PRICE&MYERS

REPORT

32 Ferncroft Avenue NW3

Basement Impact Assessment

Contents

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Job Number: 24354

Date	Version	Notes / Amendments / Issue Purpose
July 2015	1	Issued for Planning Submission
2016	2	Updated Following Camden Audit Comments

Executive Summary

This report should be read in conjunction with the K F Geotechnical report reference G/031219/001 dated 5th April 2012, see Appendix E. It demonstrates that the technical challenges of building a basement extension to this house can be overcome by carefully sequencing the construction work, design to resist the water pressure from groundwater on the site, and designing the new drainage to limit the flow of water off site and to include pumped drainage from the basement level with non-return valves to prevent the basement flooding due to high water levels in the street sewers.

1 Introduction:

The site is on the north side of Ferncroft Avenue; with its western boundary the back of the gardens of the houses in Hollycroft Avenue. It can be described as "sensibly level". There are no main utility services, tunnels or other infrastructure under the site.

BIA Screening

This report has been prepared as an update to the "Report Statement for Planning" dated 8th May 2012 prepared by Vincent & Rymill Consulting Engineers. That report was prepared at the same time as a report for 34 Ferncroft Avenue; since that time a basement extension has been built under number 34; with an overall layout very similar that now proposed for number 32.

The first stage of a basement impact assessment is the screening of issues, to identify any that need further review to determine whether or not a full BIA is required as noted in clause 2.12 of the September 2013 edition of CPG4. The screening report from 2012 is reviewed below:

Subterranean, ground water, flow	Response
Is the site located directly above an aquifer?	See note
Will the proposed basement extended beneath the water table surface?	Yes: see note
Is the site within 100m of a watercourse, well or potential spring line?	No
Is the site within the catchment of the pond Chains on Hampstead Heath?	No; see note
Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	See note
As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No; see note
Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just ponds chains on Hampstead Heath) or spring line.	No
Slope Stability	
Does the existing site include slopes, natural or manmade, greater than 7°? (approximately 1 in 8)	No

Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7°? (approximately 1 in 8)	No
Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°? (approximately 1 in 8)	No
Is the site within a wider hillside setting in which the general slope is greater than 7° ? (approximately 1 in 8)	No
Is the London Clay the shallowest strata at the site?	See note
Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree zones where trees are to be retained?	No
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	No
Is the site within 100m of a watercourse, well or potential spring line?	No
Is the site within an area of previously worked ground?	
Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No See Note
Is the site within 50m of the Hampstead Heath ponds	
Is the site within 5m of a highway or pedestrian right of way?	No
Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	See note
Is the site over (or with the exclusion zone of) any tunnels e.g. railway lines?	No

Surface flow and flooding

Is the site within the catchment of the pond chains on Hampstead Heath?	No
As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No
Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	See note
Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	See note

Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No
Is the site in an area known to be at risk from Surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	See note

BIA Scoping Discussion

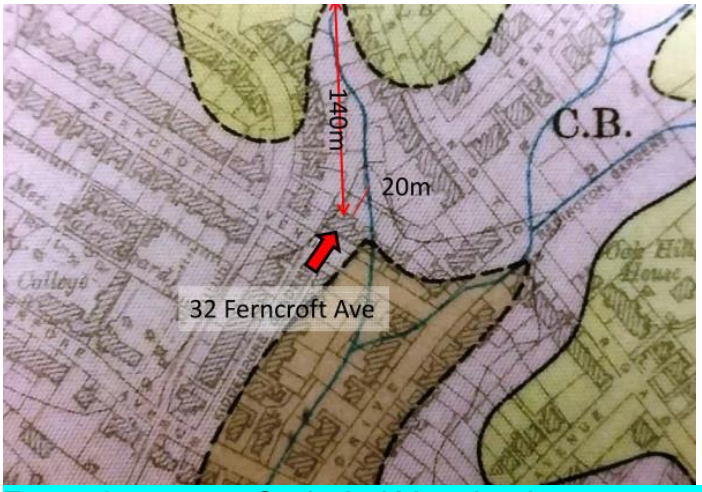
This stage of the BIA is to identify the potential impact of the scheme; and thus the extent of stage 3, site investigation; and stage 4, impact assessment work that is appropriate and required. The report from 2012 and the notes above identify the following issues where the screening questions cannot be answered with a simple "no". These issues are:

Subterranean, ground water, flow – question 1

The site may be directly above the bedrock aquifer; the impact of this is assessed in section 4 of this report.

Subterranean, ground water, flow – question 2

In order to respond to the BIA Audit Query number 7 advice on ground water flow has been sought from a hydrogeologist; on their advice an additional borehole investigation has been carried out and ground water levels have been monitored in three boreholes during January 2016. Report reference J15356/GT/1 prepared by Geotechnical & Environmental Associates. These boreholes encountered water at 3.5 to 4.5m below ground level during drilling but on monitoring water levels were recorded at around 1.25m below ground level at the rear, garden, end of the site and 2.5m below ground level in the front, street end of the site. These results would appear to indicate at least some seasonal flow of groundwater from north to south across the site, probably associated with rainfall runoff down the hill on which the house stands; this is consistent with the stream, now in a culvert, shown on the 1920's geological map running from north to south, parallel for a time with the rear gardens of Hollycroft Avenue and then under the location of either 38 or 40 Ferncroft Avenue; see figure below.



Extract from 1920s Geological Map showing stream to north and east of site

It should be noted that the construction of the basement to number 34 did not encounter any significant groundwater flow and that the back gardens of the houses in Hollycroft Avenue provide a clear path for groundwater to flow around both the existing and proposed basement to number 32. Thus the extension of the basement is this not

expected to have any adverse cumulative effect on the overall groundwater flow down the hill. In order to minimize any impact on groundwater flow past the basement when the ground water level is high the design of the new basement will provide a path for water to run under the slab.

Subterranean, ground water, flow – question 3
The only comment to make here is that the site does not lie within the catchment area of any of the Camden pond systems; the 2012 report incorrectly suggested that the site was within the catchment area for the Golders Hill Chain. So the effective answer to the question is therefore a "no"; and no further consideration of this issue is required.

Subterranean, ground water, flow – question 4 & Surface flow and flooding - question 3
The bulk of the extension is under the footprint of the existing house; however there is a very small increase in the area, around 30m^2 of hard paving resulting from the proposed work. This is due to creating the small lightwell to the front of the house and in increasing the paved area at the rear in forming the courtyard at the new lower ground floor level. The surface water drainage from these areas will be pumped into the existing drainage system with a peak flow of 1.13l/sec. See section 4 of this report for details of the site drainage proposals.

Subterranean, ground water, flow – question 5
The report from 2012 stated "no" as the impermeable area was unchanged; as noted above there is a small change around 30m^2 in the impermeable area. However as the drainage will all be directed to the public sewers there will be no infiltration into the ground and hence no increase in the discharge volume into the ground; so no further consideration of this issue is required.

Slope Stability - question 5
The report from 2012 stated "no"; and the geological records for the area show the expected sub-soil to be Head Deposits over Claygate Beds above London Clay. A further historic site borehole investigation from 2002, prepared when a ground floor rear extension was added to the house, describes the ground as "silty clay with partings of orange and brown silt and fine sand", understood to be the Claygate Beds to about 5.7m below ground level. The intrusive site investigation report prepared for potential work at 32/34 Ferncroft Avenue by K F Geotechnical dated April 2012 notes that below 400mm of made ground the subsoil is an initially firm sandy, silty clay; becoming stiffer at depth and proved to a depth of 10m; described as London Clay. It may be that this borehole at the front of the house is close to the edge of the geological boundary between the Claygate Beds and the London Clay, otherwise it would appear that the description of London Clay below the made ground is a mis-understanding. The clay on testing was found to be desiccated to a depth of 2m but not below that depth; the report therefore recommended that the design for basement retaining walls might allow for some heave pressures. However constructing the basement will place the foundations of the house below the level of desiccation so that the risk of any future subsidence will become minimal. It is therefore considered that no further consideration of this issue is required.

Slope Stability - question 10
The update site investigation has shown that the basement construction may involve construction below the water table if work is carried out when the water table is high; despite the fact that groundwater was not encountered when constructing the basement to number 34. In the anticipated silty slightly sandy clay soil, it is expected that some minor seepage, rather than significant water inflows, may occur, especially if the work is undertaken following wet weather; this will be controlled by using face boards on the excavation a sump-and a pump to take water out of the excavations.

Slope Stability - question 12
The lightwell is just within 5m of the footpath; as noted in the 2012 report the basement retaining structure will be designed to allow for a suitable surcharge load from the highway. Care will also be taken in design and construction of the side lightwell that is very close to the site boundary with the rear gardens of houses in Hollycroft Avenue. Detail discussion of the new proposals in section 3 of this report is considered as a sufficient consideration of this issue.

Slope Stability - question 13
The proposed basement to number 32 will result in the foundations of this house matching very closely the foundation depth of the newly extended basement to number 34; so the proposed work will significantly reduce the current differential depth of foundations to the adjacent building. The house is so far from the buildings in Holycroft Avenue that the basement construction will have no effect on the foundations of these houses. It is therefore considered that subject to constructing the basement in accordance with the sequence noted in section 5 below no further consideration of this issue is required.

Surface flow and flooding - question 6
Ferncroft Avenue was flooded in 1975 as noted in the 2012 report; and as listed in Appendix 4 of the Floods in Camden Report of June 2003. The 2012 report assumed that drainage improvements had been made to improve the situation; but these may been limited in scope. Therefore in accordance with Camden Planning Guidance, CPG4, a site specific Flood Risk Assessment is required of the flood risk to the proposed development and the risk of loss of life, and to recommend if any flood mitigation measures are required; see section 4 of this report.

In summary it is considered that the available site investigation provides sufficient information to allow a construction methodology to be established for the building work and that the drainage design can mitigate the effect of the marginal changes in the volume of water discharged off site. No further site investigation is required and the following sections of this report describe how the design and construction will minimise any potential movement of the adjoining property, number 34 where any damage caused as a result of the basement construction is expected to be no more than very slight.

2 Surveys and Ground Conditions

An intrusive site investigation has been carried out by K F Geotechnical and a report prepared for potential work at 32/34 Ferncroft Avenue dated April 2012. This showed that the subsoil was London Clay and desiccation was evident to about 2m below ground level. Ground water was struck in the borehole at about 8.4m below ground level; well below the proposed basement level.

3 Structural Proposals

Introduction
This modest proposed basement extension is to increase the existing basement footprint so that it extends over the full ground floor area of the house; matching the recently completed extension at number 34. There are minor alterations proposed to the upper floors of the house generally limited to relocating doors although a new steel support is expected to be required to support the rear wall at first floor when it is moved to align with the next door property.

Permanent Works

The outline structural scheme for the basement extension showing the new retaining walls and proposed underpinning of the perimeter walls of the house is shown on sketch drawings 24354/sk1 & sk2; with further detail on the kitchen extension on sk3.
New basement perimeter walls will be formed in concrete designed to span vertically between the basement and ground floor levels; soil design properties will be as described in the site investigation report. The existing timber ground floor will be strengthened, or replaced as required, to allow it to act as a prop to the retaining walls. The existing retaining walls appear to be propped by the floor; as otherwise calculations would indicate that they would not be able to function as retaining structures. See appendix D for a preliminary retaining wall calculations.
Internal basement walls will be retained where possible with new loadbearing walls built in 140 concrete block.

The new basement slab will be designed to resist the upward force from the expected head of groundwater that will be present, at least seasonally after rainfall; see the updated statement on ground water flow. The design value, taken as a 2.0m head above the proposed basement level, is a pressure of 20kN/m^2. See appendix D for updated design calculations.

This design will also cater adequately for any potential heave forces as the design water pressure is about equivalent to the heave pressure that might exist. For a 3.5m excavation a total unloading of around 70kN/m^2 would be expected; with around 50% of the total heave movement, of around 20mm, expected to happen during construction. This would imply that a heave load of 35kN/m^2 might be expected on a rigid ground bearing slab, with a deflection of 10mm after construction work is complete. However as the slab proposed is relatively thin and flexible the design heave pressure might be expected to be around 15kN/m^2 to 20kN/m^2 if the slab were to deflect upwards 5 to 10mm. As this movement would be acceptable and the slab can only be loaded either by water pressure or heave, as the effects are not cumulative, no further consideration of heave is required.

A minimum thickness of 150mm of free draining gravel will be incorporated into the construction below the ground bearing slab so that ground water flow down the hill under the house is not impeded by the enlarged basement. This material will incorporate a well designed sand and geotextile filter system at its perimeter to ensure that any fine material from the Head Deposits or Claygate Beds does not wash into the free draining material and clog the drainage over time.

The new basement concrete walls are to be designed as water resisting and a drained cavity system will be installed to provide a waterproof construction for the habitable basement. The drained cavity will have a pumped outflow to the street sewers; details of this amendment to the existing pumped drainage system in the basement will be agreed with Thames Water.

