CampbellReith
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5 Templewood Avenue
London NW3 7UY

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12466-69

Rev: F1

August 2017

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Appendices

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 5 Templewood Avenue (planning reference 2017/1229/P). The basement is considered to fall with Category C 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 review it against an agreed audit check list.

1.4. The BIA has been prepared by personnel who have suitable qualifications and experience.

1.5. No. 5 Templewood Avenue is a three/four storey detached property which has crawl space basements below half of its ground floor footprint. It is proposed to construct a single storey basement, including swimming pool, beneath the entire ground floor footprint extended beneath part of the rear garden and an enlarged extension on the east side of the house adjacent to No. 5a.

1.6. The scheme will comprise a contiguous bored pile retaining wall to form the extended basement and underpinning beneath the existing walls of the original house. Depths of excavation are anticipated to vary from 3.3m within the existing basement to 7.8m for the swimming pool beneath the rear garden.

1.7. A soils investigation has identified that the basement excavation will encounter Made Ground, Weathered Claygate Member and Un-weathered Claygate Member/London Clay. Monitoring of groundwater has shown that the groundwater level will be within the depth of the proposed basement.

1.8. It is accepted that the proposed basement construction will not impede groundwater flow and that the contiguous bored pile retaining wall will permit flow between the piles below basement level. The proposal to commence construction with the rear part (upslope) of the basement, to confirm whether it is necessary to include a groundwater bypass, is endorsed.

1.9. The BIA correctly identifies that the magnitude of movements during underpinning is dependent upon the adequacy of temporary support and quality of workmanship. The SER did not originally provide an indicative temporary works proposal, however this has been provided in the revised submissions. Care is required during construction to ensure fine material is not removed during pumping operations.

1.10. A heave assessment was undertaken using Pdisp software, with a Ground Movement Assessment (GMA) and Damage Assessment performed for neighbouring properties using the recommendations within CIRIA Report C580. The assumptions used are considered reasonable and the assessments are accepted. The BIA acknowledges that the structure of the basement will need to be designed to enable it to accommodate the heave calculated. The assessment predicts a damage category of 0 (Negligible) for No. 3 and a damage category of 1 (Very slight) for No. 5a Templewood Avenue.

1.11. The documentation recommends suitable movement monitoring and condition surveys to be undertaken.

1.12. It is accepted that the site is not at risk from surface water flooding but proposals to protect the basement entrances and lightwells from surface water ingress are endorsed.

1.13. The previous Audit Report requested clarification of impermeable site areas and SUDS proposals to mitigate off-site discharge flow rates. A SUDS strategy to reduce peak off-site discharge flow rate by 50% of the current rate (including climate change allowance) is proposed in the revised submissions.

1.14. It is accepted that the surrounding slopes to the development are stable and that no known ponds, springlines or wells are in close vicinity to the site, which lies outside the Hampstead pond chain catchment area.

1.15. Queries and matters requiring further information or clarification are discussed in Section 4 and summarised in Appendix 2. Considering the revised submissions, the criteria of CPG4 have been met.

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2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 12 April 2017 to carry out a Category C Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 5 Templewood Avenue, Camden Reference 2017/1229/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 the "*Conversion of 3 existing units to provide 2 units (1x7 bed, 1x1 bed) (C3), including erection of rear and side extensions and plant enclosure to rear, excavation of single storey basement, hard and soft landscaping works*".

and confirmed that the basement proposals did not involve a listed building.

2.6. CampbellReith accessed LBC's Planning Portal on 02 May 2017 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (BIA) dated November 2016 by Chelmer Consultancy Services.
- Structural Engineering Report (SER) and Subterranean Construction Method Statement dated December 2016 by Elliot Wood.
- Tree Report dated January 2017 by John Cromar Aboricultural Co. Ltd.
- Architects Existing & Proposed drawings nos. 1046-S01A, S02 to S11; 1046-AP01A, AP02 to AP13 by Brod Wight.

2.7. CampbellReith received the following relevant documents for audit purposes in July 2017:

- M&E Services and Sustainability Report, ref JB/625 dated January 2017 by ME7 Ltd.
- Outline Substructure Temporary Works Sketches (SK/TW/01-04) rev P1 dated June 2017 by Elliott Wood Partnership Ltd.

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3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	Foreword.
Is data required by Cl.233 of the GSD presented?	Yes	
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	BIA Sections 2 and 3.
Are suitable plan/maps included?	Yes	Included throughout BIA.
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 7.3.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 7.2.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 7.4.
Is a conceptual model presented?	Yes	BIA Section 10.1.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 8.3.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 8.2.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 8.4.
Is factual ground investigation data provided?	Yes	BIA Appendix C.
Is monitoring data presented?	Yes	Standpipes monitored on three occasions.
Is the ground investigation informed by a desk study?	Yes	BIA Appendices B, E, F & G.
Has a site walkover been undertaken?	Yes	
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	BIA Section 2.10.
Is a geotechnical interpretation presented?	Yes	BIA Section 9.
Does the geotechnical interpretation include information on retaining wall design?	Yes	BIA Section 10.4.
Are reports on other investigations required by screening and scoping presented?	Yes	Aboricultural Report.
Are baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	Yes	
Is an Impact Assessment provided?	Yes	BIA Section 10.1 to 10.4.
Are estimates of ground movement and structural impact presented?	Yes	BIA Sections 10.5 and 10.6.

Item	Yes/No/NA	Comment
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	Yes	
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	BIA Section 10.9.
Has the need for monitoring during construction been considered?	Yes	BIA Section 10.7.
Have the residual (after mitigation) impacts been clearly identified?	Yes	BIA Section 10.9.
Has the scheme demonstrated that the structural stability of the building and neighbouring properties maintained?	No	Temporary works proposals to be confirmed.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	SUDS proposal provided in revised submissions.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	
Are non-technical summaries provided?	Yes	BIA Sections 8.5, 9.9 and 11.0.

4.0 DISCUSSION

4.1. This BIA has been carried out by an established firm of consultants, Chelmer Consultancy Services, and the authors possess suitable qualifications and experience to comply with the requirements of CPG4.

4.2. No. 5 Templewood Avenue is a large, three/four storey, detached house situated within the Redington Frognal Conservation Area in the LBC and has partial basements with crawl spaces below half the footprint of the ground floor. It is proposed to construct a single storey basement beneath the full footprint of the house, to include a swimming pool and ancilliary leisure facilities, which will extend beneath part of the rear garden and an extension of the existing two-storey projection on the east side of the house, adjacent to No. 5a. A single car lift will also be installed in the forecourt area.

4.3. The Structural Engineering Report (SER) indicates that the scheme will comprise a contiguous bored pile retaining wall along the proposed rear wall of the basement and its side walls, where they extend beyond the footprint of the existing house, together with reinforced concrete underpinning beneath the existing walls. Founding level of the underpin bases will need to be approximately 4.5m below existing ground floor level of the upper part of the basement (around 97.0m AOD) and approximately 7.3m below existing ground floor level for the pool area (around 94.2m AOD), to cater for anticipated construction thickness of structure, insulation, drainage and finishes. The depths of excavation are identified to vary from around 3.3m, within the existing property with a 1.0m deep crawl space, up to around 7.8m for the swimming pool area beneath part of the rear garden.

4.4. A soils investigation has been undertaken consisting of 2 no. boreholes to 15.0m in depth and 4no. hand dug trial pits to investigate the existing foundations of the property. The boreholes have shown that that excavation will generally pass through Made Ground (0.5m to 1.2m thickness), Weathered Claygate Member (4.2m to 2.6m thickness) and Un-weathered Claygate Member/London Clay to the extent of the boreholes. Groundwater was monitored on three separate occasions and carried between 1.53m to 2.79m below ground level in BH1, whereas in BH2, a groundwater level of 2.05m bgl was recorded, i.e. within the depth of the proposed basement.

