

**7 Fitzroy Square/11 Grafton Mews, London W1T 5HL**

**Job No. 11086**

**Planning Application  
Basement Impact Assessment**

**October 2011**

## SUMMARY

In accordance with London Borough of Camden Development Policy DP27 – Basements and Lightwells and the recent LB Camden guidance document entitled “Camden geological, hydrogeological and hydrological study – Guidance for subterranean development”, a risk-based impact assessment with regard to hydrology, hydrogeology and land stability is being undertaken for the basement development on this project.

This report covers the initial desk study and screening stages of the process and outlines some of the information needed to be obtained at the following scoping and investigation stages.

In accordance with the Camden guidance document, this report should be submitted to LB Camden for review, who may consult with relevant authorities/bodies and the public for their views on the proposed scope.

The site investigation was conducted and this report has been prepared for the sole internal use and reliance of Lyons O’Neill. This report shall not be relied upon or transferred to any other parties without the express written authorization of Southern Testing Laboratories Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The findings and opinions conveyed via this Report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd believes are reliable. Nevertheless, Southern Testing Laboratories Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

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## A INTRODUCTION

### 1 Introduction

Lyons O'Neill were appointed by Fitzrovia Properties in mid September 2011 to provide the necessary pre-planning information required to support the main application from Brooks/Murray Architects.

The object of this study was to produce an impact assessment for the proposed basement construction on this site in accordance with the requirements of the London Borough of Camden. Their requirements are set out within their Development Policy DP27 – Basements and Lightwells and the recent LB Camden guidance document entitled "Camden geological, hydrogeological and hydrological study – Guidance for subterranean development".

This report is the result of the initial desk study and screening process.

### 2 Scope

This report presents our desk study findings, preliminary ground investigation findings and our interpretation of this data.

The findings and opinions conveyed via this Site Investigation Report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Limited believes are reliable. Nevertheless, Southern Testing Laboratories Limited cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

The site investigation was conducted and this report has been prepared for the sole internal use and reliance of Lyons O' Niell Structural Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorization of Southern Testing Laboratories Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The recommendations contained in this report may not be appropriate to alternative development schemes.

## B THE SITE

### 3 Site Location

The site is referred to as 7 Fitzroy Square & 11 Grafton Mews and is located on the eastern side of Fitzroy Square in central London and is approximately centred at National Grid Reference TQ 2913 8207.

The site is roughly rectangular in shape and measures approximately 8m x 38m.

The site presently contains a four-storey Georgian fronted terraced residential/commercial building overlooking Fitzroy Square with 1960's/70's offices to the rear on Grafton Mews. Both buildings have existing basements, but that fronting Grafton Mews is essentially a part-basement as the carriageway level is slightly lower than that in Fitzroy Square.

The site has an approximate elevation of +28m OD at the Fitzroy Square elevation and around 26.6m at Grafton Mews and is bounded by:

- Similar four-storey buildings to the north and south as part of the terrace on Fitzroy Square;
- The open space of Fitzroy Square to the west;
- Residential and commercial buildings on Grafton Mews, with Four-storey residential and commercial buildings on Whitfield Street to the east.

A site location plan is presented as Figure 1.

### 4 Proposed Development

The proposals for this site are to demolish the existing office building fronting Grafton Mews and replace this with a new five-storey residential building with basement. The new basement is to include an area of swimming pool at a lower level. The listed building fronting Fitzroy Square is to have some internal remodelling, but will remain structurally as per the existing.

Over the footprint of the demolished building, the proposed level of the new lower ground floor fronting onto Grafton Mews will be approximately 1.6m below the existing lower ground floor level, with the base of the swimming pool 2.0m below this. This gives a total depth of new construction of 3.6m below the existing lower ground floor.

It is envisaged that the new basement will need to be constructed using a secant piled wall set into the underlying London Clay to form an effective cut-off of groundwater flow from within the shallow aquifer. Figure 2 shows the proposals overlain on the existing arrangement.

