Great Ormond Street Hospital Children's Cancer Centre (GOSHCCC)
Flood Risk Assessment

20/05/2022

NHS
Great Ormond Street Hospital for Children
NHS Foundation Trust

RSK

RSK GENERAL NOTES

Project No.: 680181-R1(03)-FRA

Site: Great Ormond Street Hospital Children's Cancer Centre (GOSHCCC)

Title: Flood Risk Assessment

Client: Great Ormond Street Hospital for Children NHS Foundation Trust

Date: May 2022

Office: Wigan

Status: Draft

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Issue No	Version/Details		Date issued	Author	Reviewed by	Approved by
-	Internal Review		07.07.21	CW	KJ	
00	Draft for Client Review		12.07.21	CW	KJ	
01	Revised plans		13.01.22	CW	KJ	DO'S
02	Client comments		14.04.22	CW	KJ	DO'S
03	Client comments		05.05.22	CW	KJ	DO'S

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1 INTRODUCTION

1.1 Context

This Flood Risk Assessment (FRA) has been prepared on behalf of the Applicant, Great Ormond Street Hospital for Children NHS Foundation Trust (referred to hereafter as the 'Applicant') in collaboration with the appointed design and build contractor John Sisk & Son (Holdings) Ltd (referred to hereafter as Sisk) to support an application to the London Borough of Camden (LBC) for full planning permission for the redevelopment of the Great Ormond Street Hospital (GOSH) Frontage Building and Entrance on Great Ormond Street WC1N 3JH X (referred to hereafter as the 'site'), to provide a new Children's Cancer Centre (CCC).

This planning application relates to Phase 4 of the five-phase redevelopment programme for Great Ormond Street Hospital which aims to rebuild two thirds of the hospital over a 20-year period, to upgrade and better meet forecast future healthcare needs.

Improving outcomes for cancer is a major priority for the UK and paediatric cancer is assuming increasing importance. The proposed GOSHCCC will create a national resource for children with rare and difficult-to treat cancers.

The assessment has been prepared in accordance with the National Planning Policy Framework (NPPF)[1] and its accompanying Planning Practice Guidance[2], the Interim Code of Practice for Sustainable Drainage[3], BS 8533-2017 Assessing and Managing Flood Risk in Development Code of Practice[4], BS 8582:2013 Code of practice for surface water management for development sites[5] and the Non-statutory technical standards for sustainable drainage systems[6], with site-specific advice from the Environment Agency, the Lead Local Flood Authority (LLFA), the Local Planning Authority (LPA), the architect and the client.

The NPPF sets out the criteria for development and flood risk by stating that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

The key definitions within the PPG are:

- "Flood risk" is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources; and,
- "Areas at risk of flooding" means areas at risk from all sources of flooding. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. Itcan also include an area within Flood Zone 1 which the Environment Agency has notified the local planning authority as having critical drainage problems.

For this site, the key aspects that require the assessment are:

- The EA's indicative flood zone map shows that the site is located within flood zone 1, **Figure 1.1**.