4.5. The BIA identified groundwater flow from the rear of the front of the property, down the slope of approximately 7^{o}, northwest to the southeast. It is accepted that given the lack of deep basement beneath No. 5a and adjacent access driveway between Nos. 5a and 3, it is considered unlikely that construction of the basement would cause an adverse impact on groundwater flow. It is also accepted that the contiguous piled wall will permit flow between the piles below basement level, which will help to limit any build-up of groundwater pressure and levels on the upslope side of the piled wall.

4.6. The BIA discusses the possibility of encountering the permeable sand deposit of limited lateral continuity which would require the construction of a groundwater bypass in order to allow continued flow of the groundwater. The proposal to commence construction with the rear part (upslope) of the basement, to confirm whether to include a groundwater bypass, is endorsed.

4.7. The BIA accurately identifies that the magnitude of movements during underpinning operations is dependent upon the adequacy of temporary support and the quality of workmanship. It also notes that special care should be taken to ensure that fine material is not removed during sump pumping operations within the excavation.

4.8. Although the SER gives preliminary structural solutions for the intended superstructure alterations and an underpinning bay layout, no indicative temporary works proposals were originally provided. In the revised submissions, an outline temporary works strategy is proposed indicating sequencing and propping of the works to ensure a high stiffness temporary support will be provided, as required by the Ground Movement Assessment.

4.9. A settlement / heave assessment was undertaken using Pdisp software based on input parameters informed by the site investigation and the proposed construction sequence. The contiguous bored pile wall was assumed to extend 6.0m below basement formation level, giving pile lengths of around 9.5m within the main upper part of the basement, and 12.3m within the proposed pool area. The effect of the tension piles, which were recommended in the BIA to resist hydraulic uplift, were not included in the analyses due to the limited influence they would have on the resulting heave. The assumptions used in the heave analysis are considered reasonable and is accepted.

4.10. The maximum post-construction displacements beneath the slab are likely to range from around 5-10mm of heave. It is acknowledged in the BIA that the structure of the basement will need to be designed to enable it to accommodate the heave developed underneath it.

4.11. A Ground Movement Assessment (GMA) and Damage Assessment was performed, based on the recommendations within CIRIA Report C580, for neighbouring properties No. 3 and No. 5a Templewood Avenues. It is accepted that Templewood Avenue will not be affected by the car lift as it is located approximately 9m from the road edge.

4.12. Numerous assumptions are made in the GMA; it is accepted that heave effects would be beneficial for vertical movement, with a worst case scenario of heave negating vertical settlement. Vertical settlement is considered in response to excavation. A maximum horizontal displacement of 5mm is assumed due to installation and excavation, although this should be based on published data as presented in Figures 2.9a and 2.11a of C580. A separate calculation performed by CampbellReith revealed horizontal movements of approximately 5mm for No. 3 and 7mm for No. 5a. These movements, however, resulted in the same category of damage as predicted in the BIA.

4.13. The assessments predicted a damage category of 0 (Negligible) for No. 3 and a damage category of 1 (Very slight) for No. 5a Templewood Avenue. The results of the GMA are accepted, pending confirmation of the temporary works scheme. The use of best practice construction methods will be essential to ensure that the ground movements are kept in line with those predicted. It is noted that the Burland Damage Category assumes the structures considered are in good condition. The BIA indicates the brick boundary wall separating No. 5 and No. 5a shows significant crack damage, and this should be assessed in detail during the proposed condition survey and movement monitoring.

4.14. The BIA recommends a range of locations for monitoring of building movements which are acceptable and these are included within the SER. The BIA further recommends that a condition survey is undertaken prior to works commencing as part of the Party Wall process.

4.15. It is accepted that the site is not at risk from surface water flooding, although it is understood that flooding occurred to No. 5a in 2002. The BIA accepts that there is likely to be a modest increase in the area of paved surfacing. Both the original BIA and SER identify that the increase in surface water run-off should be mitigated by the inclusion of appropriate Sustainable Urban Drainage Systems (SUDS). In the revised submissions, a SUDS strategy to reduce peak off-site discharge flow rate by 50% of the current rate (including climate change allowance) is proposed, which utilises attenuation storage and a hydrobrake to control the release of discharge off-site.

4.16. The BIA proposes maintaining the channel drain at the rear of the house, raised thresholds to protect entrances to the basement, upstands around the lightwells and non-return valves and above ground loop systems on all outfall drains which connect to the mains drainage system, in order to prevent potential flooding of the basement. These proposals are endorsed.

4.17. The BIA has shown that the surrounding slopes to the development are stable and the basement is not within 5m of an adjacent highway.

4.18. It is accepted that no known ponds, springlines or wells are in close vicinity to the site and the site is outside the Hampstead pond chain catchment area.

5.0 CONCLUSIONS

5.1. The BIA has been prepared by personnel who have suitable qualifications and experience.

5.2. It is proposed to construct a single storey basement, including swimming pool, beneath the entire ground floor footprint extended beneath part of the rear garden.

5.3. The scheme will comprise a contiguous bored pile retaining wall to form the extended basement and underpinning beneath the existing walls of the original house. Depths of excavation are anticipated to vary from 3.3m to 7.8m.

5.4. The basement excavation will encounter Made Ground, Weathered Claygate Member and Un-weathered Claygate Member/London Clay. Groundwater will be encountered.

5.5. It is accepted that the proposed basement construction will not impede groundwater flow. The proposal to commence construction with the rear part (upslope) of the basement, to confirm whether it is necessary to include a groundwater bypass, is endorsed.

5.6. In the revised submissions, an outline temporary works scheme is provided. Care is required during construction to ensure fine material is not removed during groundwater pumping operations.

5.7. A settlement / heave assessment was undertaken using Pdisp software and the assumptions used are considered reasonable and are accepted.

5.8. A Ground Movement Assessment (GMA) and Damage Impact Assessment was performed for neighbouring properties, and although minor discrepancies were identified, the results are accepted. The assessment predicts a damage category of 0 (Negligible) for No. 3 and a damage category of 1 (Very slight) for No. 5a Templewood Avenue.

5.9. The documentation recommends suitable movement monitoring and condition surveys to be undertaken.

5.10. In the revised submissions, a SUDS strategy is presented. Proposals to protect the basement entrances and lightwells from surface water ingress are endorsed.

5.11. It is accepted that the surrounding slopes to the development are stable and that no known ponds, springlines or wells are in close vicinity to the site, which lies outside the Hampstead pond chain catchment area.

5.12. Queries and matters requiring further information or clarification are summarised in Appendix 2. Considering the revised submissions, the criteria of CPG4 have been met.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Yass	5a Templewood Avenue	18/04/17	Surface water flooding threat. Vibration may de-stabilise cracked rear wall	See 4.9 to 4.16

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	Stability	Indicative temporary works proposal requested	Closed	July 2017
2	Hydrology	Calculation to identify increase in paved surfacing requested	Closed	July 2017
3	Hydrology	Attenuation SUDS details requested	Closed	July 2017

Appendix 3: Supplementary Supporting Documents

M&E Services and Sustainability Report, ref JB/625 dated January 2017 by ME7 Ltd.

Outline Substructure Temporary Works Sketches (SK/TW/01-04) rev P1 dated June 2017 by Elliott Wood Partnership Ltd.

ME7

5 TEMPLEWOOD AVENUE,
HAMPSTEAD,
LONDON, NW3

M&E SERVICES AND
SUSTAINABILITY REPORT

JB/625: January 2017 (Planning)

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M&E SERVICES AND SUSTAINABILITY REPORT

CONTENTS

EXECUTIVE SUMMARY

Our client is applying for planning permission to extend this existing building (3No apartments) as part of the process, they are taking the opportunity to significantly enhance the sustainability of the proposed house and apartment; including the potential for renewable technologies. 5 Templewood Avenue is an existing residential building which is to be refurbished into a sustainable low carbon residential development finished to a high end quality standard.

