc Phosphate coating (125 microns DFT) - Functional
Internal dry	C1 - Very Low	C400/3 Ecosy Zinc Phosphate coating (75 microns DFT) - Functional
External	C4 - High	Galvanized in accordance with BS EN ISO 1461 to achieve a minimum mean coating thickness of 140 microns

3 Concrete
Concrete to be in accordance with BS EN 206-1 and as follows :
Blinding - C16/20
Mass concrete - C25/30
Reinforced concrete - C32/40

4 Masonry
All loadbearing blockwork to have a minimum characteristic strength of 7.3N/mm². All loadbearing brickwork is to have a minimum characteristic strength of 20N/mm².

5 Timber
All timber members to be grade C16 to BS EN 1995 unless noted otherwise. Timber to be pressure impregnated with preservative and cut ends brush treated.

6 Padstones
All padstones to be concrete, min grade C20/25 using max 20 mm aggregate. All steel beams supported on padstones to bolted to padstones with min 2 No. Hilti M10 HAS rod with HY 200 resin. (O.S.A.)

Rev.	Date	Drawn	Amendment
-	05.02.15	HS	Issued for Information

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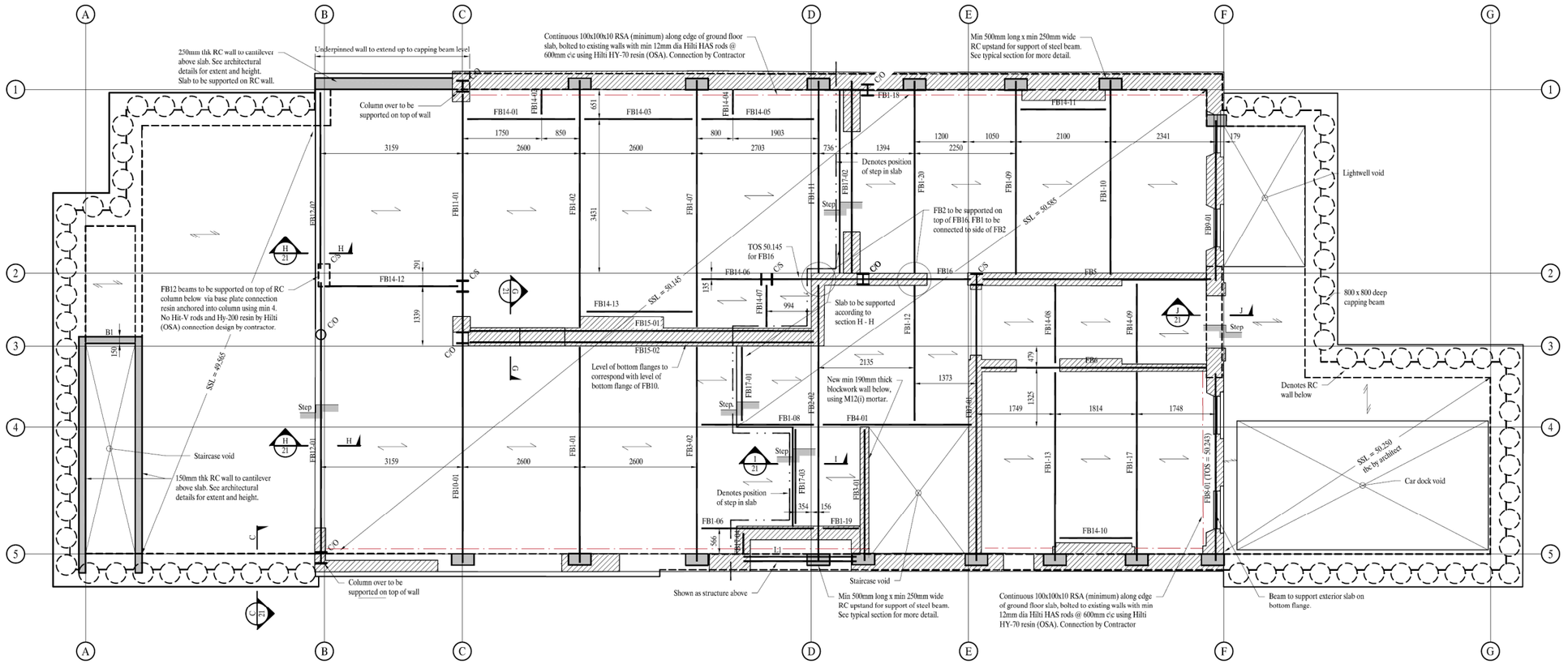
GA OF BASEMENT

DRAFT

Status : CONSTRUCTION REVIEW

Scales :	As noted @ A1			Date :	Nov 14
Drawn :	HS	Engineer :	CC	Checked :	SPJ
Drawing No.	L1802 09			Revision	-