Temporary Works

Temporary works will be required to provide lateral restraint to the ground outside the basement at all stages of the construction process and to support the existing superstructure of the house until the new internal basement support walls and footings are completed. It is proposed to construct first an excavation on the rear wall of the house near the back garden, so on the 'up-stream' face. This will act as a trial pin, to confirm the groundwater conditions and that the planned groundwater control measures will work. If conditions prove worse than anticipated, work will be paused and a revised groundwater control method can be put in place.
An outline temporary works proposal is shown on sketch drawings 24354sk tw1, sk tw2, sk tw3, & sk tw4. These drawings identify the extent of the underpinning to existing walls, with a suggested underpinning sequence; show new concrete retaining walls generally assumed to be built in an underpinning sequence and designed as cantilever walls; note the suggested temporary works support to the chimney stack adjacent to the main entrance to the house whilst the

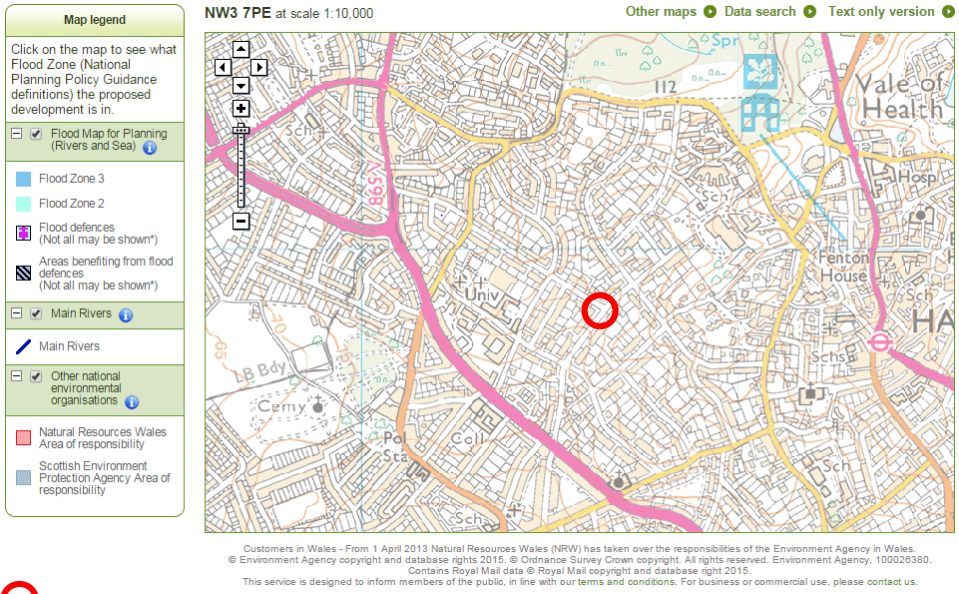
basement is excavated; and indicate the propping needed to the existing box frame to allow construction of the new basement below this area.
Final temporary works design will be prepared by the Contractor and agreed with the client's Engineer; design loadings will be based on the soil parameters used in the preliminary calculations and design surcharge loads will generally be 10kN/m^2 especially close to the public highway.

4 Flood Risk Assessment & Site Drainage Proposals

Flood Risk Assessment

- **Flood Risk from Watercourses: Fluvial/Tidal**

The Environment Agency's – EA's - indicative floodplain map, below, shows that the site is not at risk of flooding from the River Thames. The map shows that the site lies in Flood Zone 1, an area with less than 0.1% annual probability of tidal and/or fluvial flooding.

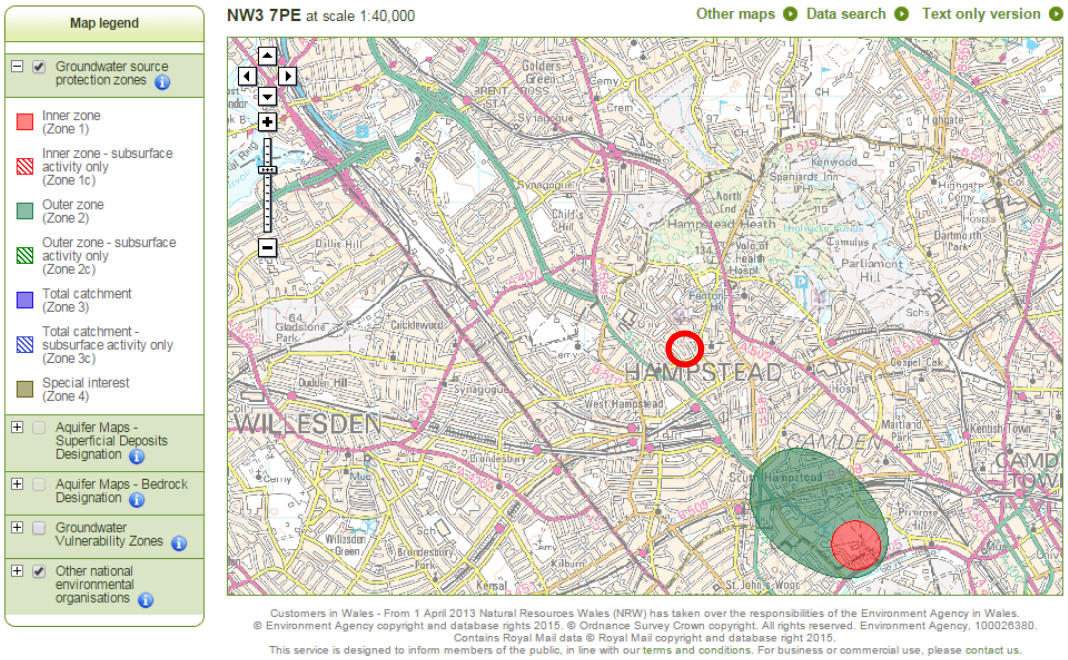


Site Location

- **Flood Risk from Groundwater**

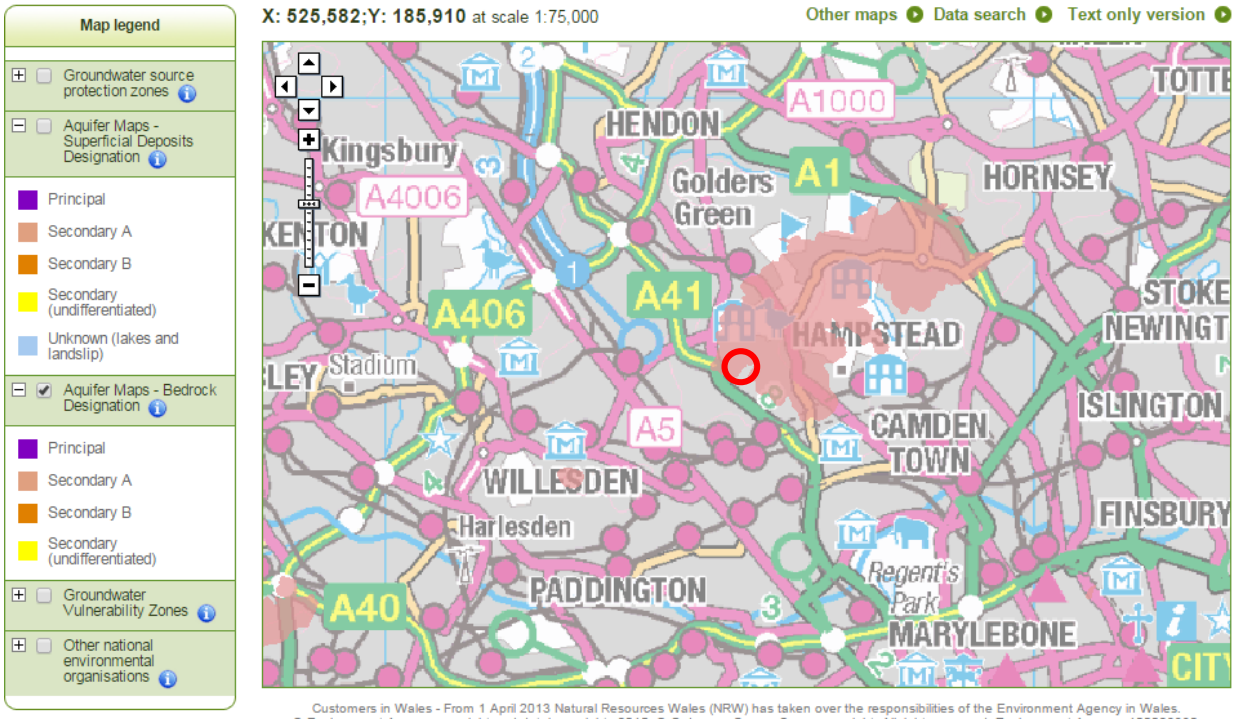
A ground investigation report for the site was issued by KF Geotechnical in April 2012: Reference No. G/031219/001. The borehole showed that the London Clay underlies a 400mm layer of made ground. Groundwater was observed in the borehole during the ground investigation works at 8.4m below ground level.
However the additional ground investigation undertaken in January 2016 - Report reference J15356/GT/1 prepared by Geotechnical & Environmental Associates has recorded groundwater at around 1.25m below ground level at the rear, garden, end of the site and 2.5m below ground level in the front, street end of the site. These results would appear to indicate at least some seasonal flow of groundwater from north to south across the site, probably associated with rainfall runoff down the hill on which the house stands. This latest ground investigation has been taken into account in the latest design for the basement, which will be fully waterproofed; so the flood risk from groundwater is therefore considered low.

The EA have defined Source Protection Zones for 2,000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The EA maps confirm that the site is not located within a groundwater Source Protection Zone, see map below.



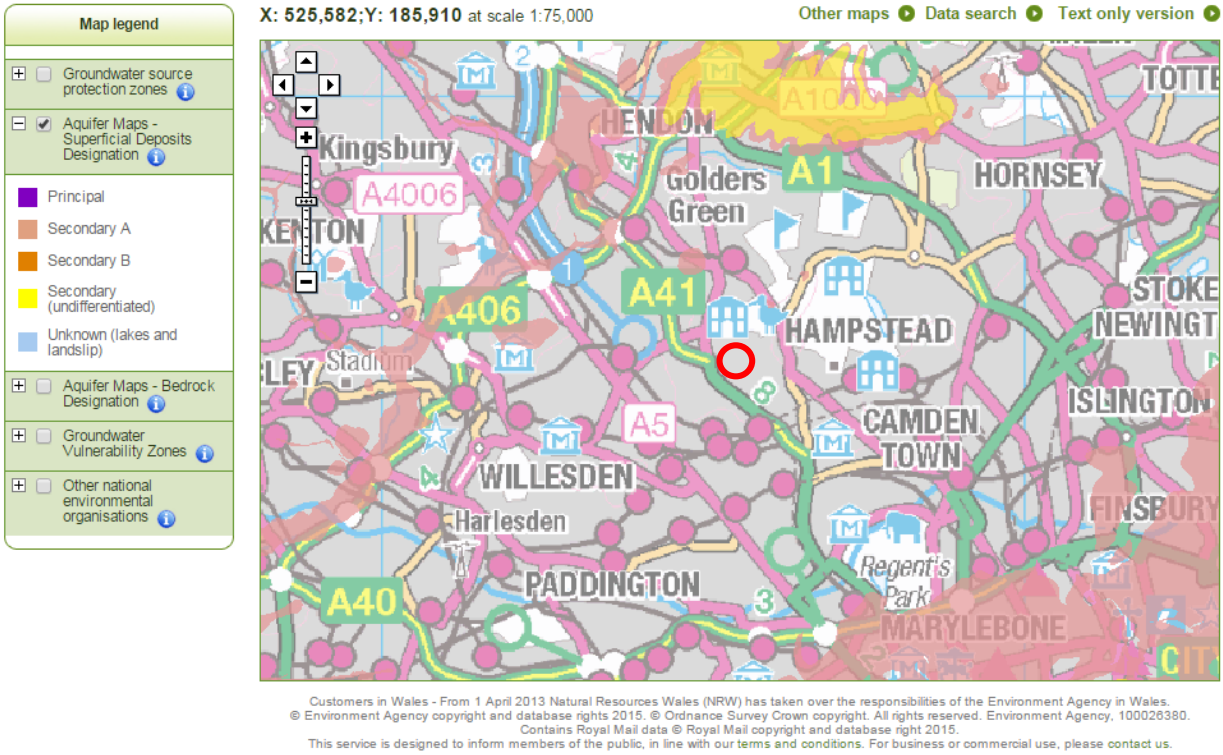
Site Location

There are two main water bearing aquifers in the London Basin known as the Upper and Lower Aquifers; these are separated from each other by the thick impermeable layer of London Clay. The Upper Aquifer comprises groundwater located within deposits of River Terrace Gravels and granular soils, including the Bagshot Formation, which overlie the London Clay. The Lower Aquifer comprises groundwater within the Thanet Sand, Upnor and Chalk Formations. The site investigation report confirms that there are no superficial deposits on the site and the proposed development will not extend beneath the London Clay. The proposed development is therefore not expected to have an impact on any of the local aquifers. This is confirmed by the figures on the following page taken from the EA's website, which show that the site is not located within a superficial deposits aquifer catchment area although it may be located above the bedrock aquifer. As the proposed basement will not extend in to the bedrock aquifer the proposals will not have an impact on any below ground flow paths and therefore will not increase the risk of flooding to the surrounding areas.



Site Location

Environment Agency's bedrock aquifer map

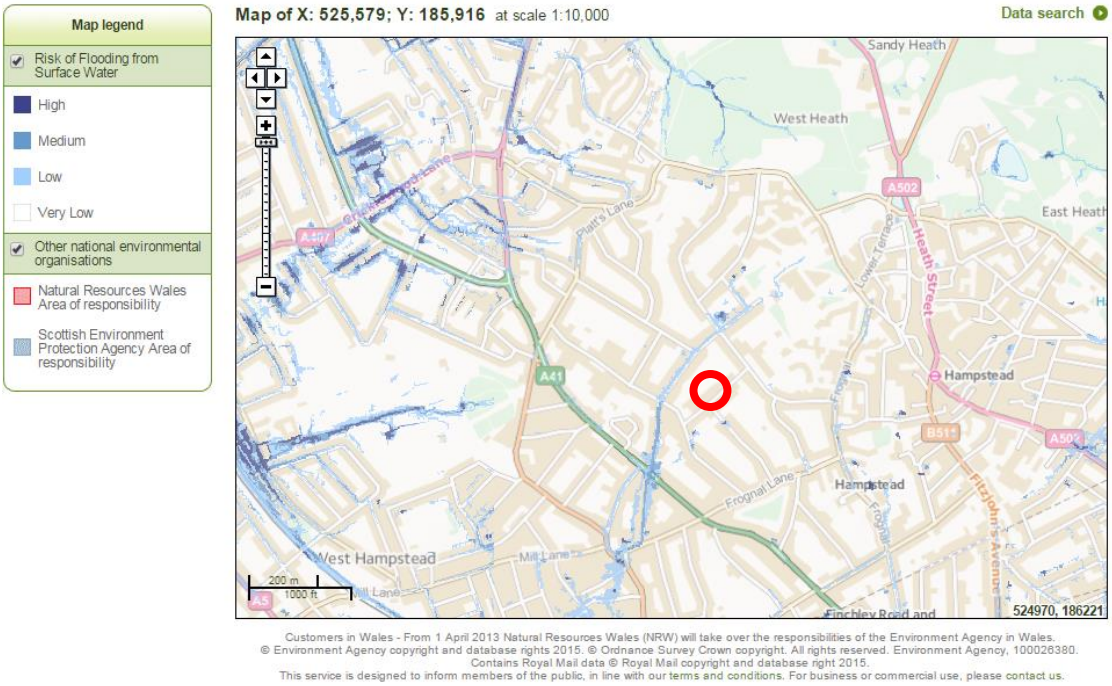


Site Location

Environment Agency's superficial deposits aquifer map

- Flood Risk from Surface Water and overland flows

Surface water flooding occurs when intense rainfall in unable to soak into the ground or enter a drainage system, due to blockages or the capacity of the system being exceeded. Developments with lower ground floors are naturally susceptible to this type of flooding. Ferncroft Avenue was flooded in 1975 as listed in Appendix 4 of the Floods in Camden Report of June 2003. The EA also provides an indicative map which highlights areas that are at risk of surface water flooding. The map below shows that Ferncroft Avenue is at "low" risk of flooding; between 0.1% and 1% annual probability of flooding. In addition the levels along Ferncroft Avenue show the road to slope steeply away from number 32 in a south easterly direction. This slope will direct any surface water flooding from the public sewers away from the building therefore the flood risk to the property from surface water flooding and overland flows is considered low.