This report has been prepared by ME7 Ltd to demonstrate how the development will achieve a good low carbon status and covers the proposed sustainable design measures related to the building fabric and mechanical and electrical services.

The proposed building has been modelled using an accredited calculation methodology (SAP 2012) and by an accredited energy assessor. Through use of appropriate passive and building fabric design as key points/measures below and energy saving measures; it is shown that the building will release lower net annual CO_2 emissions against baseline levels and satisfies the current Building Regulation Part L requirements and Local Plan.

Key points/measures proposed:

- 21.3% CO2 reduction via onsite renewable energy.
- 64.6% increase (House) 66.28% increase (Flat), in relative building energy efficiency;
  (House Existing 223.0 KWHr/M2/PA – House Proposed 78.95 KWHr/M2/PA).
  (Flat Existing 451.35 KWHr/M2/PA – Flat Proposed 152.2 KWHr/M2/PA).
- 21.5% decrease in relative building CO2 emissions (Cumulative against L1B, including the extension); 42.42% overall reduction.
  (Existing 54,300 KG/M2/PA - Proposed 23,034 KG/M2/PA).
- Corresponding NOx emission reductions and inclusion of new highly efficient heating plant and provision of renewable sources with zero NOx emissions on site.
- 50% reduction in surface water runoff from the site to the local sewer.
- BREEAM DR score of 65.99% (Very Good rating).
- Reusing/recycling and salvage existing materials where possible.
- Reducing water consumption through rainwater harvesting and flow restrictors.
- Utilisation of natural shading, orientation and planting.
- Fully insulating the existing building and providing double glazed windows to all new windows; new build sections will exceed minimum BRegs.
- Increase in air tightness to the building fabric.
- Natural ventilation/openable window provision.
- New materials to be responsibly sourced and life cycle reviewed.
- Inclusion of renewable energy systems (GSHP/ASHP).
- Data logging/internal digital metering for efficient management of the building.

Owing to the above improvements, the PEA (Predicted Energy Assessment – Outline EPC), the efficiency rating has increased from Grade D (63) to Grade B(81) and the CO_2 impact rating from Grade E (50) to Grade B(83).

Included within the report is an appraisal of various renewable technologies, demonstrating their viability and appropriateness to the environment and nature of the development. Note that on-site renewable technologies are not required under planning approval.

It is proposed that a ground source heat pump (GSHP) – main house and a air source heat pump (ASHP) – apartment, system will be suitable for providing heating to the occupied areas, with gas boilers for other areas, back up, pool heating and domestic hot water production. The GSHP/ASHP system will reduce the CO_2 emissions, thereby increasing the PEA. All renewable heat technologies are also eligible for government backed RHI (Renewable Heat Incentive) payments for a period of 20 years.

A detailed description of the proposed electrical and mechanical systems is also included within the report, detailing the energy efficient and sustainable design measures to be incorporated.

Full assessment calculations/reports demonstrating compliance, including L1B compliance, SAP L1A for modelling and PEA (Pre-EPC's); can be found in the Appendices of this report.

The M&E proposals outlined in this report are in line with the London Plan, Camden's Development Control DPD Policies; DP22 and DP23, Core Strategy document CS13 and CPG3, for an existing dwelling being refurbished and extended. The proposals also have regard to the guidance contained within CPG Sustainability (July 2015).

SECTION 2.0

MECHANICAL SERVICES

2.0 - MECHANICAL SERVICES

2.1 Incoming Utility Services (Gas and Water)

New upgraded gas and water utility supplies/meters will be provided to the building. The gas meter/s will be within the building in an external ventilated space and the water meter externally in an underground pit. (Soil conditions confirm that barrier pipe material will be required).

These will be sized to meet the demands of the building.

An additional gas sub-meter (KW/Hr) will be provided with a remote visual display installed to assist in energy monitoring and efficient management as part of the audio visual system.

An additional water flow meter (L/S) will be provided with a remote visual display installed to assist in water monitoring and efficient management as part of the audio visual system.

2.2 Design Conditions

External temperatures:

Winter:	- 8°C saturated
Summer:	32°C (DB) / 20°C (WB)

Internal Temperatures:

Living Rooms	22°C
Kitchen/Dining	21°C
Bedrooms	19°C
Bathrooms	24°C
Hall/Circulation	19°C
Utility	16°C
Plant Area	Background heating by unrecovered waste heat from plant/pipes

2.3 Building Regulations Part L1A/B (2013 – 2016 Rev)

The current part 'L1A/B' of the Building Regulations (2013 – 2016 Rev) consists of minimum requirements for dwellings, briefly consisting of the following:

- Walls, roofs and ceilings need to have adequate resistance to loss of heat.
- Sufficient control needs to be provided for occupants to vary lighting levels, to avoid unnescessary energy use and maximise natural daylight.
- Adequate user control shold be available for heating and cooling to avoid unnecessary energy use and maximise passive measures.

Part 'L1A/B' of the Building Regulations (2013 – 2016 Rev), is also concerned with the conservation of fuel and power and its aim is to maximum the possible contribution that can be made to the Government's target for reducing CO_2 production whilst allowing flexibility for designers. This philosophy will be followed in our designs.

The measures to be implemented/investigated to reduce energy consumption are:

- Specifying an efficient heating system and if gas boilers utilised, these are to be high efficiency condensing boilers with very low NOX levels.
- Optimising the boiler/heat source selection for the building occupancy and reducing energy consumption through controls and management.
- Installing responsive controls and sub-zoning of the building to allow the part load, low energy and economical use of the system. (Adaptive to user occupancy).
- Review of thermal insulation techniques and air tightness.
- Review of renewable energy sources to comply with the limits dictated by The Local Planning Authority.

- Minimising the effect of solar gain in a passive manner, to provide comfort conditions.
- Limiting fan power usage to noted requirements.
- Reviewing extract fan systems and utilising heat recovery and passive natural ventilation where possible.
- Minimising the use of cooling systems for passive measures.

2.4 Heating

The main house occupied areas space heating system will be form a GSHP (COP 4.76) with rear garden horizontal straight pipes and or slinkies. A backup gas fired high efficiency gas fired condensing boiler system will be provided for the pool heating and domestic hot water; replacing older less efficient boilers. An ASHP system (COP 4.3), will be utilised for the apartment space heating and hot water requirements, the ASHP will be metered at the main electrical distribution board.

The heating (Lower Temperature) system will serve LTHW pressurised supplies to the underfloor heating systems in the occupied areas. With towel rails to bathrooms and radiators to other areas.

The main GSHP/ASHP systems and gas fired boilers will be provided with thermal buffer tanks to provide continuous LTHW supplies. Controls will also be weather compensated and user occupation closely programmed and managed.

The gas boilers will be new condensing/very low NOx level units, replacing the old and inefficient gas boilers; this will significantly reduce existing CO_2/NOx emissions.

All pipework to be copper insulated, pex to underfloor systems and PE to extrernal GSHP pipes.

Fresh air and plantroom cooling via louvers at basement level.

All heating zones/spaces will be provided with zone valves, thermostatic control (Thimble sensors or thermostats), to ensure efficient energy use.

All heating zones/spaces will also be controlled by user interface controls to programme occupancy, holiday periods and set back times; again to ensure efficient energy use.

2.5 Water Services

A fully pressurised water system (pumps and tanks), will be provided throughout the house to ensure continuity of supply. If after testing a mains water pressure system is acceptable; this will be adopted. Mains pressure will be used for the flat. The system is to be installed in copper pipework to the sanitary/kitchen appliances, MDPE to external pipes.

The general pressure available throughout the system will be approximately 2.5 bar at the mixers/taps with flow rates accommodated to the sanitary appliances and shower mixer valves in accordance with the Part 'G' calculator; low flow/restrictors.