GROUND FLOOR - GENERAL ARRANGEMENT

Scale 1:50

BEAM	TYPE	SHEAR (kN)	MOMENT (kNm)	END MOMENT (kNm)	GRADE	Comments
FB1	203 x 203 UC 46	-	-	-	S355	-
FB2	610 x 229 UB 125	-	-	-	S355	-
FB3	203 x 203 UC 60	-	-	-	S355	-
FB4	203 x 203 UC 60	-	-	-	S355	-
FB5	305 x 305 UC 118	-	-	-	S355	-
FB6	305 x 305 UC 118	-	-	-	S355	-
FB7	305 x 305 UC 240	-	-	-	S355	-
FB8	254 x 254 UC 89	-	-	-	S355	-
FB9	254 x 254 UC 89	-	-	-	S355	-
FB10	305 x 305 UC 158	-	-	-	S355	-
FB11	203 x 203 UC 46	-	-	-	S355	-
FB12	686 x 254 UB 125	-	-	-	S355	-
FB14	152 x 152 UC 37	-	-	-	S355	-
FB15	610 x 228 UB 101	-	-	-	S355	-
FB16	305 x 305 UC 283	-	-	-	S355	-
FB17	457 x 152 UB 52	-	-	-	S355	-

(All shear and moment values are ultimate limit state and if a value is not stated, the minimum shear value should be 100kN and the moment value should be 15kNm)

B1	150mm x 650mm DP RC upstand beam (depth to be confirmed by architect)
	150mm DP concrete on Comflor 60 x 1.2 deck, using C25/30 concrete and reinforced with a single layer of A193 mesh (30mm cover)
	250mm DP flat slab, using C32/40 concrete
C/S	Column stops
C/O	Column over
	Existing load bearing masonry walls
	Proposed RC concrete
	Continuous 100x100x10 RSA (minimum) along edge of ground floor slab, bolted to existing walls with min 12mm dia Hilti HAS rods @ 600mm c/c using Hilti HY-70 resin (OSA). Connection by Contractor

Note:
All concrete to be grade 32/40, unless noted otherwise.

Lintel Schedule		
Lintel number	Type	Comment
L1	1 No. box 140 & 1 No. box 200 IG lintel	Lintel to have additional bottom plate and to be positioned towards exterior with bottom plate pointing towards exterior (both to be propped during installation)

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All welds to be minimum 6mm leg length continuous fillet welds unless specifically noted otherwise.

All steelwork coatings to be as specification and below. Coatings to be provided by Sherwin Williams Protective & Marine Coatings or similar approved. All coatings to be light grey in colour; red oxide is NOT to be used.

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5 Timber
All timber members to be grade C16 to BS EN 1995 unless noted otherwise. Timber to be pressure impregnated with preservative and cut ends brush treated.

6 Padstones
All padstones to be concrete, min grade C20/25 using max 20 mm aggregate. All steel beams supported on padstones to bolted to padstones with min 2 No. Hilti M10 HAS rod with HY 200 resin. (O.S.A.)

Rev.	Date	Drawn	Amendment
01	09.02.15	DA	Issued for Information
-	05.02.15	HS	Issued for Information

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WHITEHALL PARK

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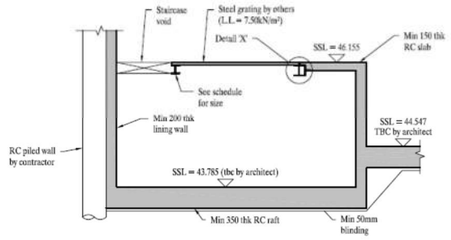
GA OF GROUND FLOOR

DRAFT

Status : CONSTRUCTION REVIEW

Scales :	As noted @ A1	Date :	Nov 14
Drawn :	HS	Engineer : CC	Checked : SPJ
Drawing No.	L1802 - 10	Revision	01



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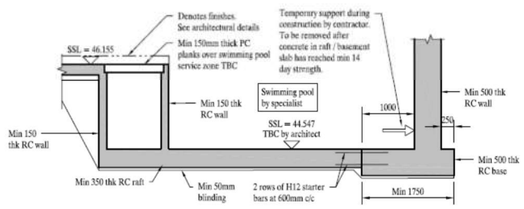

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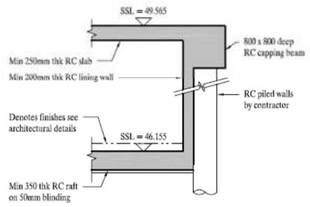

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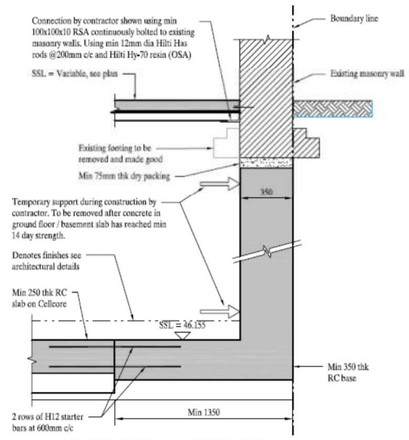