Site Location

Site Drainage Proposals

- Surface Water

In accordance with the EA's guidelines, Building Regulations and Water Authorities advice, the preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. Sustainable drainage systems (SUDS) can reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage recharge of groundwater in a manner that mimics nature. If drainage to an infiltration system proved to be an unsuitable option for a site then drainage to a watercourse must be assessed. Drainage to the public sewers can be considered only when all other alternative options are not suitable.

Drainage to infiltration systems is not a suitable option as there is no available land on site to accommodate such systems. Infiltration systems must be located at least 5m away from any structure. There are also no watercourses in the vicinity of the site and therefore drainage to the public sewers is the only available option.

The NPPF and the EA require the surface water arising from a developed site to mimic the surface water flows arising from the site prior to the proposed development. The proposed development will add 30m^2 of impermeable area increasing the peak run-off rate from the site by 1.13l/s. This was calculated based on the modified rational method:

Q = 2.78 x A x i (where "A" is the catchment area in Hectares and "i" is the rainfall intensity in mm/hours). Q = 2.78 x 0.003 x 135 = 1.13l/sec and makes a 30% allowance for climate change.

However, the London Plan requires new developments to limit surface water run-off to Greenfield rates; therefore attenuation must be considered.

The Greenfield run-off rate for the site was estimated using the Greenfield Run-off estimator tool, uksuds.com. The 1 in 100 year Greenfield run-off rate can be calculated by multiplying the 100 year growth curve factor by Q_{bar} for 1 ha and multiplying by the catchment area of 0.017ha;

Q_{100GF} = 3.19 x 4.43 x 0.017 = 0.24l/sec

R&D Technical Report W 5-074/A/TR1 Revision E, published by the EA and Defra in January 2012 states that "A practicable minimum limit on the discharge rate from a flow attenuation device is often a compromise between attenuating to a satisfactorily low flow rate while keeping the risk of blockage to an acceptable level. It is suggested that this is 5 litres per second, using an appropriate vortex flow control device or other technically acceptable flow control device".

As the development will only increase the hardstanding area by 30m^2 resulting in a peak flow rate of 1.13l/s and the remainder of the drainage on site will remain unchanged, it is not considered feasible to attenuate the surface water run-off.

It is proposed to pump the additional surface water falling in the lightwells and courtyard area at lower ground floor level to the below ground system at ground level and discharge by gravity to the public sewer as shown on the figure overleaf.

- Foul Water

The foul water drainage from the basement is expected to be below the level of the existing foul drainage from the upper levels of the house as there is no current foul drainage from the basement. The existing drains will continue to drain by gravity but the new basement drainage will be pumped; the pump system will include a non-return valve to ensure that any surcharge in the street sewer does not flow back into the basement appliances.

Proposed LGF Plan (1:100)

Proposed Lower Ground Floor Surface Water Drainage Strategy.

5 Construction Methodology

Health & Safety

All work on site will be carefully supervised by the selected contractor's "Temporary Works Co-ordinator". No work will start until the Contractor's detailed construction sequence and method statements have been agreed with Price & Myers, who are appointed by the client to review work on site.

Ground Water and Ground Support

The seasonally high ground water levels mean that great care will be needed in the design and construction of the temporary works. The water level in the monitoring standpipes will be checked carefully in the week's pre-ceding the start of work on site and, as described in the temporary works section, the first underpin will be constructed as a trial to allow the need for any measures to control the groundwater will be agreed between the Temporary Works Co-ordinator. Contractor's design engineer and the client's Engineer.

Movement Monitoring

It is essential to check that the effect of the construction work will have on the existing building and the adjoining building. A detailed schedule of condition survey of number 34 will be carried out before the work starts and the detail of the monitoring agreed with neighbour's Party Wall surveyor.

The work has been planned and will be supervised to minimise the potential for any movement in the building, the monitoring should demonstrate that the measures taken have performed as required; if however the trigger levels are reached it will allow the swiftest possible action to be taken to limit building movement.

The movement monitoring will be carried out by a specialist surveyor. The survey shall be to an array of targets fixed to the existing house, at locations to be agreed but at least three targets on each of the front, rear and flank elevations. The targets and surveying system will allow for measurement in three orthogonal directions.

Readings shall be taken weekly from the start of the work on site; the targets will be installed within a week of the work starting, until the major structural works start when monitoring shall be carried out twice a week. When the work to form the new basement is complete the frequency of readings shall be reduced to fortnightly and when all the structural work on the house is complete the frequency of readings shall be reduced to monthly. A final set of readings should be taken after a further 6 months.

Reports recording the site readings in tabular and graphical format will be issued to all Parties within two days of the measurements being carried out. These will show the trend and size of any movements.

When there is a difference between two individual readings in excess of 4mm recorded and this shows a trend of increasing movement, or there is an overall trend of increasing movement in excess of 6mm, this is a "cause for concern" and the Contractor and Engineer are to assess the need to carry out any additional works to provide temporary support to the building or adjust the planned work sequence to reduce the potential for further movement.
Where there is a "cause for concern" all Parties are to be informed of the result of the review and of any agreed additional works or adjustment to the planned work sequence

When there is a difference between two individual readings in excess of 8mm recorded; work should be suspended as soon as practicable until all Parties agree on the action to take.

Site Supervision

All work on site will be carefully supervised by the selected contractor's "Temporary Works Co-ordinator"; to minimise the potential for any movement in the building, by ensuring that at any stage of the sequence the correct temporary supports are in place and these are kept in place as required or until the permanent supports are installed.

Site Hoardings and Security

The Contractor will be expected to set up a site compound in the front garden; any proposed use of the road for skips etc. will be agreed in advance with the council.

Site Logistics

Access for the work will be co-ordinated with the final construction sequence; it is expected that a conveyor will be used to assist in removed excavated material from the rear of the site to a skip at the front. Concrete for underpinning may be site batched for individual pins; for RC walls and the basement slab readymix will be used and placed using a pump.

Appendix A

Site Location Plan

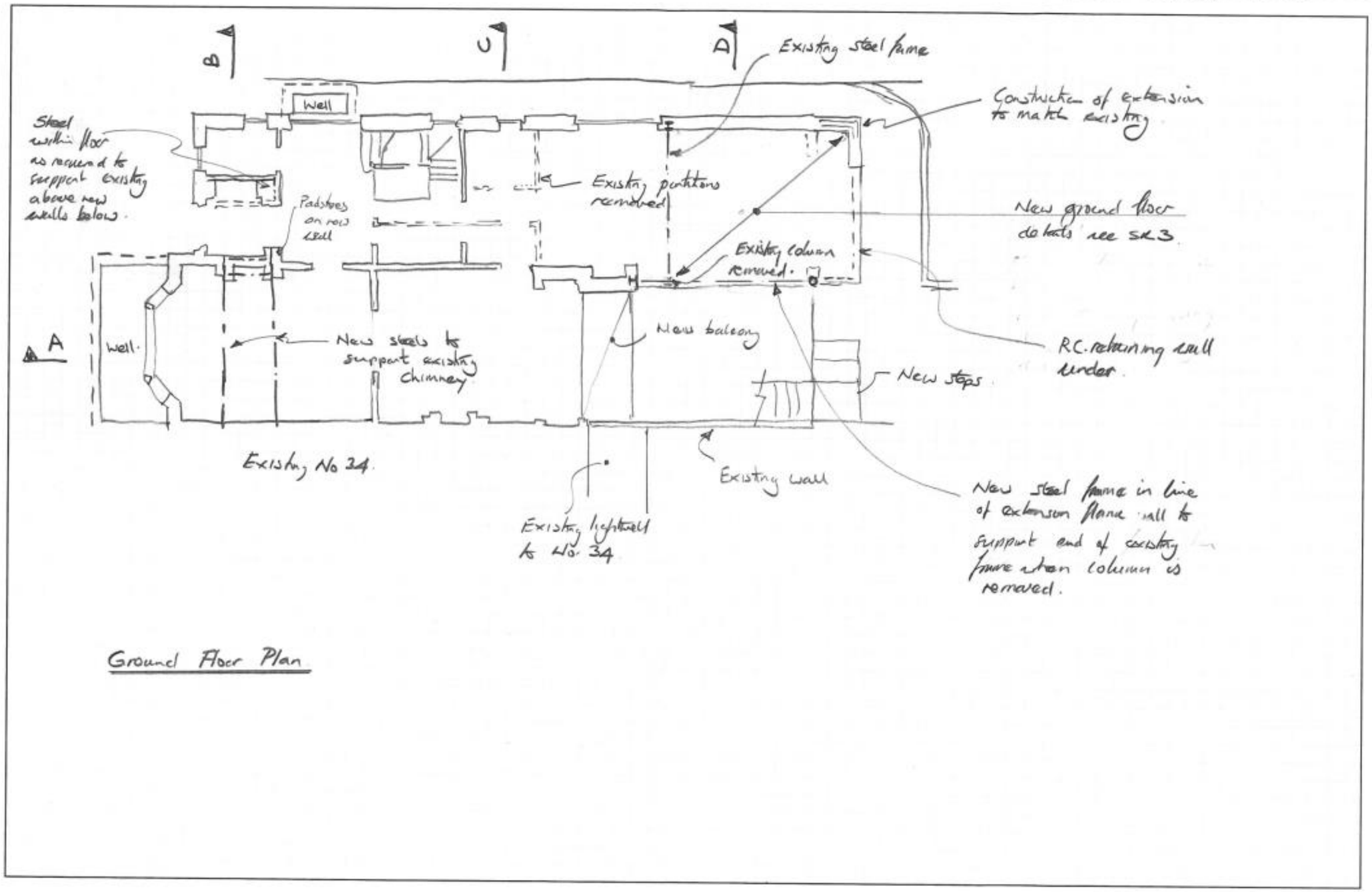
Existing Site Location Plan (1:1250)

Appendix B

Proposed Drawings

PRICE&MYERS
Consulting Engineers

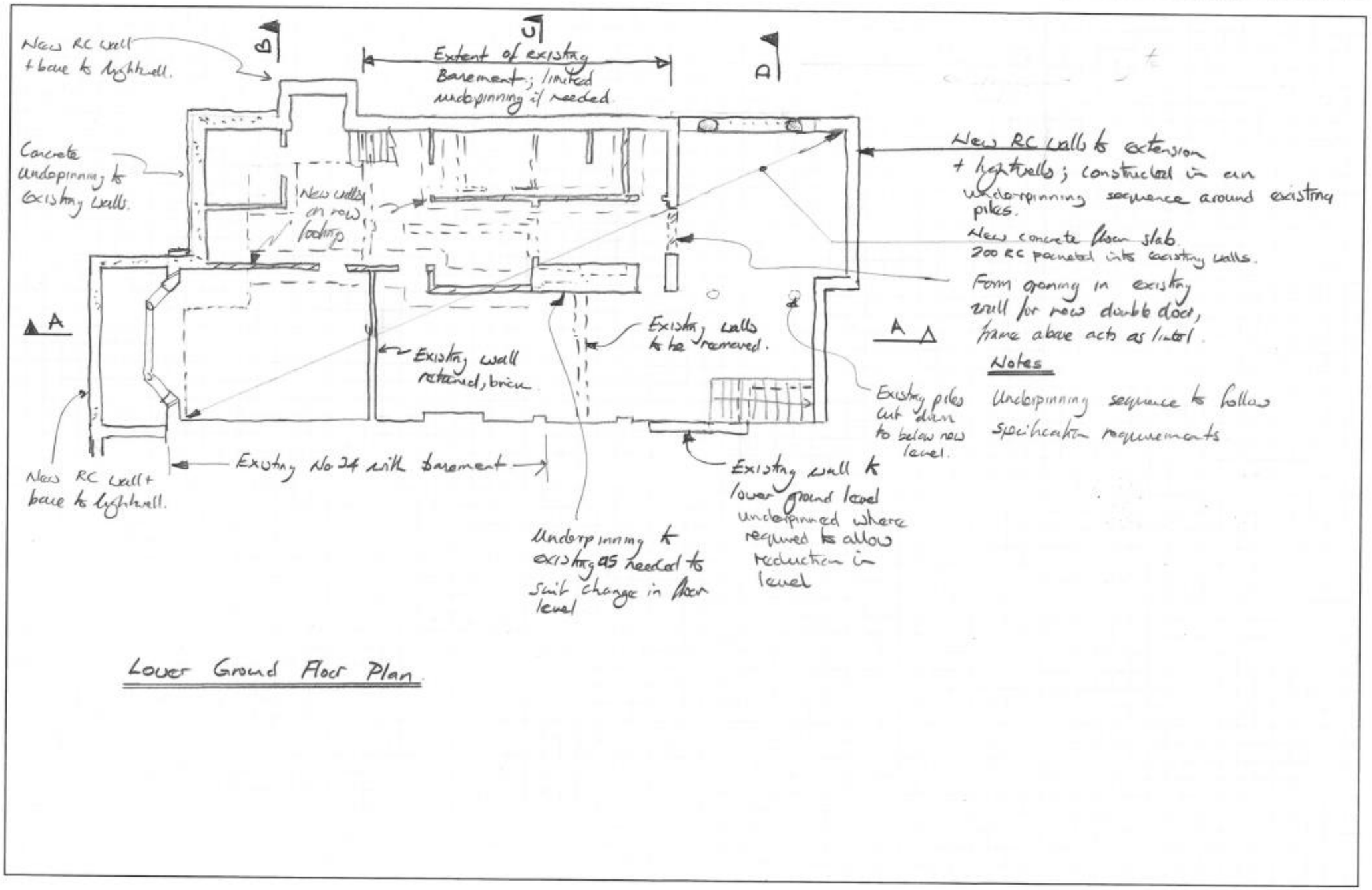
Job No 24354 Page SK-1 Rev A
Date 7/7/15 Eng P.T.T Chd
Job 32 Ferncroft Avenue



Ground Floor Plan

PRICE&MYERS
Consulting Engineers

Job No 24354 Page SK-2 Rev A
Date 7/7/15 Eng PTT Chd
Job 32 Ferncroft Avenue.