The boosted house system will operate on a variable speed pump principle to maintain a constant pressure throughout the system and limit energy use. Pressure regulating devices will be required to some areas. All sanitary fittings/plant will be individually and zone valved. All pipework to be copper insulated.

Consideration will be given to a leak detection system to provide early warning of any leaks in the systems, to minimise any water loss/damage.

2.6 Domestic Cold Water

Cold water will be mains pressurised throughout. Filtered mains drinking water will be provided to the main kitchens and the basins within each principle en-suite bathroom.

Cold water mains supplies will be provided to the plantroom for general washing and filling.

A Hydromag water conditioner will be provided within the plant spaces providing conditioned water to the hot water cylinders, as well as all the baths and shower accommodation. (Conditioned water will ensure optimum energy performance due to limiting scale build up in plant/ pipework).

2.7 Domestic Hot Water

The main house hot water cylinders located in the plant room will be provided with boosted and conditioned cold water. The systems proposed ensure that all peak demands will still be met efficiently.

For the main house, hot water will be primarily produced by efficient gas boilers, additional heat recovery systems are to be considered. The small flat will have an efficient ASHP – COP 4.76 (Dual space heating unit), providing all hot water.

Hot water production shall be strictly controlled by weather compensation, timeclock control for occupancy times and maximisation of plant duty. (Conditioned water will ensure optimum performance due to limiting scale build up in plant/pipework).

All sanitary fittings will be protected by TMV2 valves (Thermostatic mixing valves), above the minimum Part 'G' requirements.

2.8 Recycled Rainwater

The rainwater recycling drainage system (see 2.14), provide recycled rain water for general washdown and irrigation supplies. This will reduce the reliance on treated mains water and also reduce surface water runoff.

2.9 Natural Ventilation

Background habitable room ventilation is generally to be provided by trickle vents incorporated into windows, walls or roofs.

Rapid/purge ventilation to spaces will be provided by openable windows/ continuous natural ventilation.

2.10 Fresh Air Systems

Fresh air fan units with heat recovery are to certain basement rooms to provide 90% heat recovery and improve air tightness of the fabric. The units will also incorporate a summer bypass to allow pre-cooling of the fabric/ spaces over-night and during hotter periods.

This is to provide ducted fresh air/extract to all rooms, to fully comply with Part 'F' of the Building Regulations. Ductwork to be pre-insulated PVC.

The pool hall ventilation and heating is by others but based on a heat exchanger recovery system with a controlled environment.

2.11 Bathrooms, Cloakrooms and Kitchen Ventilation

Small intermittent/ MEV extract ventilation units will be provided for the purposes of sanitary accommodation and kitchen ventilation. These dedicated fan systems shall comprise of isolated (low energy/noise) ducted fan units located either within ceiling voids/ ducts and discharge to the main roof areas or locally to facades through aesthetic grilles.

Ductwork to be PVC.

MVHR (Whole house heat recovery) to be utilised to the basement pool and all basement areas, other systems may also be considered to further increase heat recovery and energy efficiency.

2.12 Plantroom/Pool Ventilation

The plantrooms will be provided with natural supply/mechanical fans and extract grilles suitably sized to provide fresh air and control heat build up. Pool ventilation/ environment by a specialist.

2.13 Automatic Controls

Automatic control systems will be provided for all of the mechanical services. It is anticipated this will be installed as a complete DDC/MCC electronic system supervised by a touch screen control/PC positioned within the plantroom of the main house.

The client will also have the facility for zoned overrun of various systems and time switch control separate to the main plantroom, via a PC interlink situated within the study.

Full remote off site access will also be provided via a modem to this system enabling an ongoing maintenance contract to be provided with the system installers and for the occupiers to efficiently control the systems.

The system will have remote interface modules which will allow the client operation of the heating and cooling, lighting and other systems via the audio visual keypads. Where this is not provided, individual room control will be provided with more basic visual/manual controls.

Controls are to be zoned to provide more efficiency, occupancy control and management.

2.14 Above Ground and Foul Drainage

The above ground drainage system shall be provided to serve all the sanitaryware accommodation.

It is anticipated that either HDPE acoustic pipe or cast iron pipework will be provided, fully insulated for both thermal and acoustic reasons, with individual local run-outs individual to the sanitary accommodation being in good quality UPVC drainage pipework.

All basement area drainage will be pumped via a separate pumping chamber to protect the basement.

Installation of leak detection systems will be considered to detect leaking water hidden in areas such as voids and shower trays etc. This is being considered to protect the building fabric and internal fixtures and fittings and to minimise leaks/wastage of water.

All external drainage shall be UPVC or clayware; pumped mains in MDPE.

2.15 Rainwater Drainage

All rainwater pipes will be routed from roof levels/terraces to drain points at ground floor level. All roof gutters/outlets/RWP's will be sized to take a rainfall intensity of 108 mm per hour. All pipes shall have access before connecting to underground drains. All external rainwater stacks are to be either aluminium or cast iron. All external rainwater stacks are to be either aluminium or cast iron and where installed internal, the stacks shall be thermally/acoustically insulated. Basement terraces/lightwells are to be fully pumped to protect the basement..

2.16 Recycled Rainwater - Irrigation Water

The rainwater recycling drainage system will provide recycled rain water for general washdown and irrigation supplies. This will reduce the reliance on treated mains water and reduce surface water runoff, water is derived from the storm attenuation tank.

2.17 SUDS/Surface Water Drainage

An underground rainwater harvesting tank will be provided within the surface water drainage system – within the rear garden; positioned in accordance with the tree specialist advice. The system is designed too collect water from the main roof areas for surface water retention and recycling for washing down/ irrigation.

A surface water retention tank and discharge pumps shall be provided as part of the harvesting tank to reduce outflow to the sewer. An HRD hydrobrake will be utilised to limit outflow to 5L/S. It is intended to drain the rear half of the house (RWP's and gullies), to the retention tank (19M3), to reduce peak outflows to 50% below the existing discharge level; with 20% factor for climate change based on a 1:100 and 1:30 year storm events.

This combined with rear garden natural percolation and small front driveway flower beds; will assist in reducing the site surface water discharge levels.

The BIA indicates that soakaways are not possible/effective and that flooding is a low risk.

The storage volume proposed is $19m^3$ within the retention tank, excluding chambers and pipework.

Rear garden land drains are to be incorporated to drain any excess ground water above the clay layers.

All external drainage shall be UPVC or clayware.

2.18 Comfort Cooling

The building will be upgraded/ designed to limit heat gains by; thermal mass, upgraded double glazed windows and improved fabric, internal blinds, tree shading, planting, openable windows (natural ventilation) and underground spaces.

Comfort cooling will be provided only to some spaces - as a peak day measure.

This is proposed to be via a very high efficiency ASHP system. This to be tied to Mitsubishi air cooled condensing plant within attenuated enclosures sensitively positioned in acoustic enclosures, serving internal DX fan coils. Additional heat rejection/ heat recovery will be considered to the domestic hot water system in summer conditions.

This system would operate at a COP of 3.70

The fancoils will be able to 'boost heat' rooms simultaneously to the underfloor heating, with some spaces being only fancoil (ASHP) heated.