SECTION D - D (TYPICAL)
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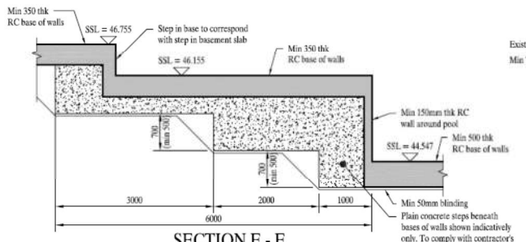

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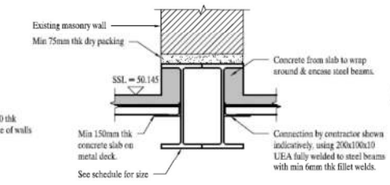

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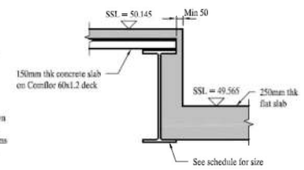

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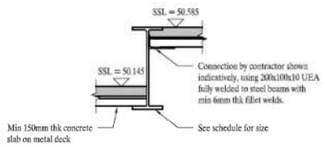

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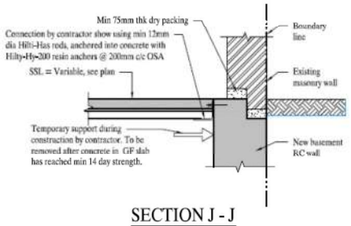

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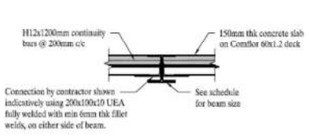

TYPICAL SECTION THROUGH NEW GROUND FLOOR SLAB SUPPORTING SLAB ONLY
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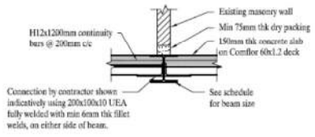
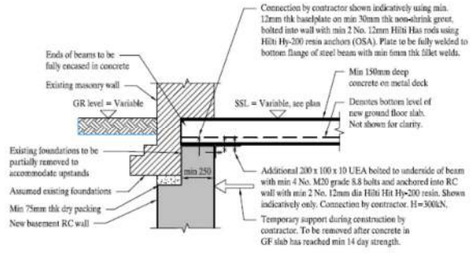
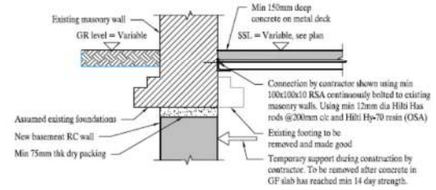


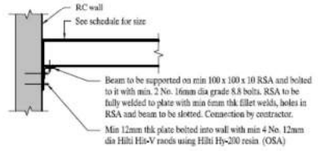
TYPICAL SECTION THROUGH NEW GROUND FLOOR SLAB SUPPORTING EXISTING WALLS
Scale 1:20



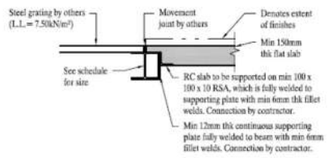
TYPICAL SUPPORT DETAIL OF STEEL BEAMS ON RC WALLS
Scale 1:20



TYPICAL SUPPORT DETAIL OF NEW GROUND FLOOR SLAB ON NEW BASEMENT WALLS
Scale 1:20



TYPICAL DETAIL SHOWING CONNECTION OF STEEL BEAM TO RC WALLS
Scale 1:20



DETAIL 'X'
Scale 1:20

Notes :

1 General
All Structural Engineering drawings are to be read with the specification and with all relevant Architects drawings and specifications.

Do not scale from any Structural Engineers drawing. All dimensions are in millimetres and levels in metres.

All waterproofing (DPM & DPC) works to Architects details.

All fire protection works to Architects details unless specifically noted otherwise.

Abbreviations:-
SSL - Structural slab level
FFL - Finished floor level
CS - Column Stops
C/C - Column Capped
UNO - Unless Noted Otherwise
OSA - Or Similar Approved

The Contractor is responsible for the design, installation and maintenance of all necessary temporary works to ensure the strength and stability of the building throughout the course of the works. Drawings and calculations detailing all temporary works shall be submitted to the Engineer for comment prior to commencement of the works.

The existing structural information shown on these drawings is based on visual inspection of the building and upon limited opening up works. All details of the existing construction are subject to confirmation by the Contractor during the works on site.