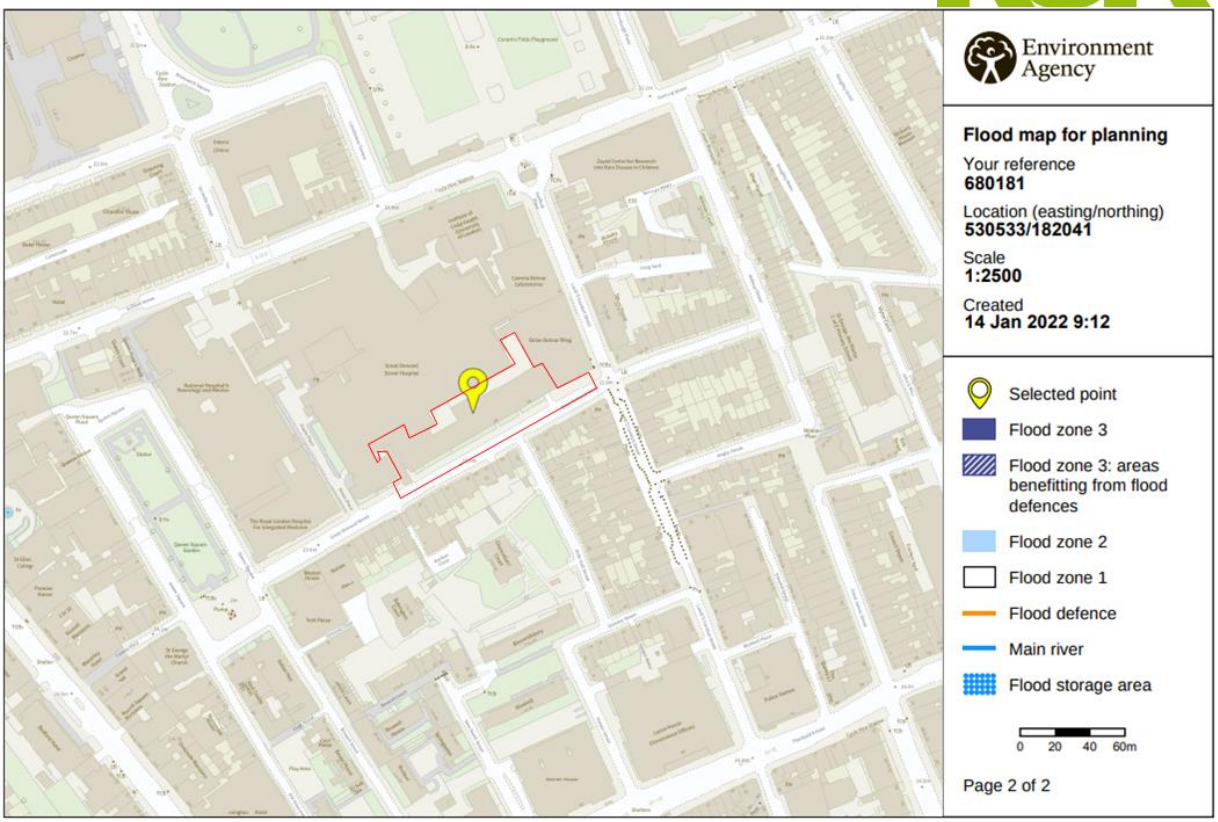


Figure 1.1: Environment Agency Flood Zone Map

[1] Communities and Local Government, 'National Planning Policy Framework', July 2021.

[2] Communities and Local Government, 'Planning Practice Guidance - Flood Risk and Coastal Change, ID 7', March 2014. http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

[3] DEFRA, 'Interim Code of Practice for Sustainable Drainage Systems' National SUDS Working Group, July 2004.

[4] BSI, 'BS 8533-2017 Assessing and managing flood risk in development Code of practice', December 2017.

[5] BSI, 'BS 8582:2013 Code of practice for surface water management for development sites', November 2013.

[6] DEFRA, 'Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems', March 2015.

1.2 Scope of work

A key element of project development is to prepare a FRA to establish the flood risk associated with the proposed development and to propose suitable mitigation, if required, to reduce the risk to a more acceptable level.

The scope of work relating to a FRA is based on the guidance provided in Section 14 of the NPPF and its accompanying Planning Practice Guidance.

A site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The scope of this assessment therefore comprises the following elements:

- To review architect plans, planning information and other studies to determine existing site conditions;
- To obtain information on the hydrology and hydrological regime in and around the site;
- To obtain the views of the EA/LLFA including scope, location and impacts;
- To determine the extent of new flooding provision and the influence on the site;
- To assess the impact on the site from climate change effects and anticipated increases in rainfall over a 100 years lifetime;
- To review site surface water drainage based on the proposed layout and, if necessary, to determine the extent of infrastructure required; and
- To prepare a report including calculations and summaries of the source information and elements reviewed.

Reliance has been placed on factual and anecdotal data obtained from the sources identified. RSK cannot be held responsible for the scope of work, or any omissions, misrepresentation, errors or inaccuracies with the supplied information. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

The comments given in this report and opinions expressed are subject to RSK Group Service Constraints provided in **Appendix A**.

2 SITE DESCRIPTION

2.1 Existing site

Site Name and Address: The Frontage Building at Great Ormond Street Hospital, Great Ormond Street, London WC1N 3JH at TQ 30396 82021.