## C GROUND CONDITIONS

### 5 Published Geological Data

The British Geological Survey Map No 256 indicates that the site geology consists of superficial Lynch Hill Gravel Formation over London Clay with the underlying Lambeth Group deposits at depth. The study site is marked on appended Figures 5 & 6 based upon the South Camden Geological Map and River Terrace Deposit Thickness Contours figures taken from "Camden geological, hydrogeological and hydrological study – Guidance for subterranean development". From Figure 6 the contour map indicates around 2m of River Terrace Deposits beneath this site; however it can be seen in the following information that within the local area these Terrace Deposits appear to be thicker than shown.

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### 6 Previous Ground Investigation data

A number of publicly available records of ground investigation or historical boreholes have been consulted in the vicinity of this site. The location of these records is shown on Figure 3.

#### 6.1 3 Fitzroy Square (approx 25m to southeast)

Ground investigation boreholes were undertaken for the proposed redevelopment of 3 Fitzroy Square in August/September 2010. The boreholes were drilled from basement level and the soils found are summarised in the following table.

Stratum	Elevation at Top of Stratum (m OD)	Stratum Thickness
Made Ground	25.3m	0.6m
Lynch Hill Gravels	24.7/24.8m	1.5 to 1.8m
London Clay	22.9/23.3m	2.9m+

Given the approximate existing ground level at this site the base of the terrace gravels is seen to be around 5m bgl in this location.

#### 6.2 Whitfield Street (approx 100m to northeast)

A water well was sunk in 1909. The soils revealed are as found are outlined in the following table. Depths and levels have been calculated from imperial measurements so will be approximate.

Stratum	Elevation at Top of Stratum (m OD)	Stratum Thickness
Basement	27.5m	N/A
Terrace Gravel	24.1m	2.1m
London Clay	22m	15.9m
Lambeth Group	6.1m	10.2m

Given the approximate existing ground level at this location the base of the terrace gravels is seen to be around 5.5m bgl.

#### 6.3 Hertford Place (approx 100m to southeast)

Ground investigation boreholes were sunk in 2001. The soils encountered as summarised in the following table.

Stratum	Elevation at Top of Stratum (m OD)	Stratum Thickness
Made Ground	27.5m	N/A
Terrace Gravel	24.1m	2.1m
London Clay	22m	15.9m+

Given the approximate existing ground level at this location the base of the terrace gravels are seen to be around 5.4 to 5.8m bgl.

#### 6.4 Buckingham Street (approx 240m to west)

A ground investigation borehole was sunk in 1980. The soils encountered are summarised in the following table.

Stratum	Elevation at Top of Stratum (m OD)	Stratum Thickness
Made Ground	26.2m	3.3m
Terrace Gravel	22.9m	3.5m
London Clay	19.4m	9.8m
Lambeth Group	9.6m	28m+

Given the approximate existing ground level at this location the base of the terrace gravels are seen to be around 6.8m bgl.

## 7 7 Fitzroy Square/11 Grafton Mews Ground Investigation

Two initial dynamic penetration tests have been undertaken from existing basement level (around 1.4m bgl from Grafton Mews) on this site and two standpipe piezometers have been installed for future monitoring of standing water levels within the ground. The tests were undertaken within the southeastern corner of the site and within the central lightwell.

The probe results indicate that the base of the River Terrace Deposits are at around 3m depth; so approximately 5.9m below existing ground levels in Fitzroy Square or 4.4m bgl relative to Grafton Mews.

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### D HYDROGEOLOGY

Data from the Environment Agency website and other information relating to controlled waters is summarised below.

Data		Remarks	Possible Hazard to/from Site (Y/N)
Ground water Vulnerability	Superficial Deposits	Secondary A aquifer - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers – relates to terrace gravel deposits.	Y
	Bedrock	Unproductive Strata – relates to underlying London Clay strata.	N
Source Protection Zones		The site is outside any recorded source protection zones. The nearest being approximately 2.2km to the northwest to the north of Regents Park (Figure 7).	N
Surface Water Features		The nearest features are the ponds within Regents Park to the northwest.	N
Flood Risk		The website shows the site to be outside the indicative area shown to be susceptible to flooding from rivers with or without the benefit of defences	N

The site is underlain by separate Upper and Lower aquifers or groundwater bodies; namely the River Terrace Deposits and the Thanet Sand/Chalk respectively. These aquifers are separated by relatively impermeable clays of the London Clay and Lambeth Group formations. The upper aquifer is considered to be relevant to the proposed development and basement impact assessment.