2 Steel
All steelwork to be grade S275 to BS EN 10025. (UNO)

The steel structure is execution Class 2 (EXC2). It is highly recommend that the Steel Contractor(s) / Fabricator(s) appointed for the project are members of the BCSA. Otherwise, the Main Contractor or Client should complete the detailed design for those elements shown on the design drawings and produce co-ordinated drawings showing all connection details etc.

The steelwork fabricator shall produce and submit two copies of dimensioned fabrication drawings to the Engineer for comment. The Engineer requires ten working days to return and comment.

All bolted connections are to include a minimum of two M16 bolts per member unless specifically indicated otherwise on details. All connection details to be designed by Contractor.

All bolts are to be grade 8.8 sheradized to
BS 4921, class1. All bolts, nuts and washers are to be to BS 5950: Part 2 clause 2.2. Washers are to be placed beneath rotated item.

All welds to be minimum 6mm leg length continuous fillet welds unless specifically noted otherwise.

All steelwork coatings to be as specification and below. Coatings to be provided by Sherwin Williams Protective & Marine Coatings or similar approved. All coatings to be light grey in colour; red oxide is NOT to be used.

LOCATION	CATEGORY	PAINT SYSTEM
Internal dampcondition	C2 - Low	C4HW3 Epoxy Zinc Phosphate coating (120 microns DFT) - Functional
Internal dry	C1 - Very Low	C4HW3 Epoxy Zinc Phosphate coating (75 microns DFT) - Functional
External	C4 - High	Galvanised in accordance with BS EN ISO 1461 to achieve a minimum mean coating thickness of 140 microns

3 Concrete
Concrete to be in accordance with BS EN 206-1 and as follows :
Blinding - C16/20
Mass concrete - C25/50
Reinforced concrete - C32/40

4 Masonry
All loadbearing blockwork to have a minimum characteristic strength of 7.3N/mm². All loadbearing brickwork is to have a minimum characteristic strength of 20N/mm².

5 Timber
All timber members to be grade C16 to BS EN 1995 unless noted otherwise. Timber to be pressure impregnated with preservative and cut ends brush treated.

6 Padstones
All padstones to be concrete, min grade C25/25 using max 20 mm aggregate. All steel beams supported on padstones to bolted to padstones with min 2 No. Hilti M10 HAS rod with HY 200 resin. (O.S.A.)

Rev.	Date	Drawn	Amendment
-	05.02.15	HS	Issued for Information

PRINGUER-JAMES
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WHITEHALL PARK

17 WADHAM GARDENS
LONDON NW3 3DN

SUBSTRUCTURE SECTIONS

DRAFT

Status : CONSTRUCTION REVIEW

Scales :	As noted @ A1	Date :	Nov 14
Drawn :	HS	Engineer : CC	Checked : SPJ
Drawing No.	L1802 21	Revision	-

Appendix C

Pringuer-James Consulting Engineers
Basement Impact Assessment

Site Investigation Report
Soil Consultants Ltd.
Report Ref: 9722/KOG/JRCB

SoilConsultants
Ground Investigation
Geotechnical Analysis
Contamination Assessment

SITE INVESTIGATION REPORT

PROPOSED REDEVELOPMENT:

17 WADHAM GARDENS, LONDON, NW3 3DN

Client	**WHITEHALL PARK LTD** **106 Hampstead Road, London, NW1 2LS**
Project manager	**G-PAD LTD** **Unit 1, 9a Dallington Street, Clerkenwell, London EC1V 0BQ**
Engineer:	**PRINGUER JAMES CONSULTING ENGINEERS LTD** **10 Beulah Road, Wimbledon, London ,SW19**
Report ref:	**9722/KOG/JRCB**
Date:	**10th February 2015 [Rev 0]**

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SITE INVESTIGATION REPORT

PROPOSED REDEVELOPMENT:

17 WADHAM GARDENS, LONDON, NW3 3DN

DOCUMENT ISSUE STATUS:

Issue	Date	Description	Author	Checked/approved
Rev 0	**10/02/15**	**First issue**	**Keith Gibbs** BSc, MSc, FGS	**John Bartley** BSc, MSc, FGS, CGeol

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APPENDIX A

Fieldwork, in-situ testing and monitoring

- Borehole records
- SPT results
- SPT hammer calibration certificate

Laboratory testing

- Unconsolidated undrained triaxial test results [QUT]
- Index property testing
- Plasticity charts

Ground profiles

- Cohesion versus depth graph

Contamination testing [QTS Environmental]

- General soil suite and soluble sulphate/pH results

Plans & drawings

- Photographs of the site
- Proposed development drawings
- Site Plan
- Location Plan

APPENDIX B

- GroundSure historical maps [Ref SCL-1840707]
- GroundSure EnviroInsight Report [Ref SCL-1840705]
- GroundSure GeoInsight Report [Ref SCL-1840706]

1.0 INTRODUCTION

A new basement is to be constructed at this existing residential property, together with refurbishment and internal restructuring. In connection with the proposed works, Soil Consultants Ltd [SCL] were commissioned to carry out a ground investigation to include the following elements:

- Desk Study to identify site history and potential contaminative uses
- Identification of ground sequence
- Provision of recommendations for geotechnical design
- Contamination appraisal, risk assessment and conceptual model
- Basement impact assessment [BIA] : Land stability and Hydrological sections [issued separately]

This report describes the investigation undertaken, gives a summary of the ground conditions encountered and then provides geotechnical related design recommendations. In addition an outline contamination appraisal is provided. The Basement Impact Assessment will be provided in a separate report.