Lower Ground Floor Plan

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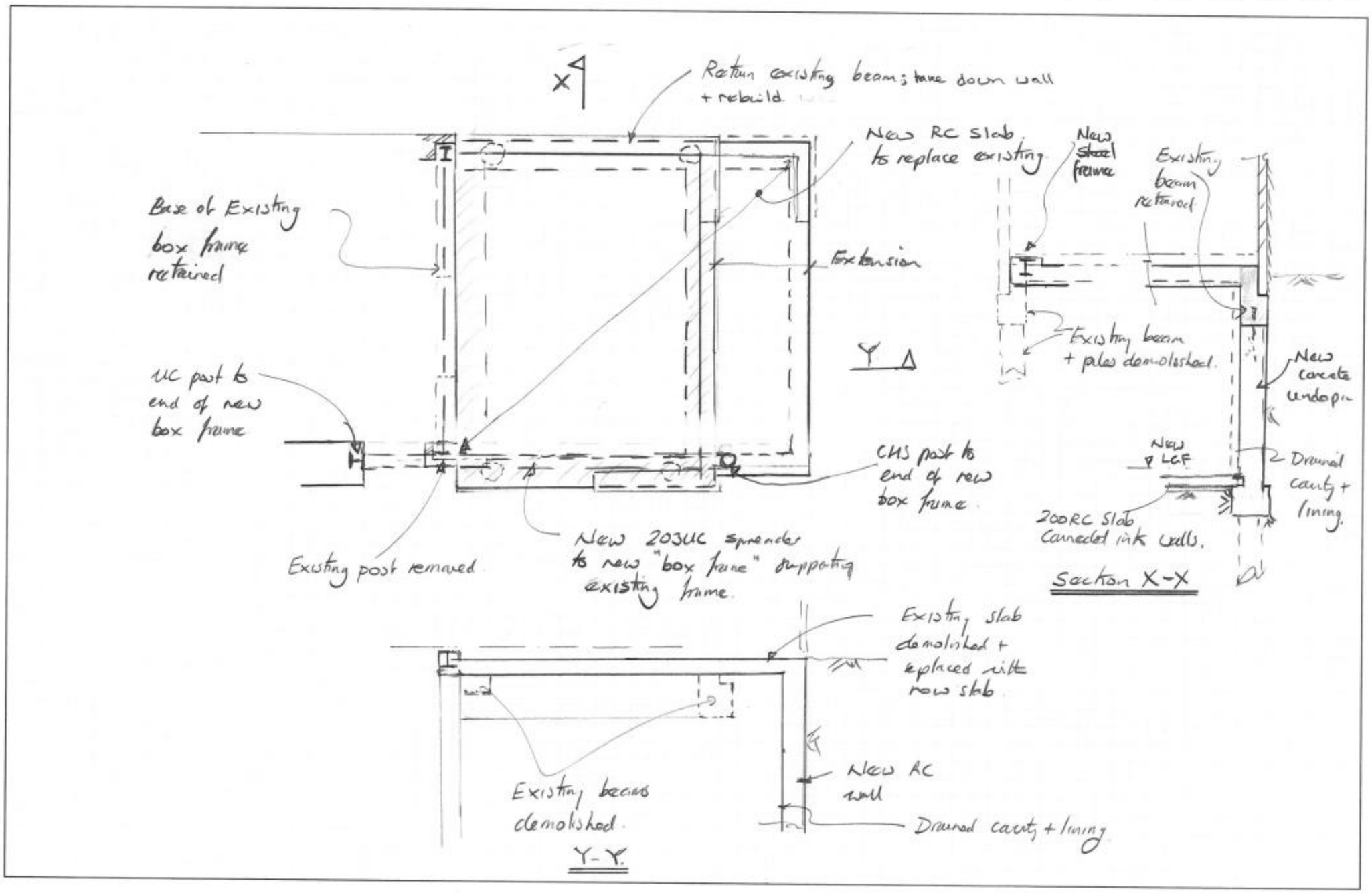
Consulting Engineers

Job No 24354 Page SK 3 Rev
Date 8/1/15 Eng P.T.T. Chd
Job 32 Ferncroft Avenue.

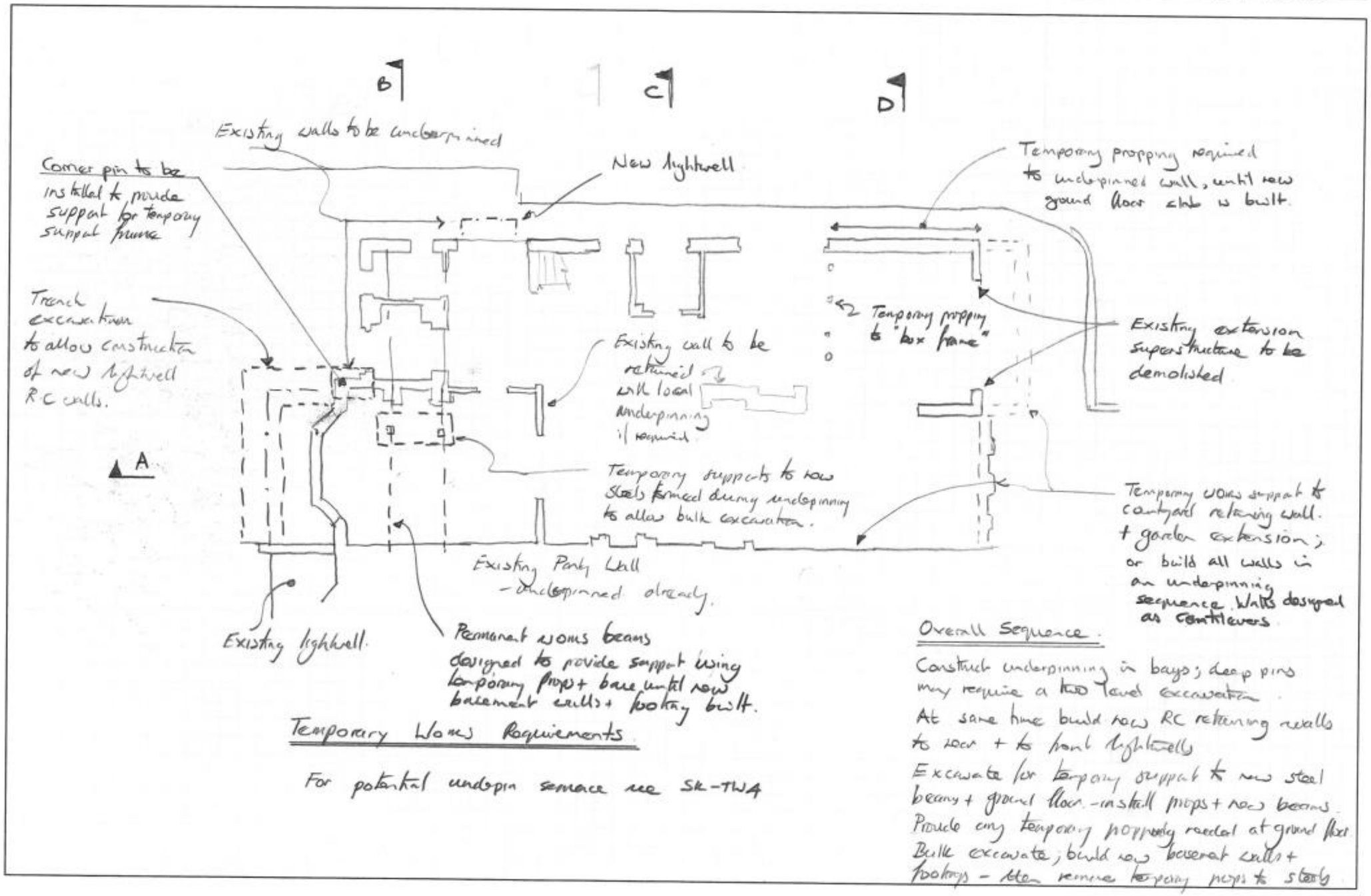


Appendix C

Proposed Temporary Works Drawings

PRICE&MYERS
Consulting Engineers

Job No 24394 Page SK-TW1 Rev A
Date 7/7/15 Eng P.T.T Chd
Job 32 Ferncroft Avenue.



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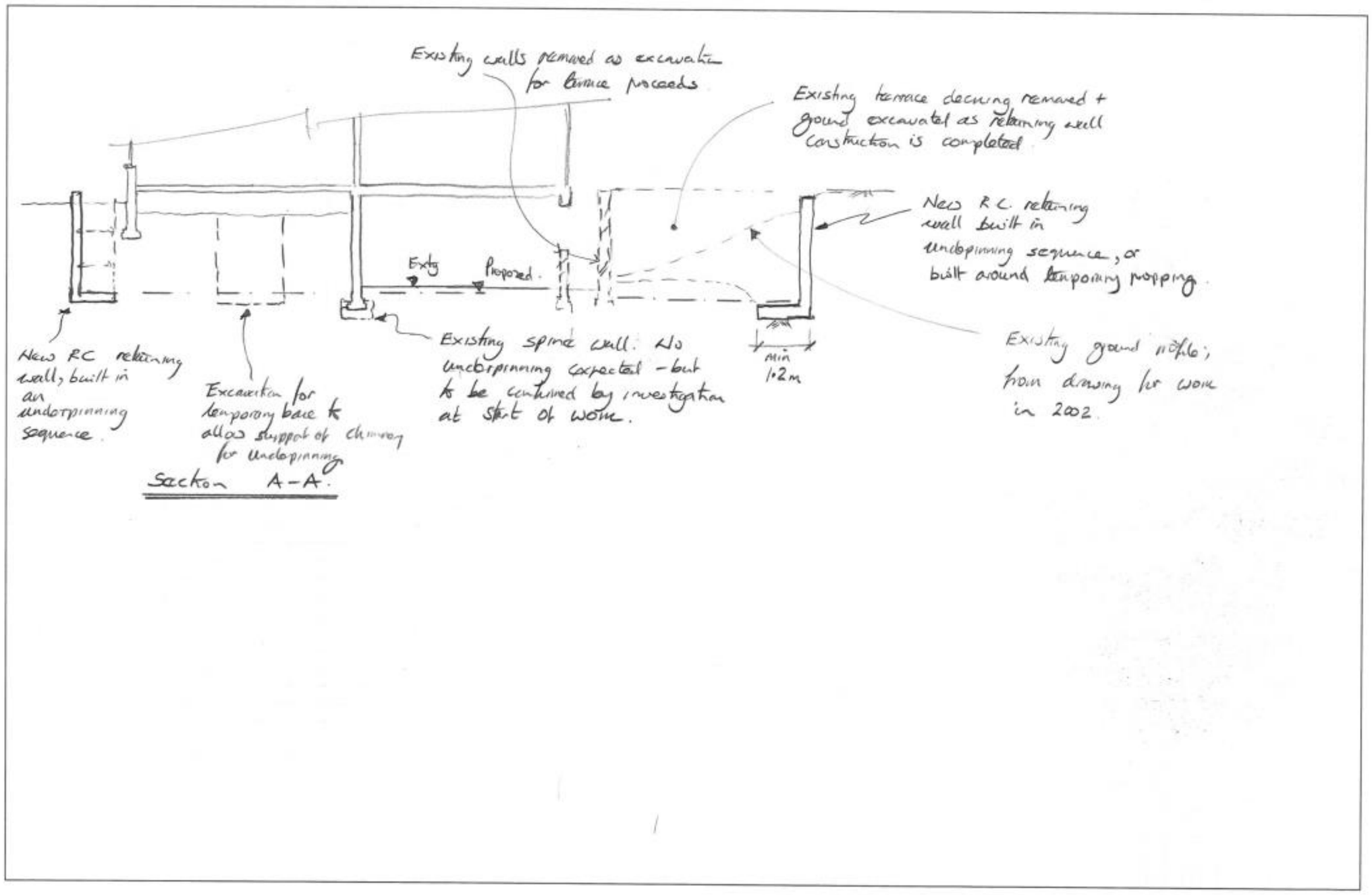
Job 32 Ferncroft Avenue.



Section A-A.