#### 8 Shallow Groundwater

Shallow groundwater is contained within the River Terrace Deposits, which form a 'secondary' aquifer. In the area of this site its thickness varies between about 5 and 6m. At this site it has been measured to be 3m thick below the existing basement floor level, which equates to around 4.4m thickness relative to Grafton Mews.

Available groundwater monitoring data within and close to the site have been reviewed. From our initial observations onsite the standing water levels have been recorded at between 0.46m and 0.56m below basement floor levels (1.86 to 1.96m below Grafton Mews).

At 3 Fitzroy Square standing water levels of around 0.6m below basement levels were measured.

Further information from a site to the south of this one indicates standing water levels of around 24mAOD, slightly lower than levels estimated at this site.

Given the available information that has been assessed it would appear there is a groundwater table within the River Terrace Deposits and that the hydraulic gradient/flow is towards the south and southeast.

#### 9 Surface Water Features

No culvert, rivers and other water bodies are known within the immediate vicinity of the site.

From information shown on appended Figure 8 this site is approximately 170m away from the headwaters of a tributary of the lower Fleet, at around Tottenham Court Road, which runs to the east of the site towards its confluence with the Thames. It is assumed to be running in a culvert.

The nearest surface water features are ponds within Regents Park which are about 1km to the northwest of the site. The River Thames passes at its closest point more than 2 km to the southeast of the site. About 2km north of the site, the Regent's Canal runs through the northern part of Regent's Park. These features are shown on appended Figure 9.

### E UNDERGROUND STRUCTURES

#### 10 Basements

From our walkover survey of the local area it appears that the majority of properties fronting Fitzroy Square have existing single storey basements. Other surrounding streets such as Fitzroy Street and Whitfield Street also have numerous basements/lightwells fronting the highway. In Grafton Mews there are one or two seen. These basements, especially if deeper, have the potential to modify the flow conditions in the upper aquifer.

#### 11 BT Deep Level Tunnels

We understand that there are two tunnels within the vicinity of the site:

- A 3.7 - 2.1m diameter tunnel is present below Howland Street about 250m to the southeast of the site. It is understood that the tunnel is around 38m below ground level.
- Another 2.1m diameter tunnel is understood to lie beneath Cleveland Street about 160m to the west of the site. Again this is a deep tunnel, some 38m below ground level.

Owing to their depth, and being below the London Clay deposits, the tunnels are unlikely to have an impact on the upper aquifer.



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### 12 London Underground Tunnels

Twin tunnels of the Victoria Line are present approximately 10 to 15m to the northwest of the site. The tunnels are assumed to be of segmented cast iron construction and are indicated by London Underground to be around 28m below ground levels at the site.

Twin tunnels of the Northern Line pass under Tottenham Court Road, approximately 150m to the northeast of the site. The tunnels are understood to measure 3.6m in diameter, and are situated with approximate crown depths of around 25m below ground level.

A location plan provided by London Underground is included as Figure 13. Owing to their depth, the tunnels are unlikely to have an impact on the upper aquifer.

### 13 Post Office Railway Tunnels

These are understood to be located to the south of the site, just to the north of Oxford Street, approximately 850m to the south. It is unknown at what depth these tunnels were constructed.

### 14 Crossrail Tunnels

The tunnel alignments are understood to run to the south of Oxford Street, approximately 1km south of the site and the tunnel between Tottenham Court Road and King's Cross stations will be about 300m to the east of this site.

Both tunnels will run at significant depth and should have no impact on the upper aquifer.

## F BASEMENT IMPACT ON STRUCTURAL STABILITY

### 15 Structural Stability

DP27 "Maintain the structural stability of the building and neighbouring properties".

The initial works to the site consist of the demolition of the existing building fronting onto Grafton Mews. It is thought that this would be de-constructed in a sequential manner from top down, with flying props installed between the party walls on either side in order to provide lateral support to these existing buildings.

The proposed development consists of a new basement deeper than the existing, together with an area of the site that is lower again from this level to form a new swimming pool.