2.0 SITE DESCRIPTION

The site is located at 17 Wadham Gardens, Primrose Hill and centred at approximate National Grid Reference 527217E 184070N. The site is rectangular in shape and measures approximately 45m [N-S] x 13m [E-W].

At the time of our investigation the site comprised an existing two-storey detached house [with additional roof level accommodation] measuring about 11m x 20m in area, with relatively flat, partly grassed and paved front and rear gardens. A number of semi-mature/mature deciduous trees are present along the rear garden boundaries and along the road pavement. There is an existing basement [approximately 2m depth bgl] to the house and this is located in the central part of the western side of the building.

OS benchmark [corner adjacent house at No.15] and spot height data [middle of Wadham Gardens at the front of No.17] indicate a ground surface OD level of about +47.5m for the site.

The surrounding area consists of similar residential dwellings, comprising two and three-storey detached properties and associated gardens.

A railway tunnel is located in the rear garden of the site. A Victorian age, brick-built air shaft tower for this tunnel is visible in the rear garden of the next but one property to the west of the site. Public domain information indicates that the tunnel was was bored and brick lined through the London Clay [rather than a "cut and cover" construction] at a depth sufficient to ensure that later surface development was not compromised.

The current site features are shown on the Site Plan which is included in Appendix A, together with selected photographs taken at the time of our fieldwork. An aerial view of the site is shown on the front cover of this report

3.0 SITE HISTORY AND GEOLOGICAL/ENVIRONMENTAL INFORMATION

3.1 GroundSure historical map pack and reports

A historical map and environmental database search was commissioned from GroundSure to ascertain the site history/usage and surrounding land usage. An indication of the gradual development of the site over the years can be gained by a study of the historical maps [shown in Appendix B]. The following table contains a summary of the site development obtained from the source maps provided in the GroundSure report.

Historical development of site and surrounding area

Map date	The site	Significant development / features in surrounding area [generally within 250m]
1866- 1871	The site consists of open land on the margin of Primrose Hill with no development visible A footpath or track is shown to traverse the site in an approximate north-west to south-east direction	Detached residential properties are shown along King Henry's Road along the northern side of the site Tunnel entrances are shown below Primrose Hill Road about 380m to the east-north-east and below Adelaide Road North shown about 700m to the west The Eton and Middlesex Cricket Ground is shown about 90m to the east The West Middlesex Waterworks Reservoir is shown about 380m to the south Two small ponds are shown about 200m to the south Residential development is shown along Avenue Road to the south-west
1894-1896	No significant changes apparent	An Air Shaft [presumed related to the underground railway tunnel] is shown about 40m to the west Increased residential development of the surrounding areas

Historical development of site and surrounding area		
Map date	**The site**	**Significant development / features in surrounding area [generally within 250m]**
1915-1948	The existing house is now shown together with the adjacent properties along Wadham Gardens	The Air shaft is shown in the rear garden of one of the adjacent residential properties Residential development of the area between Wadham Gardens and Primrose Hill to the south-east has occurred along Elsworthy Road
1952-Present	The route of the underground railway tunnel below the rear garden of the site is shown for the first time on the 1952 edition	No significant changes apparent

The relevant historical maps are included in Appendix B of this report.

The GroundSure Report includes information from a database of local activities encompassing a range of subjects related to land use, pollution, and geological/hydrological conditions. A summary of contaminative uses and other environmental issues covered by the desk study within the site and its immediate surroundings is as follows:

Environmental Permits, Incidents and Registers

- No recorded data within 500m buffer

Landfill and other Waste Sites

- Records of Environment Agency historic landfill sites within 1500m:
  1no, 1,324m NW, Canfield Place – no detail on type-Surrendered

- Records of Environment Agency licensed waste sites within 1500m
  2no [for same location] for a Household Amenity site, 1442m E, at Jamestown Road, Camden - Surrendered

Current Land Use

- Potentially contaminative uses: 8no records within 250m, mainly electricity substations with the nearest being 62m SW. Others include Sports and Leisure Equipment repair; Special Purpose Machinery and Equipment; and Hobby, Sports and Pastime Products
- Petrol and Fuel station sites - None