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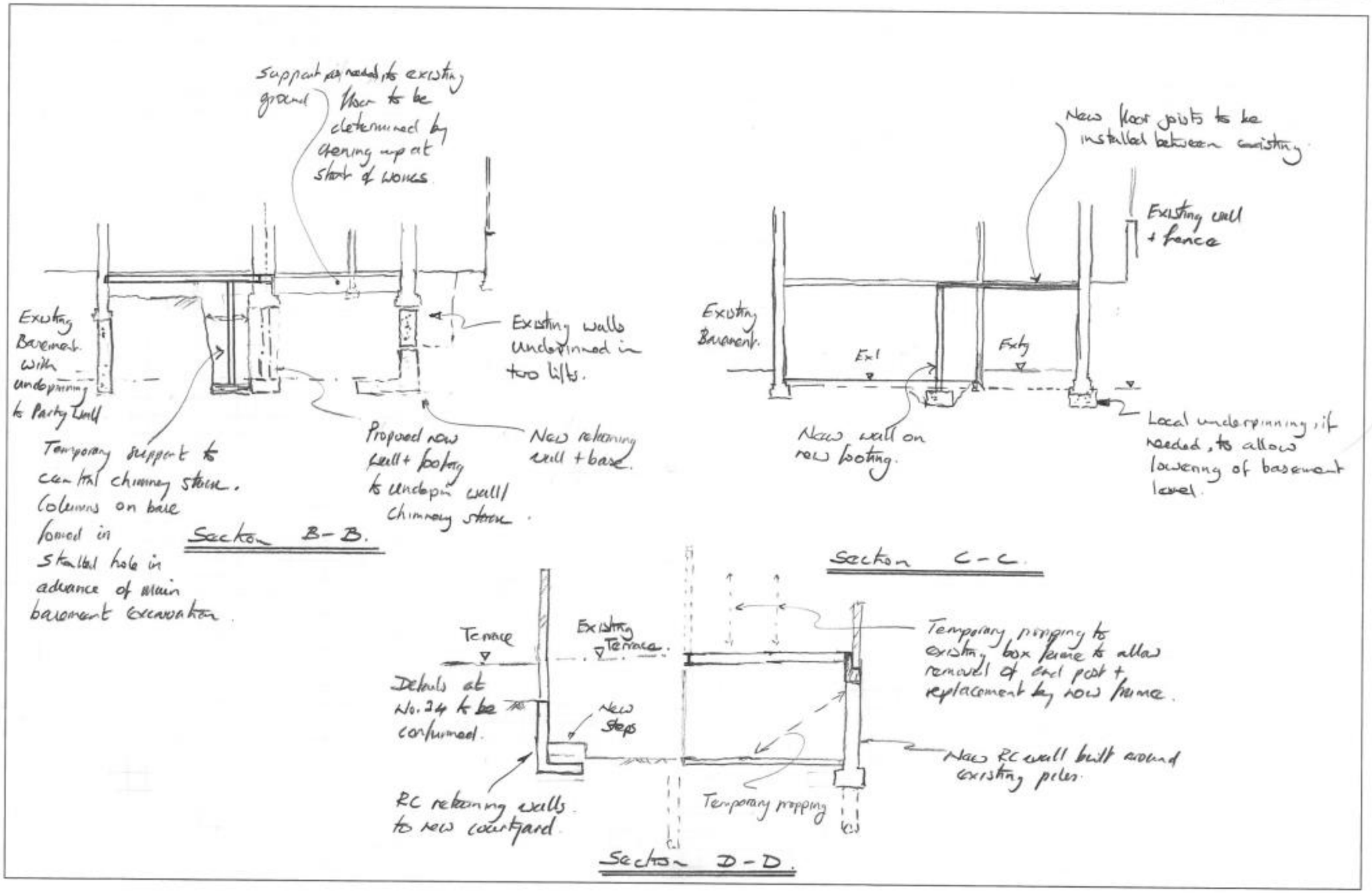
Date 2/11/15 Eng P.T.T. Chd
Job 32 Ferncroft Avenue.



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Job No 24354 Page TN4. Rev
Date 22/1/16 Eng P.T.T Chd
Job 32 Ferncroft Avenue

Temporary Works - Potential Underpin Sequence

Appendix D

Design Calculations

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Job No 24354 Page 1 Ver
Date 13/7/15. Eng P.T.T Chd
Job 32 Ferncroft Avenue.

Introduction

This house is to be extended by enlarging the basement; at the same time generally minor alterations will be made to the upper floors of the house. The basement will be formed using reinforced concrete underpinning to existing masonry walls, with new R.C. walls around external lightwells.

Design will be carried out in accordance with BS Codes of Practice:-

BS 449:	Steelwork
BS 5268	Timber.
BS 5628	Masonry
BS 8004	Foundations
BS 8110 + BS 8500	Concrete

Design Loadings.

13½" Walls.	7.5 kN/m²
9" Walls	5.0 kN/m²
Stud walls	1.0 kN/m²
Existing timber floors	2.25 kN/m²
Imposed (domestic)	1.5 kN/m²
Surcharge	10 kN/m²

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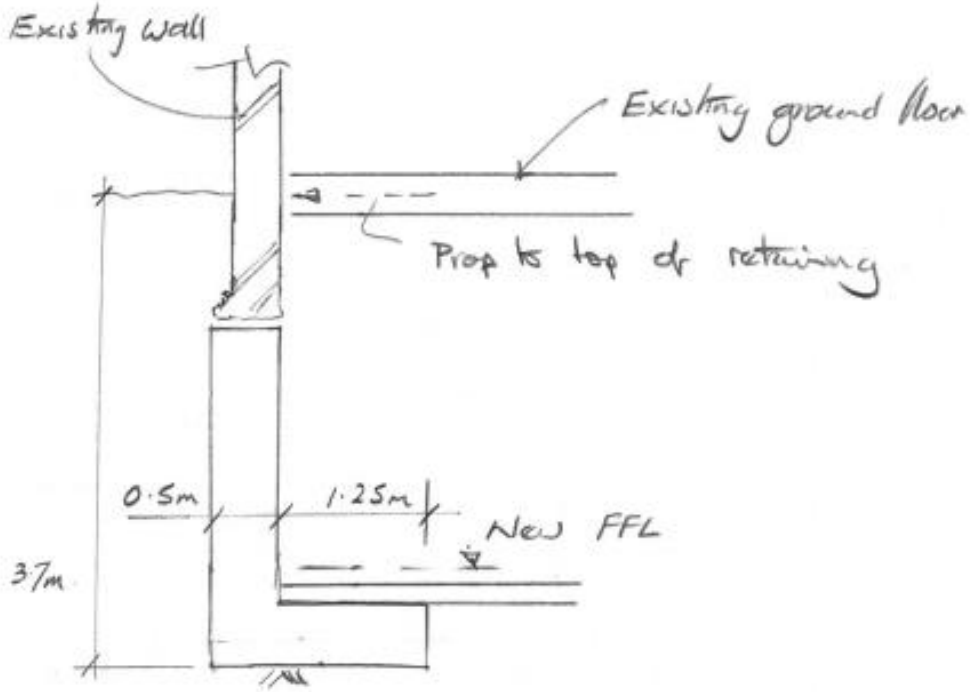
Job No 24354 Page 2 Ver A
Date 13/7/15 Eng P T T Chd
Job 32 Ferncroft Avenue.

Basement Retaining Structure

Concrete grade to be FND - strength 30 N/mm²



Typical Underpinning Section.

Design loading; assuming a temporary worst case water level at 1.0m below ground level

Loadings soil ϕ = 22°.

$K_a = 1 - \sin\phi / 1 + \sin\phi = 0.43$

Surcharge on ground = 10 kN/m²
Soil density = 19 kN/m³

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Job No 24354 Page 3 Ver A
Date 13/7/15 Eng P.T.T Chd
Job 32 Ferncroft Avenue

On 3.7m high retaining wall

$P_S = 3.7 \times 4.3 = 15.9 kN$ $P_E = 55.9 kN$ $P_W = 27 \times 27/2$

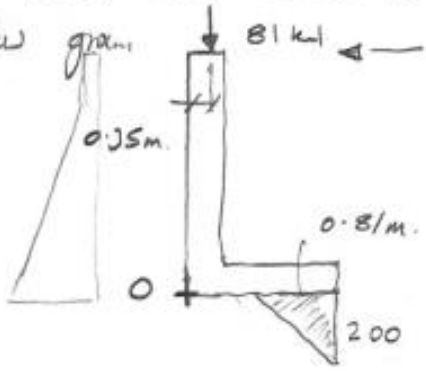
$P_W = 36.5 kN.$

Wall load = 7.4m of 13½" solid brick
= 56 kN/m

Underpin S.W = 2.5m @ 10kN/m² = 25 kN/m.

total load = 81 kN/m

In worst case that there is water at 1.0m below ground



Provides vertical equilibrium

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Date 12/7/15 Eng P.T.T. Chd
Job 32 Ferncroft Avenue.

Then to prevent overturning

$$3.7 F_T + 81(1.75 - 0.35 - 0.27) = 15.9 \times \frac{3.7}{2} + 55.9 \times \frac{3.7}{3} + 36.5 \times 2.7/3.$$

$$F_T = 10.7 \text{ kN.}$$

(Note with no water

$$M_{OT} = 15.9 \times 3.7/2 + 55.9 \times 3.7/3 = 98.4 \text{ kNm}$$

$$M_{REST} = 10.7 \times 3.7 \times 81 \times 1.13 = 131.1 \text{ kNm.})$$

Timber ground floor can provide required prop load of 10.7 kN/m.

Design R.C wall cantilever for moment in wall stem; use load factor of 1.0 on resisting prop 1.6 on imposed + 1.4 on water + earth

$$M = 1.6 \times 15.9 \times 3.7/2 + 1.4\left(55.9 \times \frac{3.7}{3} + 36.5 \times \frac{2.7}{3}\right) - 10.7 \times 3.7$$

$$M = 150 \text{ kNm/m.}$$

For 500 thick concrete with 75 cover to earth face $d = 500 - 75 - 10 = 415$.

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Date 10/7/15. Eng P.T.T Chd
Job 32 Ferncroft Avenue.

$M_u = 0.156 \times 30 \times 1000 \times 0.415^2$

$M_u = 806$ kNm/m

$M/M_u = 0.19$ $z = 0.95d$

$A_s = 874$ mm²/m

Use H16 @ 200p (1005 mm²/m)

Check wall bending at 800 below ground

$M = 0.8 \times 10.7 - 3.4 \times 0.4 - 2.6 \times 0.8/3$

$M = 6.5$ kNm/m

$\sigma = 6.5 \times 10^6 \times 6 / 1000 \times 330^2$

$\sigma = 0.36$ N/mm². accept

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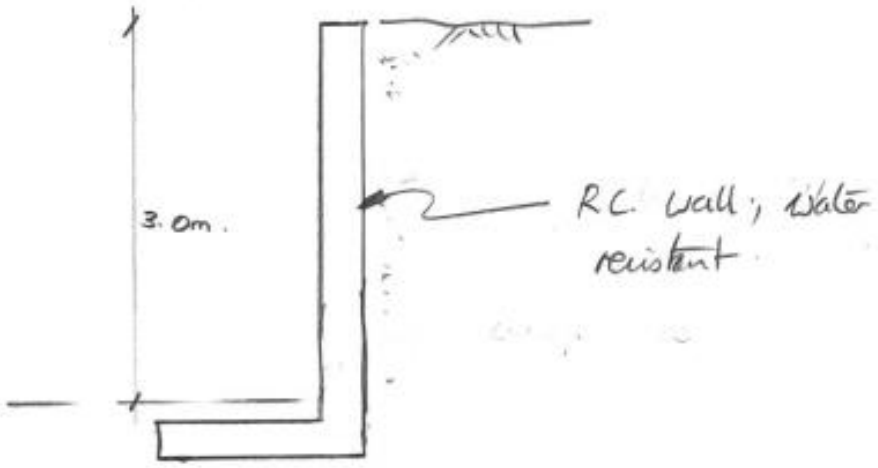
Job No 24354 Page 6 Ver
Date 12/1/16 Eng P.T.T Chd
Job 32 Ferncroft Avenue

New Garden Retaining Walls.

For retained height of approx 3.0m



External walls - allow drainage so design for say 2.0m head of water to allow for some degree of blockage in weep holes / poor drainage.

Ka = 0.43 garden surcharge = 10 kN/m².

Load on wall = $0.43(3\times19)\times\frac{3}{2} + 0.43\times10\times3$

$+ 20\times1 = \underline{69.7\ kN}$

For 1.2m wide bearing stress = 58 kN/m² OK

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Date 12/1/15 Eng P.T.T Chd
Job 32 Ferncroft Avenue

Wall bending

$M = 1.2 \times 0.43(3 \times 19) \times 3^2/_2 \times 1 + 1.6 \times 0.43 \times 10 \times 3^2/_2 + 1.2 \times 10 \times 1 \times 2/_3$

$M = 91.1$ kNm/m ULS.

For 300 thick RC wall $d = 300 - 75 - 10 = 215$

$M_u = 252$ kNm.

$M/M_u = 0.36$ $z = 0.9d$.

$A_s = 1082$ mm²/m

Use H16 @ 150 p/c
(1340 mm²/m)

R.C. garden retaining walls - 300 thick with 1200 long/ends base.

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Job No 24354 Page 8 Ver
Date 19/2/16 Eng P.T.T Chd
Job Ferncroft Avenue

Basement Slab.

Design for uplift due to water pressure load = 2.0m water = 20 kN/m²

For 200 R.C Slab self weight = 4.8 kN/m²
finishes etc allow load of 5.0 kN/m²

So nett uplift nds = 20 × 1.4 − 0.9 × 5 = 23.5 kN/m²

Slab to span 4.4m max in bedroom.

$M = wl^2/8$ $M = 23.5 \times 4.4^2/8$

$M = 56.7$ kNm

For 200 RC Slab 20 top cover

$d = 200 - 20 - 8 = 172$mm

$M_u = 161$ kNm/m C35 concrete

$M/M_u = 0.35$ $Z = 0.9d$

$A_s = 56.7 \times 10^6 / 0.87 \times 500 \times 0.9 \times 172$

$A_s = 842$ mm²/m

Use H12 @ 125c/c.
(905 mm²/m)

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Job No 24354 Page 9 Ver
Date 19/2/16 Eng P.T.T Chd
Job Ferncroft Avenue

End reaction = 15×22 = 33 kN/m. Wormy load.