Due to the presence of groundwater at approximately 0.5m below the level of the existing basement, the new basement will need to be formed using a watertight construction. It is thought at this will be formed using a secant piled wall, formed in hard/firm piles. This would be designed to resist lateral pressures from the water, soil and adjacent party walls. The section of this wall that borders Grafton Mews would also be designed to accommodate surcharge loading from the roadway.

The top of the wall would be propped during the construction phase using some flying shores/diagonal bracing and in the permanent condition through the new basement floor slab. The extent and nature of propping, and the size and detail of the piled wall will be explored during the detailed design phase of the works in order to allow discussions with the party wall surveyor to occur.

Throughout the construction phase the party walls on both sides of the building (No's 9 and 13 Grafton Mews) would be monitored for both movement and vibration to make sure these are within acceptable limits.

## G SCREENING EXERCISE

DP27 "Avoid adversely affecting drainage and run-off or causing other damage to the water environment and Avoid cumulative impacts upon structural stability or the water environment in the local area" LB Camden's "guidance for subterranean development" requires that any development proposal which includes a subterranean basement should be screened in order to determine whether there is an requirement for a BIA to be carried out.

The existing building on the site has a basement. However, the proposed new building will include a basement that will be deeper than the existing one. Therefore screening is required.

In this section, the questions in the screening flowcharts of Appendix E of the LB Camden guidance document are addressed in turn.

### 16 Surface Flow and Flooding

Question 1: Is the site within the catchment of the pond chains on Hampstead Heath?

No. The site is more than 4km away and downstream of Hampstead Heath (see Figure 9).

Question 2: As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?

No. The current proposal is to re-use the existing storm water connections to the Thames Water sewer, provided that this is at a sufficient level to allow this to occur through gravity, otherwise the drainage will be pumped. Subject to a more detailed condition survey of these connections, it is not envisaged that any new connections will be required.

A green wall is proposed for the edge of the new building facing the retained section. Through the nature of this being a living wall it will remove water previously falling straight into the drainage system, hence the volume of water surface water discharging off the site will be reduced from the existing condition.

Question 3: Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?

No. The new basement will not affect the proportion of hard surfaced/paved areas as the footprint of the proposed basement covers an area; which is currently basement or hard surfaced lightwell.



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Question 4: Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?

No. The proposed basement will not alter surface water flows downstream as they will use existing connections to the sewer network. The area of the proposed building on plan is approximately the same as the existing.

Question 5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?

No. The quality of the surface water should be unaltered that is discharged to the sewer. As mentioned under the response to question 2, the proposed green wall will filter the rainwater, as well as reducing the amount of flow reaching the below ground drainage.

Question 6: 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?

No. The site is not within an area known to be at risk of flooding, see Figure 10.

### 17 Groundwater Flow

Question 1a: Is the site located directly above an aquifer?

Yes. The site is located above the Upper aquifer, designated a Secondary Aquifer by the EA which comprises River Terrace Deposits, see Figure 5.

Question 1b: Will the proposed basement extend beneath the water table surface?

Yes. The water table is within the River terrace Deposits. Proposed secant walls around the basement cut into the underlying London Clay.

Question 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?

Yes. The nearest watercourse is around 170m away, see figure 8. There is a water well we are aware of that is approximately 100m to the northeast of this site, see figure 3, which extended into the Lower Aquifer (Chalk). We assume this is disused as it was sunk to supply a former public baths, and the subject site is believed to be downgradient of this well. We do not believe there are any springlines within 100m of this site.

Question 3: Is the site within the catchment of the pond chains on Hampstead Heath?

No. The site is more than 4km away from the pond chains on Hampstead Heath and downstream of them, see Figure 9.

Question 4: Will the proposed basement development result in a change in the proportion of hard surfaced /paved areas?

No. The new basement will not affect the proportion of hard surfaced/paved areas as the footprint of the proposed basement covers an area which is currently either a basement or a hard surfaced lightwell.

Question 5: 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. All surface water will be discharged to the sewer network through existing connections, replicating the existing arrangement. The volume of water is no greater than in the existing condition.

Question 6: 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 the pond chains on Hampstead Heath) or spring line?

No. There are no known local water features in the immediate vicinity of this site.