Geology

- Artificial/Made Ground: none

- No superficial deposits or landslips recorded
- Bedrock/Solid Geology: London Clay Formation [very low to moderate permeability]
- Bedrock Faults [500m buffer]: No record
- Radon: The property is not in a Radon Affected Area [<1% of properties are above action level] - no protective measures required
- Historical Surface Ground Workings: one entry for 192m S - ponds
- Historical Underground Workings [1000m buffer]: Numerous entries for railway tunnels and associated air shafts, the nearest records refer to the tunnel previously identified in the rear garden of the site
- Current Ground Workings: None recorded within 1000m of the site
- Mining, Extraction & Natural Cavities [1000m buffer]: Numerous Air shaft entries with the nearest being 40m W [previously identified Air Shaft on old maps]
- Natural Ground Subsidence: Very low to negligible risk for all categories where identified, with the exception of shrink-swell clays, moderate risk due to the presence of London Clay on the site
- Borehole Records Map: A cluster of 6no boreholes approximately 200m to the east
- Railways and Tunnels: Numerous entries within 250m of site with the nearest recorded on-site [see previous references above]
- Active railways: Tunnel identified on site relates to an active Fast line railway service [WCML]
- High Speed 2 rail project: The site is located within 500m of the High Speed 2 rail project

Hydrogeology and Hydrology

- Aquifer within Superficial deposits: None
- Aquifer within bedrock deposits: 'Unproductive' [London Clay Formation]
- Groundwater Abstraction [2000m buffer]: 7no [some duplication of entries], nearest being 442m NW, Swiss Cottage Borehole – irrigation water, Thames Groundwater
- Surface Water Abstraction: 3no entries, nearest Grand Union Canal at 1265m E Oval Road, Camden and used for evaporative cooling
- Potable Water Abstraction [2000m buffer]: 4no entries [some duplication], the nearest being 545m SE, Barrow Hill Borehole
- Source Protection Zones [500m buffer]: Type 2 on site – Outer catchment; 248m SE, Type 1 Inner catchment
- Source Protection Zones within confined aquifer [500m buffer]: None
- Ground water vulnerability/soil leaching: None
- River Quality: No data

- Detailed River Network [500m buffer]: 1no entry , 32m W -culvert
- Surface Water Features: None recorded within 250m of the site

Flooding

- None recorded for Zone 2 or Zone 3 floodplains within 250m of site
- Flood defences: No records
- Groundwater Flooding Susceptibility Areas: Not prone to flooding

Designated Environmentally Sensitive Areas

- Records of Local nature reserves [2000m buffer]: 2no, nearest 1004m S for St John's Wood Church Grounds

3.2 Walk-over survey

Our walkover survey was undertaken in conjunction with the fieldwork on 13 January 2015. The site was found to be in a clean and tidy state with no waste, rubbish, tanks etc. present. The surrounding areas were also noted to be in a well-maintained and tidy state.

Overall we have not identified any particular features [such as fuel tanks], materials [such as chemical containers] or land use within the site or in its immediate vicinity which are likely to give rise to significant contamination risks and we thus have no particular concerns in this regard.

4.0 EXPLORATORY WORK

The ground investigation was carried out on 13 January 2015 and comprised the following elements.

Boreholes

A single 150mm diameter cable percussive borehole [BH1] to 15m bgl and a single smaller diameter borehole [BH2] using hand held window sampler equipment to 7m bgl were constructed. In situ Standard Penetration testing [SPT] was undertaken in BH1 together with hand shear vane testing where appropriate. Representative samples [both disturbed and undisturbed] were taken for geotechnical testing and contamination analyses.

Water level observation pipes were installed in both of the boreholes upon their completion to a depth of 7m to enable later ground water monitoring.

The current calibration certificate for the cable percussive drilling rig SPT equipment indicates that an Energy Ratio, Er, of 76% should be used to provide corrected N_{60} values in line with the recommendations given in BS EN ISO 22476-3, 2005, National Annex A.

To facilitate later assessment and correlation of the borehole records we have used the external ground level as shown on the Architect's section drawings for an approximate ground level of +50.2m SD for the exploratory locations.

Geotechnical laboratory testing

The following geotechnical laboratory testing was completed:

- Unconsolidated undrained triaxial test results [QUT]
- Moisture content and index property tests [Atterberg Limits]
- Soluble sulphate/pH analyses [tested externally by QTS Environmental Ltd]

Contamination testing

Selected soil samples were delivered to a specialist laboratory [QTS Environmental Ltd] and the following testing was carried out:

- General soil suite 5 no samples
- WAC tests 1 no samples

The borehole logs and the laboratory test results are included in Appendix A.