Wall load = 6.0m brickwork @ 13½"
+ 6.0m brick @ 9"

= 6.0 × (7.5 + 5.0) = 75 kN/m

Clearly the water pressure will not lift the house out of the ground, as erected since the proposed depth is only a modest increase on the existing

Appendix E

K F Geotechnical Site Investigation

REPORT ON
GROUND INVESTIGATION
AT
32/34 FERNCROFT AVENUE
LONDON NW3

CLIENT: VINCENT & RYMILL

DATE: 5 APRIL 2012 **REF:** G/031219/001

K F GEOTECHNICAL

CONSULTING GEOTECHNICAL ENGINEERS

W. J. C. WALLACE B.Eng (Hons.)

85 Alexandra Road
Farnborough
Hants GU14 6BN

Tel: Farnborough (01252) 518521
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Consultant
G. L. Martin B.Sc., M.Sc., C.Eng., M.I.C.E.

CONTENTS

APPENDICES

REPORT ON GROUND INVESTIGATION AT 32/34 FERNCROFT AVENUE, LONDON, NW3

1. INTRODUCTION

1.1 We were instructed by Vincent & Rymill Consulting Engineers, acting on behalf of the owners of the properties, to carry out a borehole at 34 Ferncroft Avenue, London NW3.

1.2 The purpose of the investigation was to determine ground conditions to assist in the design of alterations and additions to the properties including the construction of a basement beneath the existing footprint.

1.3 The site work took place on the 14 March 2012.

2. THE SITE

2.1 Ferncroft Avenue is in Fortune Hill which lies to the east of Hampstead and to the south and west of Hampstead Heath. It is a residential road consisting in the main of three storey semi-detached houses.

2.2 The avenue is lined by mature London Plane trees and there is one growing within 4.0m of the party wall between No. 34 and No. 32. At the front of No. 32 there is a driveway at the right hand side with an area of grass to the left. The front garden is marked by hedges and bushes and our borehole was put down within 4.0m of the front elevation.

2.3 The Geological Survey Sheet for the area, Sheet No. 256 (North London), indicates that the naturally occurring subsoil is London Clay.

3. SITE WORK

3.1 The layout of the site and the location of our borehole is indicated on our attached sketch G/031219/101. The log of the borehole is appended at the rear of this report.

3.2 The borehole revealed turf and topsoil and fill material to 400mm over a firm sandy silty clay, changing at 900mm to a very stiff friable sandy silty clay. This changes back to stiff at 1.9m and at 5.8m, changes to a stiff grey silty clay typical of undisturbed unweathered London Clay. This becomes very stiff below 8.6m and is proved to the base of the borehole at 10.0m.

3.3 Roots of live appearance were encountered to 3.1m with hair and fibrous roots extending to 4.6m. There was a water strike at 8.4m with water standing at 8.3m on completion.

3.4 In-situ testing by hand held vane test was carried out at regular depths in the borehole with, in addition, a Mackintosh Probe being driven at 1.0m within the very stiff/hard clay found at this depth.

3.5 Disturbed samples were taken at regular depths and these were bagged and labelled and sent to our laboratories for appropriate geotechnical analysis.

4. LABORATORY WORK

4.1 At this stage moisture contents only have been carried out on the samples taken. The results are appended.

5. DISCUSSION

5.1 The ground investigation revealed the anticipated geology with the subsoil being typical of London Clay.

5.2 The clay between 900mm and 1.9m is hard with refusal on the Mackintosh Probe of 50 or more blow counts per 75mm of penetration. This, coupled with the low moisture contents would indicate that there is significant desiccation down to 2.0m but not below this depth.

5.3 The borehole was put down 4.0m from the large London Plane tree in the road. The nearest point of the house is approximately 8.0m and it is likely, therefore, that the depth of desiccation will be less here. However, care needs to be taken with regards to the proximity of the bushes and hedges. Because of this, we would recommend designing the basement based on a significantly desiccated clay down to 2.0m and therefore some allowance might need to be taken for potential of heave against the walls of the basement to this depth should the tree or the hedges be removed.

5.4 For the purposes of our recommendations with regard to basement design, we have assumed a clay of high plasticity and we therefore recommend the following parameters for basement wall design.

Bulk density (γm) - 19kN/m^3

Critical state angle of shearing resistance (ϕ') - 22°

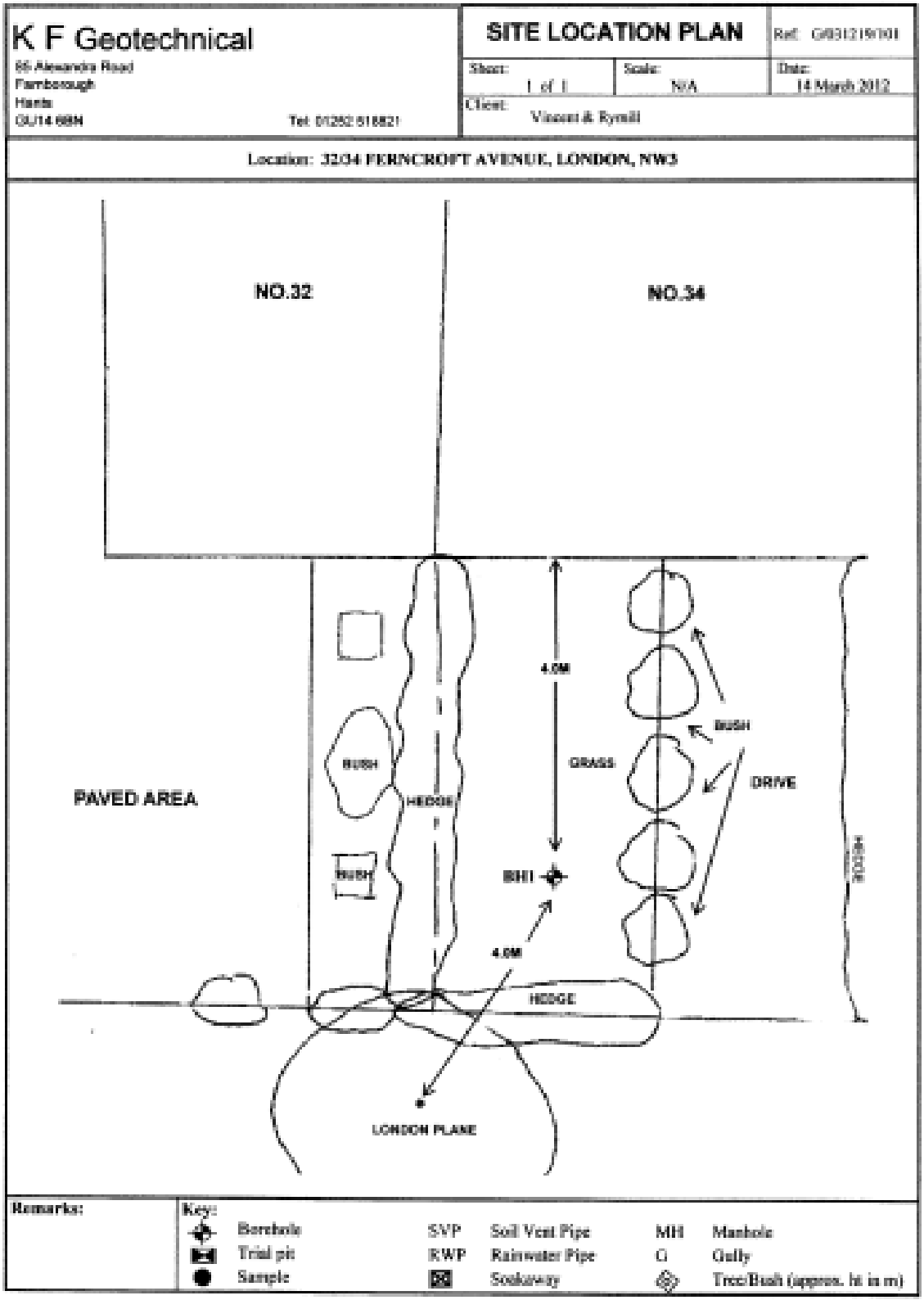
Effective cohesion (c') - 0.

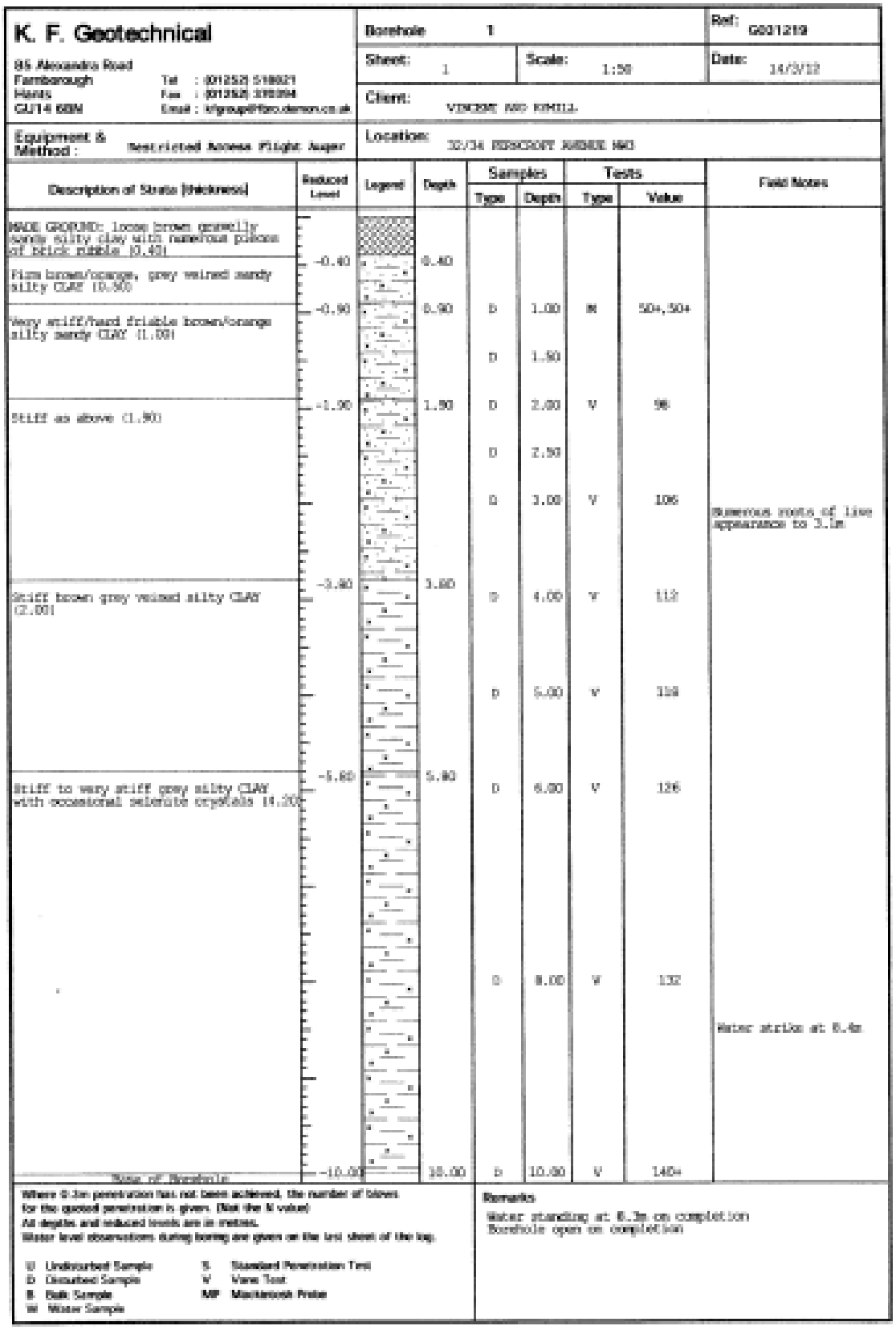
5.5 There will be long term heave recovery of the base of the excavation due to the removal of overburden but as the basement is relatively small it is unlikely that this will not exceed more than approximately 12mm and we would recommend this figure for design purposes.

5.6 Although no water was struck until 8.4m, some hydrostatic pressure should be allowed for in the design of the basement walls.

5.7 Based on our in-situ testing the safe bearing capacity at 3.0m depth is in excess of 200kPa and we would recommend this figure for design purposes.

W J C Wallace


K F Geotechnical
66 Alexandra Road
Farnborough
Hants
GU14 6BN
Tel: 01252 518821
SITE LOCATION PLAN
Ref: GI031219/101
Sheet: 1 of 1
Scale: N/A
Date: 14 March 2012
Client: Vincent & Rymill
Location: 32/34 FERNCROFT AVENUE, LONDON, NW3
NO.32
NO.34
PAVED AREA
BUSH
HEDGE
BUSH
4.0M
GRASS
BUSH
DRIVE
HEDGE
BH1
4.0M
HEDGE
LONDON PLANE
Remarks:
Key:
Borehole
Trial pit
Sample
SVP Soil Vent Pipe
RWP Rainwater Pipe
Soakaway
MH Manhole
G Gully
Tree/Bush (approx. ht in m)



K. F. Geotechnical

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Tel : (01252) 518021
Fax : (01252) 370394
Email : kfgroup@ftec.demon.co.uk

Borehole 1 | Ref: G031219
Sheet: 1 | Scale: 1:50 | Date: 14/3/12
Client: VINCENT AND KIMILL
Equipment & Method : Restricted Access Flight Auger
Location: 32/34 FERNCROFT AVENUE NW3

Description of Strata (thickness)	Reduced Level	Legend	Depth	Samples Type	Samples Depth	Tests Type	Tests Value	Field Notes
MADE GROUND: loose brown gravelly sandy silty clay with numerous pieces of brick rubble (0.40)								
	-0.40		0.40					
Firm brown/orange, grey veined sandy silty CLAY (0.50)								
	-0.90		0.90	D	1.00	N	50+,50+	
Very stiff/hard friable brown/orange silty sandy CLAY (1.00)				D	1.50			
	-1.90		1.90	D	2.00	V	98	
Stiff as above (1.90)				D	2.50			
				D	3.00	V	106	Numerous roots of live appearance to 3.1m
	-3.80		3.80	D	4.00	V	112	
Stiff brown grey veined silty CLAY (2.00)				D	5.00	V	116	
	-5.80		5.80	D	6.00	V	126	
Stiff to very stiff grey silty CLAY with occasional selenite crystals (4.20)				D	8.00	V	132	Water strike at 8.4m
				D	10.00	V	140+	
None of Borehole	-10.00		10.00					

Where 0.3m penetration has not been achieved, the number of blows for the quoted penetration is given. (Not the N value)
All depths and reduced levels are in metres.
Water level observations during boring are given on the last sheet of the log.