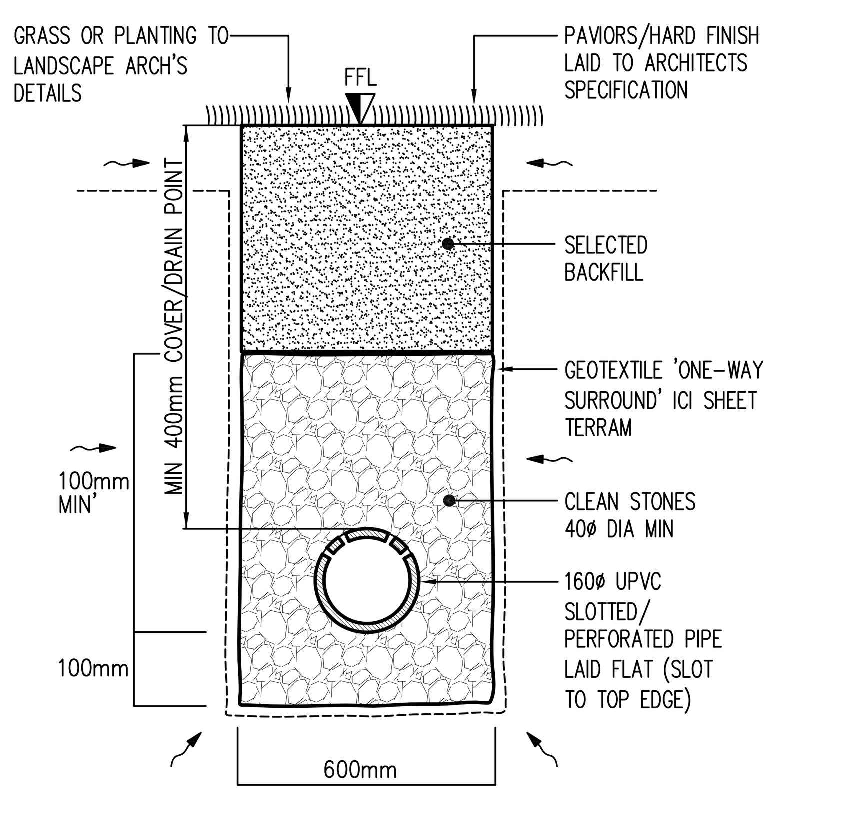
Cooling for each room will be provided by a mixture of horizontal/ vertical fan coil refrigerant R410A units mounted either within joinery or false wall/ceiling details. Pre-insulated discharge ductwork will be attached to these fan coils to discharge through high induction linear grilles incorporated within joinery/coffers and wall finishes at high level. The fan coil units will have very low noise levels, NR25-30.

A habitable room refrigerant gas sensor system will be incorporated to provide safety/protection in accordance with FGAS requirements.

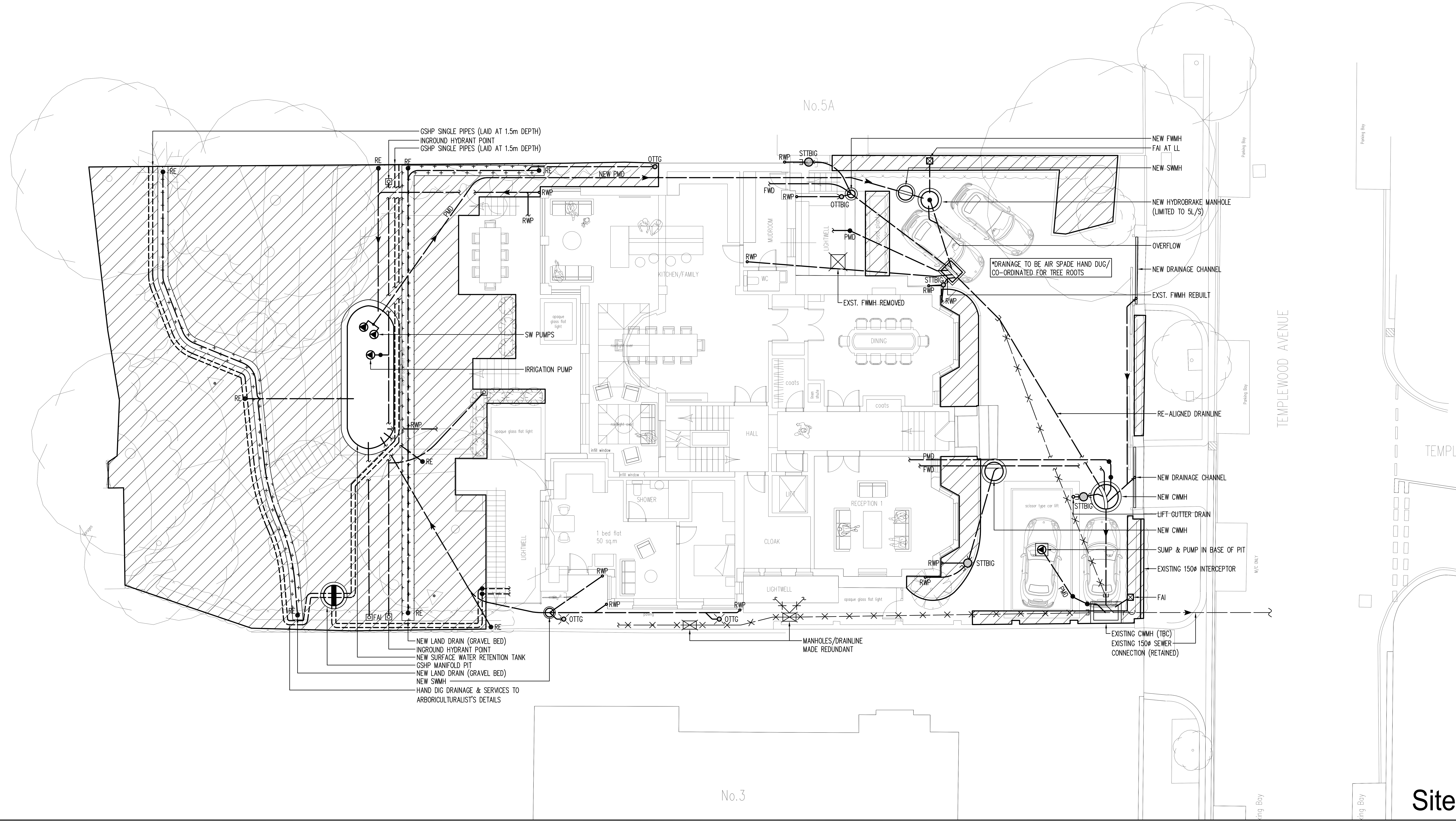
Each room/space will have individual control via a remote room controller to each fan coil, controlled via a discrete room sensor for operation or modification to the set point of the controllers. (Fan speed/temperature).

KEY

SOFT/GRASS AREAS (PERMEABLE SURFACE)



LAND DRAIN DETAIL (NTS)



Note

ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE SETTING OUT OR MAKING ANY SHOP DRAWINGS. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE CONSULTANT ENGINEER'S SPECIFICATION.