5.0 GROUND CONDITIONS

The geological survey map of the area indicates that the site is underlain by the London Clay Formation. Below a surface layer of made ground this stratum was confirmed by our boreholes. The sequence met may be summarised as follows:

Stratum	Depth to base	Thickness
Made ground	Up to 1.10m	0.70-1.10m
London Clay		
Naturally reworked zone	Up to 3.50m	2.50m [approx.]
Undisturbed zone	>15.00m [not proven]	>11.70m [not proven]

5.1 Made Ground

Below the surface layer of topsoil in BH1 [front garden] and below the paved surface in BH2 [rear garden] the made ground comprised a mottled brown and grey silty sandy clay containing scattered stone and brick debris.

5.2 London Clay Formation

The London Clay was met directly below the made ground in both boreholes and proved to the maximum depth of boring at 15m. A natural re-worked upper layer was present overlying the 'undisturbed London Clay.

Naturally re-worked clay

Initially this deposit comprised an orange brown mottled silty clay, containing rare or isolated medium to coarse rounded flint gravel (indicative of some geological reworking). The results of our in-situ vane and laboratory strength tests indicated this clay to correspond to a low to medium strength classification with shear strength values mainly ranging between 40 kN/m^2 and 50 kN/m^2 and with an SPT N_{60} value of 11 at 1.50m [BH1]. Lower moisture contents near the base of this layer and a slightly lower shear vane value of 35 kN/m^2 in BH2 at 3.3m depth reflect a slightly more silty composition.

Results of laboratory tests in this top part of the London Clay indicate Plasticity Index [PI] values to range from 22% to 40%, corresponding to an Intermediate to High plasticity according to the British Standard 5930 classification and a Medium to High volume change potential according to NHBC Standards, Chapter 4.2 'Building near trees'. Live rootlets/root hairs were noted in BH1 and BH2 to depths of 1.5m and 2.3m respectively, but no obvious signs of desiccation were noted.

'Undisturbed' clay

Below about 3.3m [BH1] and 3.5m [BH2] there was an obvious visual change into a fissured brown slightly stained blue grey clay containing occasional selenite crystals. Below about 6m a more uniform brown colour was evident, which became a fissured grey clay with occasional fine sand partings below about 9.45m [BH1].

From about 3.5m depth there was a general increase in strength of the clay with increasing depth with laboratory undrained strength values ranging from 88 kN/m^2 to 127 kN/m^2 and SPT N_{60} values increasing from 16 to 28. Below about 14m, an SPT N_{60} test indicates the clay to correspond to a very high strength classification.

Results of laboratory tests below 3.5m depth indicate an increased plasticity with PI values in the range 46% to 54%. This corresponds to a Very High plasticity [BS:5930] and a High volume change potential [NHBC].

5.3 Groundwater

Groundwater was met during our fieldwork in BH2 only as an inflow at the interface of the made ground and the underlying relatively impermeable London Clay at about 1.10m depth. Standpipes have been installed both boreholes to enable future monitoring.

5.4 Environmental observations

No obvious olfactory or visual signs of soil or groundwater contamination were encountered in the boreholes.

6.0 GEOTECHNICAL APPRAISAL

Current redevelopment proposals include retaining the existing house superstructure and the construction of a full footprint basement. This basement will extend about 1m into the rear garden from the northernmost end wall of the house. In addition a new lightwell basement [approx.2.2m x 4.2m] is to be excavated below the front garden at the south-eastern corner. Some local deepening of the basement will be required to accommodate a swimming pool and a potential plant room.

The architect's proposed development plans are included in Appendix A. These drawings indicate an external ground level of about +50.2m SD and show the main part of the proposed basement to extend to about 3.6m depth. The swimming pool and plant areas are shown to extend to about 4.6m depth and 6m depth respectively, measured below current external ground level.

Of prime significance is the location of the railway tunnel in the rear garden of the house. A precise on-site location of this tunnel has not been provided, however the desk study mapping indicates that the southern wall of the tunnel may be about 6m from the nearest northern end wall of the house. The existence of the tunnel is known by the client and we understand that some representations have previously been made to determine whether any permissions/authorisations are required to allow the proposed scheme. Confirmation should be sought from the tunnel owners as to the precise location and depth of the tunnel crown and walls in order to determine the effects [if any] on the proposed scheme and whether or not it will be necessary to demonstrate any effects upon the tunnel.

The existing house is assumed to be supported on shallow spread foundations and clearly the building loads will need to be transferred to competent soils at basement level. The investigation has indicated that beneath a nominal thickness of made ground, the London Clay Formation is present and this will extend to the full depth of the proposed basement excavation. The London Clay is a relatively competent stratum which should be capable of supporting the likely underpinning loads and should allow relatively straightforward basement construction using either traditional underpinning techniques or if preferred [in areas close to adjacent buildings] an embedded retaining wall. From our observations localised groundwater will probably be encountered at the interface between the made ground and London Clay and control measures will be necessary, depending on the techniques adopted.