U Undisturbed Sample
D Disturbed Sample
B Bulk Sample
W Water Sample
S Standard Penetration Test
V Vane Test
MP Mackintosh Probe

Remarks
Water standing at 8.3m on completion
Borehole open on completion

LABORATORY TEST RESULTS

Moisture Content & Plasticity Tests.

Location: 32/34 Ferncroft Avenue.

Ref: G/031219/A
Sheet: 1 of 1

Client:

Date: March 2012.

BH No:	Description	Depth (m)	MC (%)	PL (%)	LL (%)	PI (%)	% < 425μm	I'p (%)
1.	Brown sandy CLAY.	1.00	15					
	Brown sandy CLAY.	1.50	17					
	Brown sandy silty CLAY	2.00	26					
	Brown sandy silty CLAY.	2.50	25					
	Brown sandy silty CLAY.	3.00	23					
	Brown sandy silty CLAY.	4.00	27					
	Brown sandy silty CLAY.	5.00	27					
	Dark brown sandy silty CLAY.	6.00	26					
	Dark grey sandy silty CLAY.	8.00	29					
	Dark grey sandy silty CLAY.	10.0	33					

MC - Moisture Content
PL - Plastic Limit
LL - Liquid Limit
I'p - Modified Plasticity Index = PI x (%<425μm)/100%
PI - Plasticity Index
NP - Non Plastic

Notes.

K. F. GEOTECHNICAL

Appendix F

Vincent & Rymill Report – May 2012

VINCENT & RYMILL CONSULTING ENGINEERS

Proposed Basement Extension to Existing Basement, at

32 FERNCROFT AVENUE, LONDON, NW3

FOR MR AND MRS PAGE

1. INTRODUCTION
2. STAGE 1 - SCREENING FOR BIA
3. STAGE 2 – SCOPING FOR BIA
4. STRUCTURAL DESIGN PHILOSOPHY FOR BASEMENT UNDER AN EXISTING PROPERTY.
5. BRIEF METHOD STATEMENT FOR CONSTRUCTION OF BASEMENT.
6. PROBABLE CONSTRUCTION SEQUENCE.
7. SITE INVESTIGATION BY K.F. GEOTECHNICAL

VINCENT & RYMILL CONSULTING ENGINEERS

INTRODUCTION.

The property is one of a large pair of three storey semi detached dwellings constructed in the early part of the 20th century.

The development proposal is to extend the existing basement to the full footprint of the existing ground floor of the property. Details of the proposals are shown by the relative GJP Architects drawings.

The purpose of this report / statement is to provide details of the stage 1 and 2 BIA as requested by the ' Camden Planning Guidance Basements and Light wells', together with details of the method and sequence of construction.

STAGE 1 - SCREENING FOR BIA- Reference Camden Planning Guidance Basements and Lightwells

Figure 1. Subterranean (ground water) flow screening chart.

Q1a Is the site located directly above an aquifer ?

NO. See figure 8, site above 'unproductive strata'

Q1b Will the proposed basement extend below the water table surface?

NO. Formation of new basement is at -3.50m below ground level, site investigation has shown minor water seepage at -8.3m below ground level.

Q2. Is the site within 100m of a watercourse, well or potential spring line?

NO. With reference to figure 12 the site is not within 100m of any of these features.

Q3. Is the site within the catchment of the pond chains on Hampstead Heath.

NO. Refer to figure 14 the site is within the Golders Hill chain.

Q4. Will the proposed basement development result in a change in the proportion of hard surfaced paved areas.

NO. Basement is below footprint of existing building.

Q5. As part of the site drainage will more surface water than at present be discharged into the ground.

NO. There is no increase in impermeable area.

Q6. Is the lowest point of the proposed excavation close to or lower than the mean level in any pond or spring line.

NO. The nearest pond is the Leg of Mutton in Golders Hill Park, 725m away in a direct line. The site ordnance level is above this pond.

VINCENT & RYMILL CONSULTING ENGINEERS

Figure 2. Slope Stability Screening Flow Chart.

Q1. Does the existing site include slopes natural or manmade greater than 7°

NO.

Q2. Will the proposed re-profiling of the landscaping at site change slopes at the boundary to more than 7°

NO. There are no re-profiling works.

Q3. Does the development neighbour land have slopes greater than 7°.

NO

Q4. Is the site within a wider hillside with general slopes greater than 7°.

NO

Q5 Is the London Clay the shallowest strata on the site.

NO. Site Investigation describes strata as silty sandy clay which is believed to be the Claygate Beds.

Q6. Will any trees be felled or are any of the works within root zones of protected trees?

NO.

Q7. Is there a history of seasonal shrink swell subsidence in the area? And evidence that this affects the site.

NO. Site examination of buildings did not reveal evidence of subsidence due to shrink / swelling of soils.

Q8. Is the site within 100m of a watercourse or a potential spring line?

NO.

Q9. Is the site within an area of previously worked ground?

NO. The site is presently a dwelling within its own land.

Q10. Is the site within an aquifer?

NO. See figure 8, site above 'unproductive strata'

Q11. Is the site within 50m of Hampstead Heath Ponds?

NO.

Q12 Is the site within 5m of a highway or pedestrian Way.

YES. Ferncroft Avenue footpath is just within 5.0m of the proposed front light well. As described in the Design Philosophy the structural elements at subterranean level will be designed to accommodate the loading from the Public Highway.

Q.13 Will the proposed basement significantly increase the differential depth of foundations to the relative properties.

YES

Q. 14. Is the site over any tunnels?

NO

Figure 3. Surface Flow and Flooding Screening Flowchart.

Q1. Is the site within the catchment of the pond chains on Hampstead Heath.

NO.

Q2. As part of the proposed site drainage will surface water flows be materially changed from the existing route?

NO. The existing surface water routes will not be changed by the development.

Q. 3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.

NO. The development does not increase the impermeable paved areas.

Q4. Will the basement result in changes to the profiles of the inflows of surface water being received by adjacent properties or downstream watercourses.

NO. The development does not increase the impermeable paved areas.

Q5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses.

NO. The presence of the basement structure will not alter the quality of the surface water.

Q6. Is the site in an area known to be at risk of flooding?

YES. Camden Planning Guidance on page 29 lists Ferncroft Avenue as being flooded in 1975.

VINCENT & RYMILL CONSULTING ENGINEERS

STAGE 2 - SCOPING FOR BIA- Reference Camden Planning Guidance Basements and Lightwells

Figure 2.

Q12 Is the site within 5m of a highway or pedestrian Way.

YES. Ferncroft Avenue footpath is within 5.0m of the proposed front light well. As described in the Design Philosophy the structural elements at subterranean level will be designed to accommodate the loading from the Public Highway.

The structural element design and stability of the walls and base to the front light well will be made to accommodate a surcharge load of 10KN/m^2 or wheel load of 40KN which ever gives the most onerous loading.

Design of final structure and temporary elements within the method of construction will be made to minimise ground movement laterally, refer to method statement for construction.

Q.13 Will the proposed basement significantly increase the differential depth of foundations to the relative properties.

YES

The construction of the basement below no 32 will take place at the same time as that construction to the attached property no 34 , the foundations will be founded at the same depth.

Foundations to neighbouring, but not attached, properties may be founded (subject to existing basements being present) at or around 1.0m below existing ground level. Account of this nearby, higher founded foundations will be taken account of in the design of the basement walls and bases.

Prior to works commencing the existing fabric of the neighbouring buildings will be made to identify and record any existing cracks or movement. Monitoring points will be fixed at third points along the party wall, these levelled horizontally and vertically, these would be checked weekly to monitor movement of the party wall.

Differential movements between the underpinned foundations and those on the neighbouring properties will be minimised and controlled through careful structural design and controlled construction.

Figure 3. Surface Flow and Flooding Scoping Flowchart.

Q6. Is the site in an area known to be at risk of flooding?

YES. Camden Planning Guidance on page 29 lists Ferncroft Avenue as being flooded in 1975.

This occurred 37 years ago due to surcharge of existing drains during a storm and it is assumed that drainage improvements have been made to improve the situation. No 32 is at a higher part of Ferncroft Avenue and as such any surcharge flooding to the road will travel away down the road and not have detrimental effect on the basement. The basement will be protected from water / moisture by an internal cavity drainage layer, (DELTA SYTEM) or similar approved, gravity drainage will not effectively be linked to the basement therefore the external drainage system will not be able to surcharge the new basement.

It should be noted that this is not a self contained apartment.

STRUCTURAL DESIGN PHILOSOPHY

Basement Walls

Basement walls are designed as propped cantilevers in reinforced concrete, the basement slab acting as the prop at base level. The walls are designed using the parameters noted in the site investigation report. The walls will be designed for a water table 3/4h above the base of the stem in accordance with the relvant Code Of Practice.

The surcharge load allowed on the external walls of the property will be 2.5KN/m^2 i.e within the garden areas of the property. The party wall bounding will have a surcharge load of 5.00KN/m^2 for adjoining floor and partition wall construction and will also take into account any loads from adjoining foundations. Lightwells within the front garden will be designed as necessary for a surcharge load of 10KN/m^2 or 40KN wheel load, whichever gives the most onerous design case.

Basement Slab

The slab will be formed in reinforced concrete. It will be designed for uplift due to water pressure below, or as a clear span as appropriate. The basement slab will act as a prop to the base of the basement walls.

Design Criteria.

Basement walls and bases are designed using the program 'TEDDS' parameters for the retained soils and bearing soils are as chosen for each particular project. The design is in accordance with BS 8002:1994.

The design adopts the coulomb theory in calculating the active and passive earth pressures. Pressure coeficients in the design adopt " at rest pressures'.

The wall and base in designed for the following

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1.Vertical loads from walls above.
2.Party wall will be designed for a surcharge loading of 5kN/m^2.
3. Other external will be designed with a surcharge load of 2.50KN/m^2.
4. The design adopts a water head behind the wall to ¾ the height of the wall below ground in accordance with BS 8102.
5. Front lightwell will be designed for a surcharge of 10KN/m^2 or a wheel load of 40KN, which ever is most onerous.

The Site Investigation describes the sub soils at new basement formation level as London Clay, an SBP of 200KN/m^2 is proposed in the site investigation, however a value of 150KN/m^2 will be used in the design to limit differential founadtion movements.

Concrete will generally be grade C35 and Class 1 to BRE Digest 363. Reinforcement will be grade 500N/mm^2.

Existing brickwork assumes 7N bricks in a lime mortar, CP.111 gives basic compressive stress for this makeup of 0.45N/mm^2, and therefore allowable bearing stress will be 0.45N/mm^2. Any bearings into existing external or party wall masonry will take account of this allowable stress.

Mortar will be class (ii) or (iii) as required.

Relevant Codes of Practice and British Standards

B.S. 8004	Code of Practice For Foundations
B.S. 6031	Code of Practice For Earthworks
B.S. 8110	Structural Use of Concrete
B.S. 5750	Structural Use of Steelwork in Buildings

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BRIEF METHOD STATEMENT FOR CONSTRUCTION OF A BASEMENT

The exact sequence of works will be agreed with Main Contractor and Structural Engineer, a Contruction Method Statement for the works could be as follows.

a) The walls to the perimeter of the new basement will be underpinned in reinforced concrete. The underpins will take the vertical loads from the walls and horizontal loads from the earth. During their construction the walls and bases will require laterally propping in the temporary condition; propping will be made against the central earth pudding.
b) Underpinning legs will be excavated in short sections not exceeding 1200mm in width.
c) The sequence of the underpinning will be in the 1, 3, 5, 2, 4 sequence and such that any given underpin will be completed, dry packed, and a minimum period of 48 hours lapsed before an adjacent excavation commenced to form another underpin.
d) In the event that the existing foundations to the wall are found to be unstable, sacrificial steel jacks will be installed underneath the foundation to prop the bottom few courses of bricks. These steel jacks will be left in place and will be incorporated into the concrete stem.
e) Whilst forming the wall and in the event that the vertical soil face is unstable, lateral propping will be provided as required to the excavation and to the sides of the working trench. The front and side faces of the excavation will be propped using a sacrificial inert board and acrow props as appropriate.
f) The wall and base may be formed in two separate drives. The first drive being the formation of a 1.50m portion of wall, these formed a maximum of 1200mm wide in a 1, 3, 5, 2, 4, sequence. The subsequent second drive forming the remainder of the wall and the base will be formed in the same sequence but lapping the 1st drive by at least 50% of the drive over.
g) Concrete will be chuted from the point of delivery into a 'holding bath' within the excavated basement and placed by wheelbarrow and /or bucket, or mixed on site. The exact arrangement will be finalised when works commence on site.
h) Excavation for an underpin section will be excavated in a day, and the concrete to the base poured by the end of the same day.
i) The concrete to the stem (or first drive) of the underpin will be poured the following day. This will be poured up to within 50 – 75mm of the underside of the existing wall foundations.
j) On the following day, the gap between the concrete and the underside of the existing foundation will be dry packed with a mixture of sharp sand and cement (ratio 3 : 1).
k) Once the dry pack has gained sufficient strength, any protrusions of the footings into the site will be carefully trimmed back using hand tools to avoid causing any damage to the foundation. The protrusions will be trimmed back to be flush in-line with the face of the wall above.
l) A minimum of 24 hours will be allowed before adjacent sections will be excavated to form a new underpin.
m) Once all pins are complete a temporary cross propping system will be introduced between the walls to allow bulk excavation will be carried out down to formation level.
n) The below – slab drainage for foul & ground water, sumps and pumps will then be installed. The pumps will discharge the foul / ground water into the sewer system to the front of the properties. The drainage layout will be designed in due course.
o) The basement slab will then be constructed, once cured this will provided the designed propping to the walls and the temporary cross propping can be removed.

p) A cavity drainage layer will be laid to the slabs and walls.
q) An arrangement of beams will be inserted at existing ground floor level to support the new ground floor over the constructed basement, either timber suspended or precast concrete beam and block.