Orientation

Rev./Date	REVISIONS
P 30.08.16	PRELIMINARY ISSUE
P1 07.10.16	PLANNING ISSUE
P2 23.01.17	DRAINAGE REVISION

ME7

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Description

SITE PLAN
DRAINAGE SERVICES

Project

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HAMPSTEAD
LONDON
NW3 7UY

Architect

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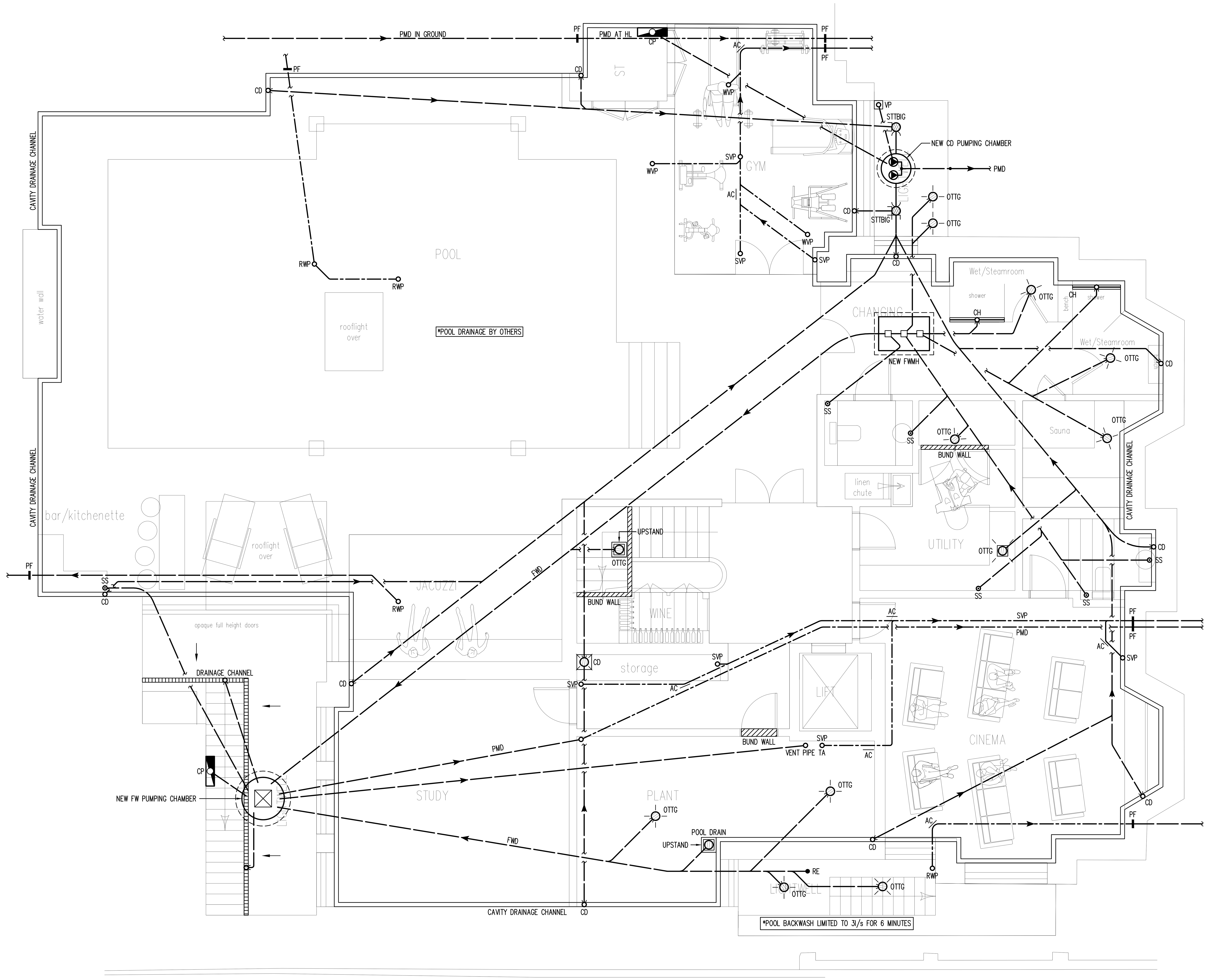
Scale	Drawn
A1 @ 1:100 A3 @ 1:200	JB / DC
Date: AUGUST 2016	Checked

Issue: PRELIMINARY

Site

Project No.	Services	Dwg No.	Rev.
625	D	1	P2



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Description

BASEMENT
DRAINAGE SERVICES

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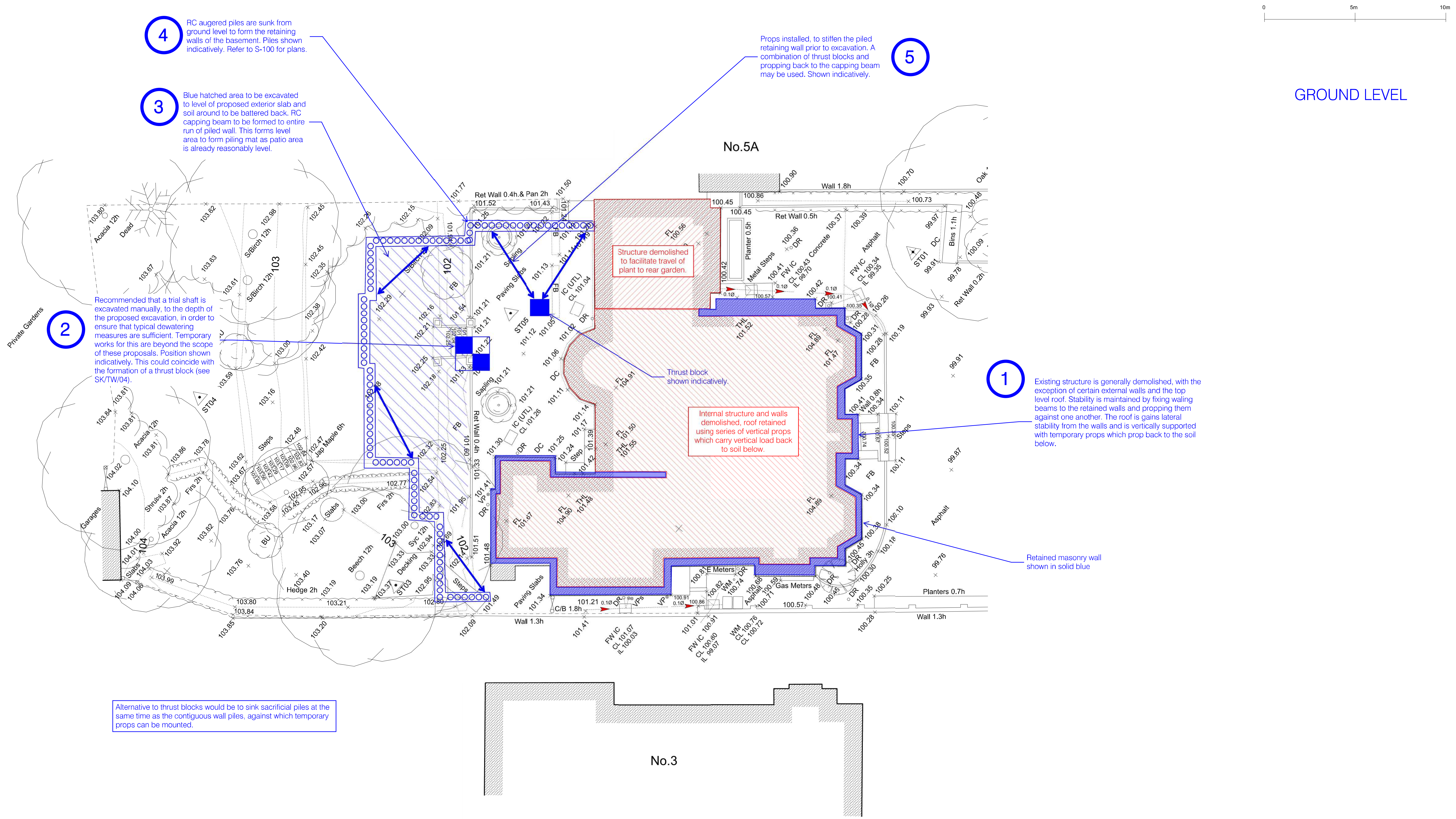
Scale	Drawn
A1 @ 1:50 A3 @ 1:100	JB / DC
Date: AUGUST 2016	Checked