Some trees and hedges are present along the garden boundaries and close to the area of the proposed basement construction and other trees are present along the road pavement. Obvious effects of desiccation were not noted in the boreholes but tree roots were observed to extend to a depth of 2.3m in BH2. Given the depth of excavation proposed however, this aspect should not be a major issue at this site and no special precautions are considered necessary with respect currently desiccated clay soils. Notwithstanding this, all foundation design should be carried out in full accordance with the NHBC Standards.

6.1 Basement excavation and construction

The generally cohesive made ground and the London Clay are expected to be self-supporting in the short term and any ground-water should be limited to the interface of the made ground and the London Clay as previously discussed. Although claystones or significant silt/sand layers were not noted in the London Clay to the depth envisaged by the basement excavation, their occurrence should be allowed for together with any associated seepages of trapped water.

Conventional underpinning of the wall foundations should be appropriate if properly designed, with correctly specified 'pin' widths and construction sequencing. The underpinning to the foundations would act as the basement retaining structure during construction and particular consideration will clearly need to be given to the excavation for the basement along the western and eastern sides of the basement footprint which are close to the neighbouring houses. Excavation depths of between 3m and approximately 6m are envisaged and the adjacent houses at No.15 and No.19 are about 3m and 1.5m distant respectively from the edge of the proposed basement. The foundations of these neighbouring houses are likely to be similar to No 17, ie presumed shallow spread foundations, and if this is the case they are likely to impose some surcharge on the back of the new retaining wall. Any significant lateral movement of the basement wall would be translated into settlement beneath the adjacent foundations and provision of a well-designed lateral and vertical support system will obviously be essential; a robust system of waling beams and propping across the site is likely to be required. We recommend that a well-established underpinning specialist who has extensive experience with this type of construction undertakes this work and provides the temporary works design.

The alternative of a contiguous piled basement retaining wall may also be considered. Such methods may allow the construction of a more integrated support structure with more predictable overall stability. It should be noted however that access will be extremely tight and marginal even for a micro piling rig; a specialist contractor should be consulted to advise on the practicalities of installing such a system.

In the permanent case the lateral earth pressures will be retained directly by the underpinning/piles or by an internal RC lining wall. In either case horizontal support will be provided by the new ground and basement floor slabs.

The following table of coefficients may be used for the design of the basement retaining wall:

Stratum	Bulk density [Mg/m³]	Effective cohesion, c' [kN/m²]	Effective friction angle, ϕ' [degrees]
Made ground	1.80	0	22
London Clay:			
<5m below basement level	2.00	0	22
>5m below basement level	2.00	5	22

The wall designer should use these parameters to derive the active and passive earth pressure coefficients, Ka and Kp. The determination of appropriate earth pressure coefficients, together with

factors such as the pattern of earth pressure distribution, will depend upon the final type/geometry of the wall and the overall design approach.

6.2 Underpinning/spread foundations at basement level

At the main basement excavation depth of 3.6m, high strength natural London Clay should be present at the formation and this stratum should be capable of supporting the likely structural loads using spread foundations. Any internal columns or load-bearing walls would be supported either by separate pad/strip foundations or more probably by properly specified pad/strip thickenings within the slab. Within the undisturbed high strength London Clay we recommend that an allowable bearing pressure of 180kN/m^2 is adopted for foundations at 3.6m and below. At this pressure the Factor of Safety against bearing capacity failure should be >3 and settlements should remain within tolerable limits.

All foundation excavations should be carefully inspected to ensure that a competent stratum is present and if any obviously desiccated or root-infested clays are encountered local deepening should be carried out.

6.3 Piled foundations

If an embedded piled basement retaining structure is to be considered these piles may also be used to carry the existing/proposed structural loads. Advice on the practicalities of deploying this equipment at this site should be sought at the earliest opportunity from specialist contractors. For the ground conditions and the restricted access available we presume that mini piled rotary augered piles [with temporary casing though any made ground] would be considered. Alternative pile types such as screw piles could also be considered subject to specialist advice/design.

The following table of coefficients may be used for the design of rotary piles, based upon the measured strength versus depth profile, included in Appendix A.

Shaft adhesion

Stratum	Depth	Undrained cohesion [from strength profile]	Ultimate unit shaft adhesion 'q_s'
All soils to say 6m [allow for max. basement excavation]	Above say 6.0m depth	N/A	Ignore
London Clay	6.0m to 15.0m depth	Increases linearly from 100kN/m^2 at a rate of 6.67kN/m^2/m	Increases linearly from 50kN/m^2 at a rate of 3.33kN/m^2/m [incorporates α = 0.50]

Notes:
a] Unit shaft adhesion 'q_s' = $\alpha \times c_u$ [where α = 0.50 and c_u is the undrained cohesion from the design line]
b] The α value of 0.5 is based upon 102mm diameter triaxial tests and this should not be varied
c] The average shaft adhesion over the pile length should be limited to 110kN/m^2
d] The maximum value for unit shaft adhesion should be limited to 140kN/m^2