The majority of the site is currently occupied by the existing GOSH Frontage Building, a five storey building (inclusive of basement) dating from the 1950s that was constructed in two separate phases. The building is currently occupied by a number of GOSH departments including Audiology Department, Clinical Research Facility (CRF), Department of Child and Adolescent Mental Health and Paediatric Psychology Department.

The western most part of the site is occupied by the main GOSH Entrance providing connections to the wider GOSH island site and by a small rear element (external staircase) of the Paul O'Gorman Building that will be demolished to facilitate the proposed development.

The site is bounded by the Paul O'Gorman Building to the west, Octav Botnar Wing to the east, the Variety Club Building and Premier Inn Clinical Building to the north and Great Ormond Street to the south.

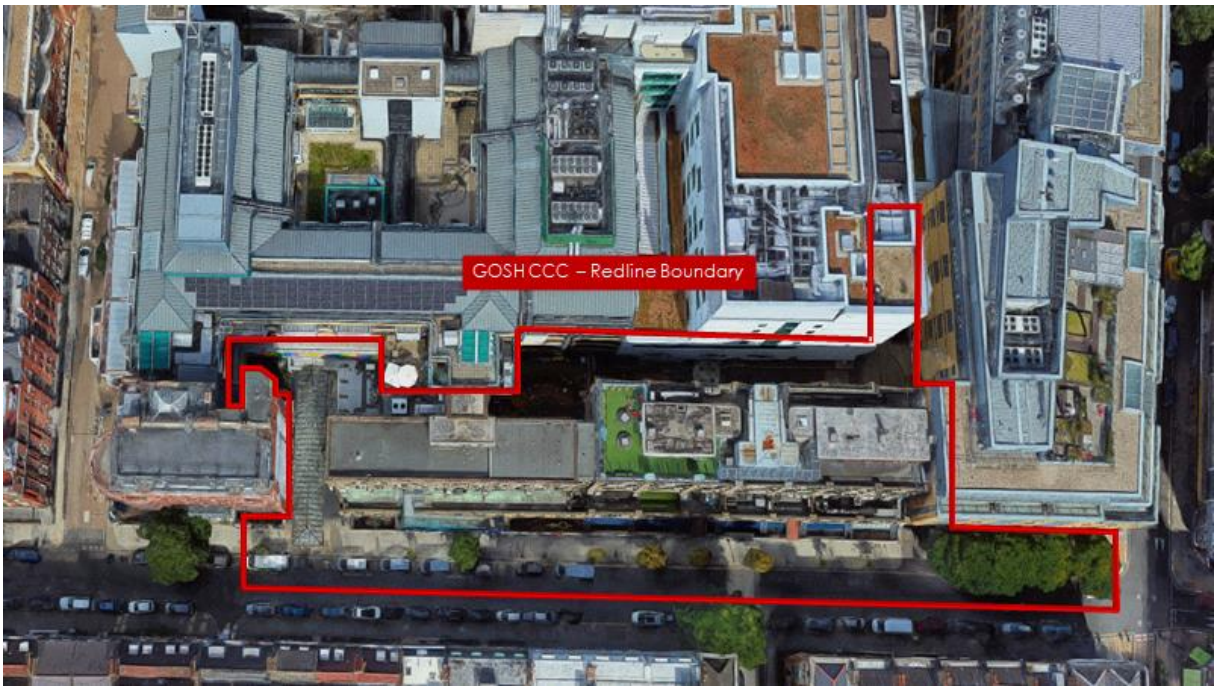


Figure 2.1: Site location map

The site is mainly occupied by the existing building. Surrounding levels typically fall in a easterly direction. A full existing site survey is included as **Appendix B**.

2.1.1 Hydrology

The Lost Rivers of London Map indicates that the site is in very close proximity to a tributary of the historic River Fleet. Maps indicate the tributary lies to the south, but the

exact distance is not known. It is understood that the River Fleet now forms part of the Sewer network and is shown on Thames Water Sewer records. From the available records for the site, the River Fleet does not flow under the site. From anecdotal evidence the River Fleet runs from Hampstead Heath down through Camden then past King's Cross following the line of King's Cross Road then Farringdon Road into the Thames at Blackfriars, approximately one mile north and east of GOSH at its nearest points to the Hospital site. It is possible that historic minor tributaries for the Fleet exist within the vicinity of the site. There are no other known water features on the site or watercourses in the immediate vicinityof the site.