Issue

PRELIMINARY

Basement

Project No.	Services	Dwg No.	Rev.
625	D	2	P1



sketch title
Outline Substructure Temporary Works 1/4

SKETCH

scale (s)	date	drawn
1:200@A3	June '17	HSt

elliottwood

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project
5 Templewood Avenue

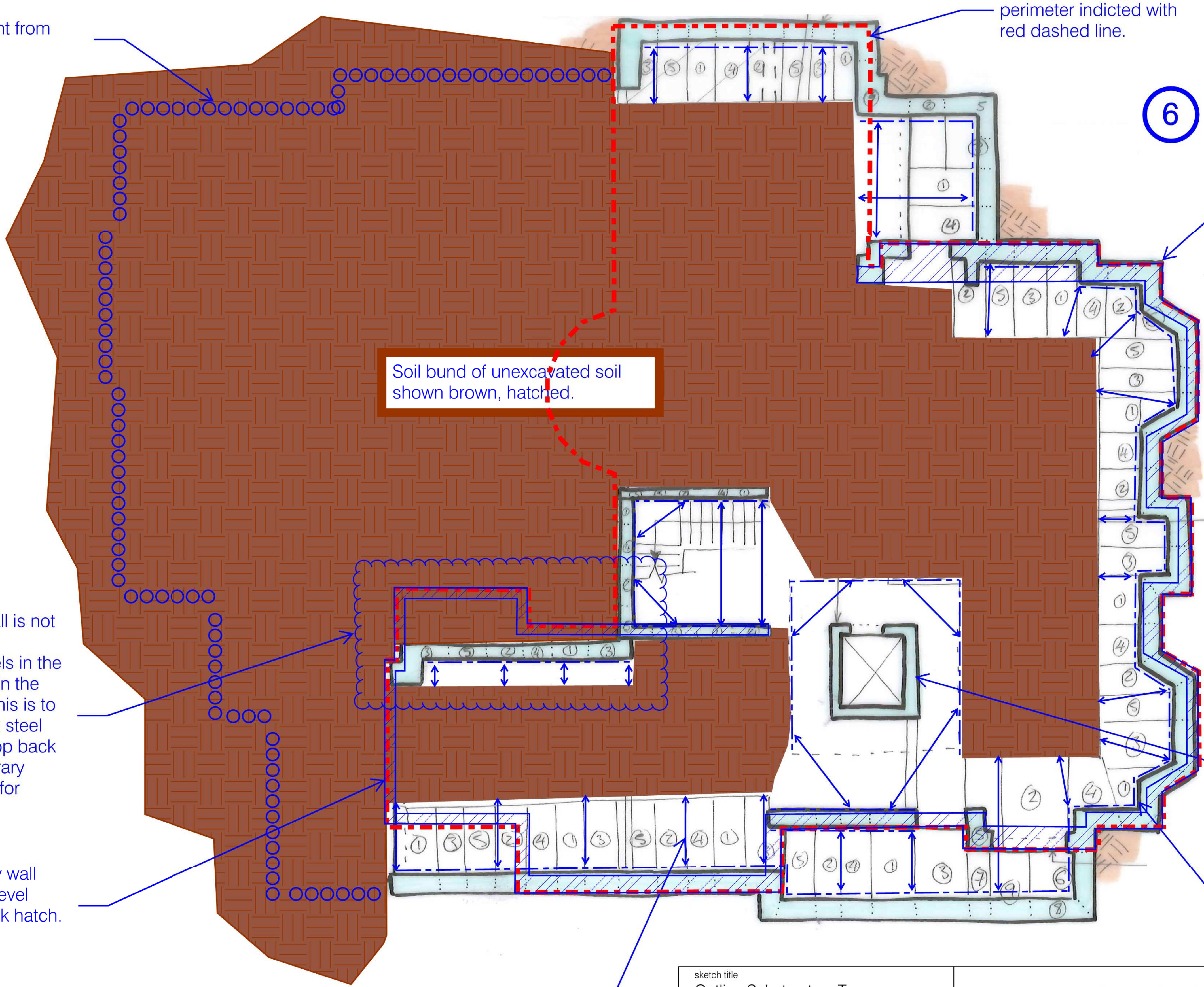
Project no.
2150493.01

Sketch no.	revision
SK/TW/01	P1

BASEMENT 1 LEVEL

Piles present from stage 2

Existing building perimeter indicted with red dashed line.



6

L-shaped, RC Underpins formed in sequence shown, propping back to the earthen bund at high and low level to prevent sliding and rotation. Propping back to bund shown indicatively on plan drawing. Waling beams installed at high and low level, against which props are mounted.
Note multiple shafts will be necessary to form the various sections of underpins.

Waling beams, props and spreader plates to be determined during detailed design phase.

Where the bund is not propped against, it will be battered back, as required.

We note that L-shaped retaining walls and underpins are all to be formed in an underpinning sequence, regardless of the presence of existing wall above.

7

Form RC core bases and core walls in shaft. Sides of shaft propped similarly to shown on plan with waling beams and spreader timbers.

Steel waling beam resin fixed to the L-shaped RC retaining walls at high and low level.

Where existing wall is not underpinned, it is supported by steels in the permanent case. In the temporary case, this is to be supported with steel needles which prop back to suitable temporary footings. Omitted for clarity.

Retained masonry wall above at ground level shown in brickwork hatch.

Steel props between steel waling beam and timber spreader beams on earthen bund.

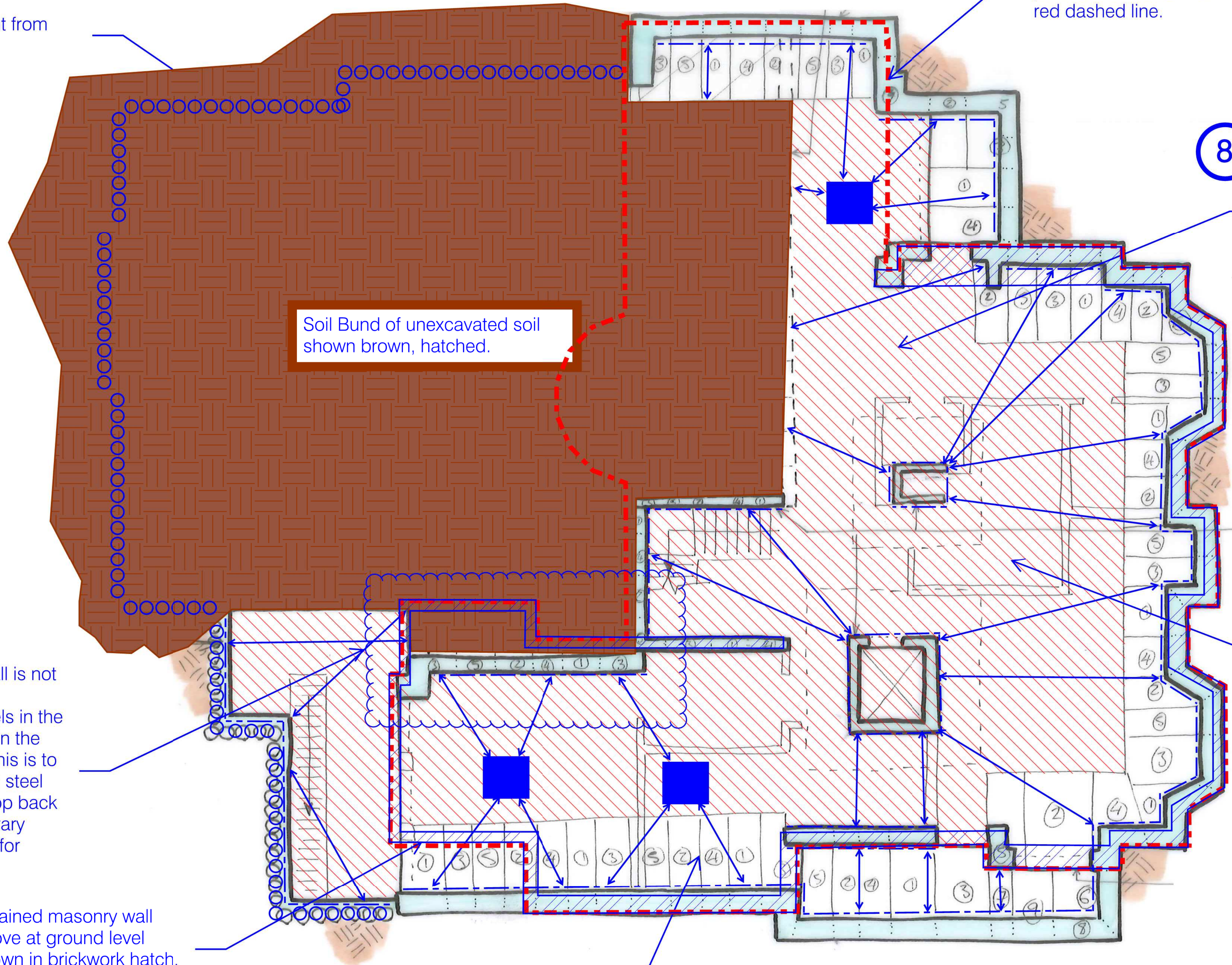
<u>Alternative Solution to propping underpinning:</u>
Underpins are backfilled with soil and well compacted in max 150mm layers to provide horizontal restraint to retaining walls.

sketch title Outline Substructure Temporary Works 2/4 SKETCH scale (s) 1:100@A3 · date June '17 · drawn HSt	elliottwood Elliott Wood Partnership Ltd **Wimbledon • Central London • Nottingham** Consulting Structural and Civil Engineers tel: (020) 7499 5888. www.elliottwood.co.uk	project 5 Templewood Avenue Project no. 2150493.01 Ske:ch no. SK/TW/02 revision P1

BASEMENT 1 LEVEL

Piles present from stage 2

Existing building perimeter indicted with red dashed line.