CONSTRUCTION SEQUENCE (Assuming Occupancy of the property during the works)

1. Site set up will include a hoarding to the front garden; placement for skips will either be made within the front garden or on the public highway subject to Camden approval.
2. The light well to the front of the property will be constructed first to give access to the remainder of the works. The light well will be constructed by initially forming the upper part of the wall. Excavation will be made to form this part of the wall in the ground approximately 1.0 to 1.5 m deep. Once cured this wall will then be underpinned in the usual sequence to form the remainder of the wall and its base. Once formed the light well will be backfilled but leaving enough space to allow access subsequent works under the property.
3. A conveyor will be located within the formed light-well to remove spoil from the excavation face to the skip.
4. Construction under the property will commence by forming a heading tunnel, approx 1.50m deep, below the ground floor, propping the existing floors as the tunnel extends. Side tunnels will be formed to access the underpinning points. Priority will be given to pins or bases that may have to eventually support any structural steel columns.
5. Underpins will be carried out in the usual 1, 4, 2, 5, 3 underpinning sequence, backfilling of the excavation will be made after each pin has been formed.
6. On completion of all underpinning and fixing of the structural steelwork supporting the ground floor, cross propping of the pin walls will be erected to allow release of the local pins that may be propped against the central dumpling so the basement slab can be constructed. The propping will be designed to suit the lateral loads behind the walls but generally takes the form of a series of horizontal slim-shor props adequately laced and braced set approximately 1.5m from lower ground floor level.
7. Bulk excavation will be carried out down to basement slab formation level. Muck will continue to be removed from site via the conveyor belt.
8. The below – slab drainage for foul & ground water, sumps and pumps will then be installed. The pumps will discharge the foul / ground water into the sewer system to the front of the properties. The drainage layout will be designed in due course.
9. The basement slab (ground – bearing slab) will then be constructed.
10. After the new basement slabs have cured, the cross propping will be removed.
11. A drained – cavity layer will be laid to the slabs and walls.

T J Vincent

T. J. Vincent BSc C.Eng M.I.Struct E.

8 May 2012

Appendix G

Underpinning Specification

D50 Underpinning

To be read with Preliminaries/ General conditions.

NOTE Where changes have been made to the standard NBS clauses these are identified in **bold** type

Generally

100 Before starting the work the Contractor is to check for any services that could be damaged by the underpinning work. Inform the CA or Engineer and arrange for any disconnection and reinstatement needed.

105 SITE INVESTIGATION
The site investigation report prepared by K F Geotechnical reference G/031219/001 is included in the tender documents.

120 The Contractor is responsible for ensuring that his operations do not in any way impair the safety or condition of the building both before and during the execution of the work and immediately inform the Engineer if he considers that more stringent procedures than those specified are necessary.

125 The Contractor is to provide the Engineer and the Building Inspector with 24 hours notice of when underpinning will be ready for inspection.

130 Underpinning is to be carried out in short sections of about 1 metre in length. The bottoms of the foundation shall be inspected and approved by the Engineer and the Building Inspector before concrete is poured. The underpinning is to be carried out to the satisfaction of the Engineer and the Building Inspector.

140 Projecting portions of the existing footings are to be carefully cut off where directed and the underside of the footings are to be cleaned and hacked free of dirt, soil or loose materials before underpinning.

150 The body of the underpinning is to be constructed in 1:2:4 mix concrete, or better, and is to be cast to the widths shown unless otherwise directed by the Engineer. Excavation and concreting of any section of underpinning are to be carried out on the same day.

160 The mass concrete is to be stopped off 75mm below the underside of the existing footing and the final pinning up over the whole of the footing is to be carried out with 1:3 mix cement to sharp sand dry pack mortar well rammed in 24 hours after the mass concrete has been poured.

170 Excavation to any section of underpinning, adjacent to a completed section, shall not be started until at least 48 hours after completion of the adjacent sections.

180 The sides of the previous underpinning bays are to be roughened or keyed to the satisfaction of the Engineer and Building Inspector.

190 Sequence of underpinning to be as shown, or an alternative agreed with the Engineer. All sections marked 1 to be excavated, cast and dry packed before starting excavation of section marked 2 and all sections marked 2 to be complete before excavation for sections marked 3 etc.

200 The Contractor is to keep a record of the sequence and dimensions of the underpinning actually carried out, including details of excavation, casting concrete and pinning up for each section.

210 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.

Appendix H

Geotechnical & Environmental Associates Report

Reference J15356/GT/1

January 2016

02 February 2016

Geotechnical & Environmental Associates

Widbury Barn
Widbury Hill
Ware
SG12 7QE

tel 01727 824666
email mail@gea-ltd.co.uk
web www.gea-ltd.co.uk

Our ref: J15356/GT/1

Mr and Mrs J Ward Lilley
32 Ferncroft Avenue
London
NW3 7PE

Dear Mr and Mrs Ward Lilley

Re: 32 FERNCROFT AVENUE, LONDON NW3 7PE

In order to complete the basement impact assessment GEA have been instructed on your behalf by Price & Myers to carry out a groundwater level investigation, which comprised three additional open drive percussive boreholes with the installation of three standpipes to a depth of 5.00 m at the above site and this letter comprises our report on the findings.

1.0 Site Description

The site is located in a residential area in the Hampstead area of the London Borough of Camden, approximately 830 m northwest of Hampstead London Underground station. It fronts onto Ferncroft Avenue to the southwest, is bordered to the northwest by the rear garden of a three-storey semi-detached property and to the south by the adjoining three-storey semi-detached house. The site may be additionally located by National Grid Reference 525559, 185926.

The site measures approximately 10 m by 50 m and slopes towards the south and is currently occupied by a three-storey house with a single level basement. The site includes a driveway to the front and a passageway runs down the northern boundary of the property providing access to the rear gardens. Reference to a Thames Water drawing indicates the street level of Ferncroft Avenue 20 m to the south of the site to be at 85.5 m OD.

A number of trees are present in the rear garden, along the perimeter of the site.

2.0 Geology

The Geological Survey map (sheet 256) indicates that the site is possibly in an area of Head propensity overlying the London Clay. The boundary between the London Clay and the Claygate Member is located to the northeast of the site approximately 25 m to 30 m north-east of the positon of Borehole No 2.

3.0 Borehole Results

In order to establish the depth to groundwater an additional three boreholes have been drilled and a standpipe has been installed to a depth of 3 m in each. The boreholes encountered a moderate thickness of made ground, overlying Head Deposits which are in turn underlain by the London Clay.

The made ground comprised of orange-brown to dark brown silty sandy clay with fine to coarse gravel, fragments of brick, coal, ash, roots and rootles to depths between 1.00 m and 2.00 m, overlying head deposits comprising of firm brown silty slightly sandy clay with orange-brown silt pockets, rootlets, blue-grey veins and fine to medium angular to subrounded gravel and extended to a depth of 5.00 m. The London Clay comprised an initial horizon of firm brown mottled orange-brown silty clay with rootlets to a depth of 5.10 m below which it comprised firm dark brownish grey silty clay with rootlets to the maximum depth investigated of 6.00 m.

During drilling groundwater was encountered at a depth between 3.50 m and 4.50 m, and subsequently monitored on two occasions approximately two and four weeks after installation. The results of the monitoring visit are shown in the table below:

Date	Borehole No	Depth to water (m)
04/01/2016	1	2.60
	2	1.25
	3	1.68
15/01/2016	1	2.20
	2	1.12
	3	1.40

We trust that we have provided sufficient information for your present requirements but if we can be of any further assistance please do not hesitate to contact us.

Yours sincerely
GEOTECHNICAL & ENVIRONMENTAL ASSOCIATES

Gwennan Thomas

Encs

GEA Geotechnical & Environmental Associates

Widbury Barn
Widbury Hill
Ware
SG12 7QE

Site	Borehole Number
32 Ferncroft Avenue, London NW3 7PE	BH1

Boring Method	Casing Diameter		Ground Level (mOD)	Client	Job Number
Open drive sampler	Depth	Diameter		Mr and Mrs J Ward Lilley	J15356
	Location		Dates	Engineer	Sheet
			18/12/2015	Price and Myers	Sheet 1 of 1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.40)	Made Ground (dark brown silty sandy clay with medium to coarse gravel, brick, coal, ash and rootlets)		
						0.40 (0.40)	Made Ground (orange-brown silty sandy clay with fine to medium gravel, fragments of brick, ash and rootlets)		
						0.80 (0.50)	Made Ground (brown mottled orange-brown silty sandy clay with fine to medium gravel, fragments of brick, coal, ash and rootlets)		
						1.30 (0.30)	Made Ground (brown very silty slightly sandy clay with fine gravel, fine coal/ash and rootlets)		
						1.60 (0.40)	Firm brown silty CLAY with orange-brown silt pockets and rootlets		
						2.00 (1.10)	Firm brown mottled orange-brown silty slightly sandy CLAY with blue-grey veins, fine gravel and rootlets		
						3.10 (0.70)	Firm brown mottled orange-brown and blue-grey silty slightly sandy CLAY with occasional black carbonaceous pockets, rare fine gravel and very rare coarse angular gravel		
						3.80 (1.20)	Firm brown mottled orange-brown and blue-grey silty sandy CLAY with pale brown fine silty sandy pockets, at 4.5m sand pockets become orange-brown medium sand		
						5.00 (1.00)	NO RECOVERY		
						6.00	Complete at 6.000m		

Remarks

50 mm standpipe installed to a depth of 5 m, groundwater was monitored on 4/01/2016 at a depth of 2.6 m and on 15/01/2016 at a depth of 2.20 m

Scale (approx)	Logged By
1:50	GT

GEA Geotechnical & Environmental Associates

Widbury Barn
Widbury Hill
Ware
SG12 7QE

Site	Borehole Number
32 Ferncroft Avenue, London NW3 7PE	BH2

Boring Method	Casing Diameter		Ground Level (mOD)	Client	Job Number
Open drive sampler	Depth	Diameter		Mr and Mrs J Ward Lilley	J15356
	Location		Dates	Engineer	Sheet
			18/12/2015	Price and Myers	Sheet 1 of 1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.10)	Brick and sand		
						0.10	Made ground (Pale brownish yellow coarse sand with brick, coarse to medium angular to subrounded gravel, coal and ash)		
						(0.40)			
						0.50	Made ground (brownish grey silty sandy clay with fine to medium brick fragments, orange-brown silty pockets, fine gravel, coal and ash)		
						(0.50)			
						1.00	Soft brown mottled reddish brown silty CLAY with fine to coarse subangular to subrounded gravel, rootlets and roots		
						(0.30)			
						1.30	Firm brown mottled orange-brown silty sandy CLAY with fine to coarse angular to subrounded gravel and pale brown silty sand pockets		
						(0.40)			
						1.70	Firm brown mottled orange-brown and blue-grey silty slightly sandy CLAY with fine to medium subangular to subrounded gravel, rootlets		
						(1.40)			
						3.10	Firm brown mottled orange-brown and blue-grey silty sandy CLAY with occasional fine to medium gravel, rare coarse gravel, rootlets and pale brown sandy pockets		
						(1.40)			
						4.50	Firm brown silty sandy CLAY with yellow-brown sandy pockets and rootlets		
						(0.30)			
						4.80	Firm brown mottled brownish grey silty sandy CLAY with fine yellow-brown sand pockets and rootlets		
						(0.30)			
						5.10	Firm dark brownish grey sandy silty CLAY with pale grey sand pockets with rare decayed rootlets		
						(0.90)			
						6.00	Complete at 6.000m		

Remarks

50 mm standpipe installed to a depth of 5 m, groundwater was monitored on 4/01/2016 at a depth of 1.25 m and on 15/01/2016 at a depth of 1.12 m

Scale (approx)	Logged By
1:50	GT

GEA Geotechnical & Environmental Associates

Wildbury Barn
Wildbury Hill
Ware
SG12 7QE

Site	Borehole Number
32 Ferncroft Avenue, London NW3 7PE	BH3

Boring Method	Casing Diameter		Ground Level (mOD)	Client	Job Number
Open drive sampler	Depth	Diameter		Mr and Mrs J Ward Lilley	J15356
	Location		Dates	Engineer	Sheet
			18/12/2015	Price and Myers	Sheet 1 of 1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.10) 0.10	Made Ground (brick and sand)		
						(0.90) 1.00	Made Ground (grey-brown silty sandy clay with fragments of yellow and red brick, gravel, coal and ash)		
						(0.15) 1.15	Made Ground (brown silty sandy clay with orange-brown clayey pockets, fine to coarse angular to sub-angular gravel, brick, coal and rootlets)		
						(0.65) 1.80	Made Ground (brown mottled orange-brown and pale grey silty clay with fine to medium gravel, brick, coal and rootlets)		
						(0.20) 2.00	Made Ground (dark brown-grey clayey silt with rootlets and fine sub-rounded gravel)		
						(0.30) 2.30	Pale brown clayey SILT with orange-brown veins and dark grey vertical decayed roots and fine rounded gravel		
						(2.60) 4.90	Firm brown mottled orange-brown and blue-grey silty sandy CLAY with rare pale brown silty pockets, occasional fine rounded gravel and rootlets		
						(0.70) 5.60	Firm brown mottled orange-brown and blue-grey very gravelly CLAY; medium to coarse angular to rounded gravel and rootlets		
						(0.60) 5.60	NO RECOVERY: due to water		
						(0.40) 6.00	Firm dark brown silty CLAY with orange-brown sandy partings		
							Complete at 6.000m		

Remarks	Scale (approx)	Logged By
50 mm standpipe installed to a depth of 5 m, groundwater was monitored on 4/01/2016 at a depth of 1.68 m and on 15/01/2016 at a depth of 1.40 m	1:50	GT

GEA Geotechnical & Environmental Associates

Widbury Barn
Widbury Hill
Ware
Herts SG12 7QE

Site Plan

Site	32 Ferncroft Avenue, London NW3 7PE
Client	Mr & Mrs J Ward Lilley
Engineer	Price & Myres

Job Number J15356

Sheet 1 / 1

Approximate
Scale in metres

0 2 4 6