### 18 Slope Stability

Question 1: Does the existing site include slopes, natural or manmade, greater than 7 degrees? (approximately 1 in 8)

No. The site has no slopes within its boundary.

Question 2: Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7 degs? (approximately 1 in 8)

No.

Question 3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7deg? (approximately 1 in 8)

No. The site is located within a relatively level area, see figure 12.

Question 4: Is the site within a wider hillside setting in which the general slope is greater than 7 degrees? (approximately 1 in 8)

No. The site is located within a relatively level area, see figure 12.

Question 5: Is the London Clay the shallowest strata at the site?

No. London Clay is below a layer of both superficial Made Ground and River Terrace Deposits, see figure 5.

Question 6: Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained? (Note that consent is required from LB Camden to undertake work to any tree/s protected by a Tree Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).

No. There are no existing trees present on this site.

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Question 7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?

No. We have no evidence indicating any possible shrink-swell subsidence in the local area.

Question 8: Is the site within 100m of a watercourse or a potential spring line?

No. The nearest watercourse is around 170m away, see figure 8.

Question 9: Is the site within an area of previously worked ground?

No. The site is not within an area shown as having been worked on figure 5 or on the 6" BGS sheet for the area. However we have not undertaken a full historical desk study.

Question 10: Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?

Yes. The site is within the shallow aquifer (River Terrace Deposits), see figure 5. It is thought to be around 4.6m thick at this locality with a standing water level around 1.8/1.9m below ground level. However, it is unlikely that significant dewatering will be required as it is envisaged a secant piled wall will be used to form a good groundwater cut-off around the basement excavation. Minor seepage into the working area would be dealt with using sumps or other localised measures.

Question 11: Is the site within 50m of the Hampstead Heath ponds?

No. See figure 9.

Question 12: Is the site within 5m of a highway or pedestrian right of way?

Yes.

Question 13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?

The proposed lowest point of the basement (swimming pool) will be around 3.7m lower than the existing basement level. At present the arrangement of the existing foundations is unknown, though early within the next phase of the works a series of trial pits will be undertaken on the site in order to determine information on the depth and nature of the existing footings. The results of these investigations will then be used in the design of the perimeter basement walls. These new walls will be designed for the lateral load from the existing loads on the party wall, as described in Section F.

Question 14: Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?

No. It sits in close proximity to the Victoria Line Underground Tunnels.

London Underground Infrastructure were contacted in relation to the drive in standpipes and confirmed that these did not cause any issues.

A plan showing the location of their infrastructure is presented as Figure 13.

### 19 Conclusions from Screening

On the basis of this screening exercise, it is concluded that there are a number of items that will need to be investigated further and taken into the scoping stage of the process.

There is a need for an assessment of the potential impact of the new basement on groundwater levels in the Upper aquifer. The new basement will extend through the River Terrace Deposits and could, potentially, have a local 'damming effect' on groundwater flow. This could have an influence on adjacent groundwater levels. The status of the nearby historical water well may need to be further investigated.

The other issue that will need to be addressed is the piling in close proximity to the Victoria Line Underground Tunnels. It is anticipated that during the next phase of the design process more advanced discussion will take place with London Underground with regards to piling being constructed close to their property.

The proposed approach to addressing these issues is set out in the following section.

## H SCOPE OF PROPOSED HYDROGEOLOGICAL & STABILITY ASSESSMENT

To address the issues identified in the screening, a calculation of the basement impact on groundwater flow will need to be undertaken. The procedure will be as follows:

- Carry out a detailed ground investigation works on this site to determine the nature of the River Terrace Deposits, obtain an assessment of permeability/conductivity values through in-situ testing;
- Obtain, where possible, further groundwater level data in the immediate area to better assess groundwater gradient/flow data;
- Undertake some groundwater flow modelling to assess likely affects of the proposed basement upon groundwater flows.

An investigation into the nature of the foundations of the neighbouring buildings will need to be undertaken, in order that the design of any proposed works will not impact upon them.

Further discussions will occur with London Underground regarding the Victoria Line Tunnels and the proposed basement works on this site.

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**Appendix A**  
**Figures 1 - 13**



Site Location Plan