8 Soil Bund excavated down to basement level under the main part of the house. Temporary props replaced with thrust blocks, formed in shafts through earthen bund. and new props.

9 Slab at basement level under main house poured, followed by the RC liner walls to the piles and the slab at ground level *throughout*. Once these have cured sufficiently, slabs provide lateral restraint to the piled and L-shaped retaining walls at basement and ground floor levels, except in lightwells, where the permanent structure is designed to span. Basement slab area to be cast in this step shown with red diagonal hatch.

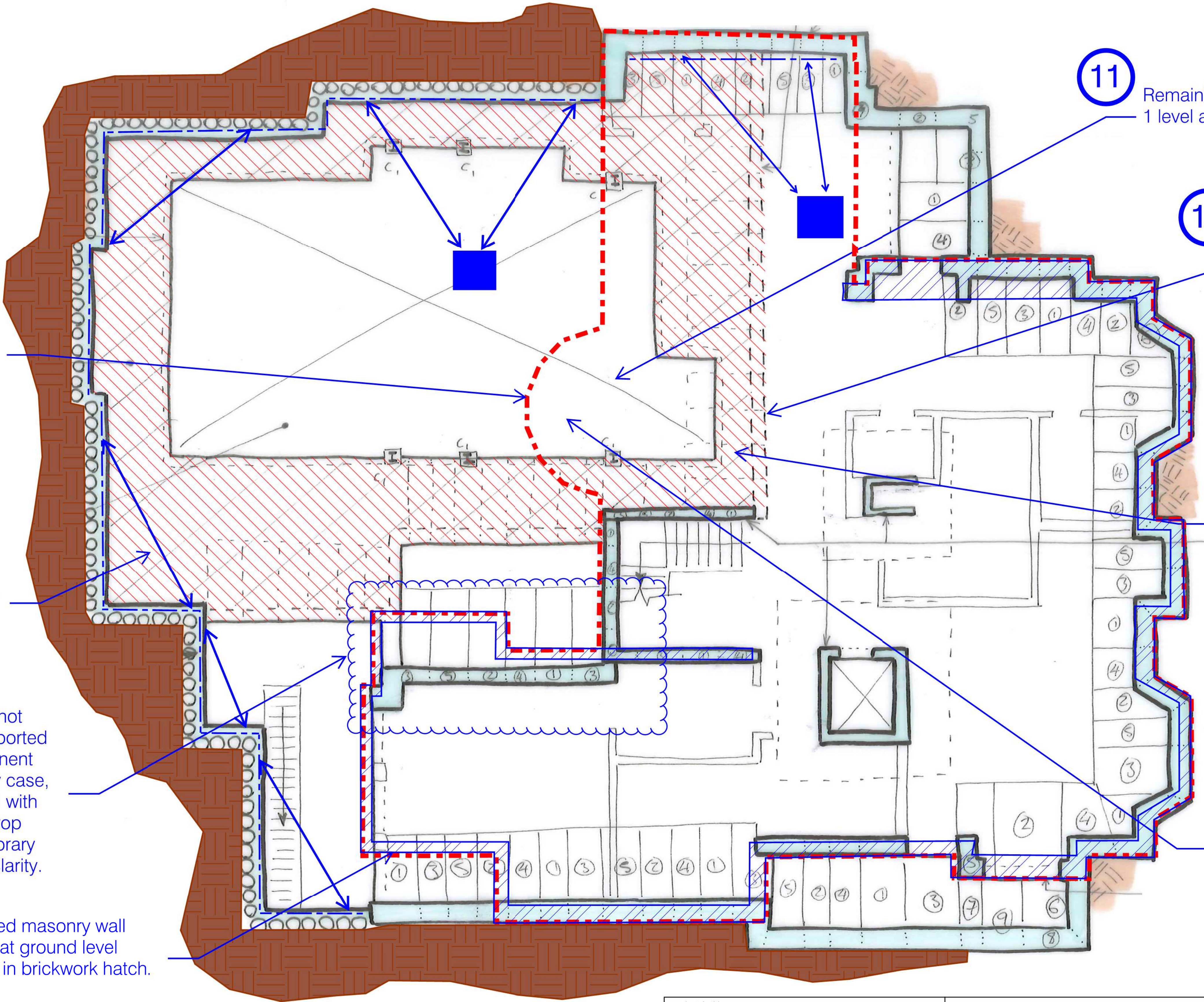
Where existing wall is not underpinned, it is supported by steels in the permanent case. In the temporary case, this is to be supported with steel needles which prop back to suitable temporary footings. Omitted for clarity.

Retained masonry wall above at ground level shown in brickwork hatch.

Steel props between steel waling beam and timber spreader beams on earthen bund.

sketch title Outline Substructure Temporary Works 3/4 SKETCH scale (s): 1:100@A3 · date: June '17 · drawn: HSt	elliottwood Elliott Wood Partnership Ltd **Wimbledon • Central London • Nottingham** Consulting Structural and Civil Engineers tel: (020) 7499 5888. www.elliottwood.co.uk	project 5 Templewood Avenue Project no.: 2150493.01 Ske:ch no.: SK/TW/03 revision: P1

BASEMENT 1 LEVEL



Existing building perimeter indicted with red dashed line.

10 Piles are laterally restrained by the slab at ground level. Shafts sunk through slab to form thrust blocks at formation level.

Where existing wall is not underpinned, it is supported by steels in the permanent case. In the temporary case, this is to be supported with steel needles which prop back to suitable temporary footings. Omitted for clarity.

Retained masonry wall above at ground level shown in brickwork hatch.

11 Remaining earthen bund excavated to basement 1 level and props provided at lower level of piles.

12 Pool level underpins are formed in a similar manner to that of the basement level. shafts are backfilled with compacted soil upon completion of each underpin, instead of propping.

13 Suspended slab around pool is cast at basement level, as well as the remaining RC liner walls. Slab area to be cast hatched red. Once cured, this provides lateral restraint to the remainder of the retaining walls and remaining lateral props can be removed.

14 Pool area is excavated, including under the slab. This reduce dig is fairly modest so underpins and RC piles do not require lateral restraint at lower level; they are designed to resist this load. Slab is cast below the pool, to provide waterproofing to the service void below the pool. **Basement temporary and permanent works considered substantially complete.**

sketch title: Outline Substructure Temporary Works 4/4	elliottwood	project: 5 Templewood Avenue
SKETCH	Elliott Wood Partnership Ltd	Project no. 2150493.01
scale (s): 1:100@A3; date: June '17; drawn: HSt	Wimbledon • Central London • Nottingham Consulting Structural and Civil Engineers tel: (020) 7499 5888. www.elliottwood.co.uk	Sketch no. SK/TW/04; revision P1

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