2.1.2 Geology

The underlying bedrock geology is recorded as London Clay Formation – Clay, Silt and Sand, which is overlain by Lynch Hill Gravel Member – Sand and Gravel superficial deposits. Superficial deposits including Hackney Gravel Member – Sand and Gravel and a narrow band of Alluvium – Clay, Silt, Sand and Gravel are recorded to the east of the Site. There are no superficial deposits recorded immediately north-east of the Site.

The closest borehole data to the proposed development is located in the north-west corner of the Great Ormond Street Hospital complex. The borehole recorded 4 m of made ground overlying 14 m of brown grey silty clay with occasional pyritised wood fragments. This in turn overlays 12 m of green and brown and locally red mottled sandy silty clay.

2.1.3 Hydrogeology

Information available in the Envirocheck report and the MAGIC website indicates that the site does not lie within a currently designated groundwater Source Protection Zone (SPZ).

The site is underlain by a secondary A aquifer relating to the superficial Lynch Hill deposits. This is underlain by the London Clay formation, classified as an unproductive aquifer.

2.2 Development proposals

The proposed development will involve the re-development of the Frontage Building to comprise a replacement hospital building that will focus on the treatment of children with cancer.

The proposed development is Phase 4 of the hospitals Masterplan.

The re-development will be largely restricted to the footprint of the existing building and main hospital entrance, although the north-west face of the new hospital building will be extended into an existing courtyard and vehicle access to the rear of the building.

2.3 SFRA

The Lead Local Flooding Authority covering the proposed development site is the London Borough of Camden, who have produced a Strategic Flood Risk Assessment (SFRA; Byers, 2014[7]), which contains the most up to date flooding information and is used to help inform planning decisions. The SFRA presents Flood Risk Management Policy Options, which include:

- FRAs are required for proposals of 1 hectare or greater in Flood Zone 1 and for new development (including minor development and change of use) in an area of

Flood Zone which has critical drainage problems (known as a Critical Drainage Area)

- Flood Risk to development should be assessed for all sources of flooding.
- Surface water flooding should be investigated in detail as part of site specific FRAs for future developments and early liaison with LBC is recommended for appropriate management techniques.
- Groundwater flooding should be investigated in more detail as part of site specific FRAs for developments located in areas of the borough where a potential for groundwater flooding exists.
- When re-developing existing buildings in areas at risk from flooding, the use of flood resilient measures should be promoted at the individual property level.
- The screening stage of a Basement Impact Assessment should be applied to all basement developments to identify any potential risks in relation to the water environment or local properties. Should any risks be identified, appropriate assessment of these risks should be carried out.

The Surface Water Management Plan[8] for Camden indicates that the proposed development site is within a Critical Drainage Area (CDA) and an 'area with increased susceptibility to elevated groundwater', as well as an area with infiltration constraints.

[7] Byers, E. (2014) London Borough of Camden — Strategic Flood Risk Assessment. Report 47070547 Prepared for the London Borough of Camden. Available at: http://hampsteadforum.org.uk/evidence/Basement%20evidence/Hydrology%20evidence/London%20Borough%20of%20Camden%20Strategic%20Flood%20Risk%20Assessment.pdf

2.4 Local Plan

The relevant policy in the Camden Local Plan (2017) is: Policy CC3 Water and flooding, which states:

The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible. We will require development to:

- incorporate water efficiency measures;
- avoid harm to the water environment and improve water quality;
- consider the impact of development in areas at risk of flooding (including drainage);
- incorporate flood resilient measures in areas prone to flooding;
- utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible;
- not locate vulnerable development in flood-prone areas; and
- Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

In addition to the local plan, consideration has been given to the Camden Planning Guidance 'Water and Flooding' (March 2019). This Camden Planning Guidance (CPG) on Water and flooding to support the policies in the Camden Local Plan 2017. This guidance is consistent with the Local Plan and forms a Supplementary Planning Document (SPD) which is an additional "material consideration" in planning decisions

2.5 Site-specific consultation

As part of this assessment, the following authorities have been contacted to obtain relevant data/guidance and establish key site constraints:

Table 2.1: Key site-specific consultations

Consultee	Date issued	Enquiry	Appendix
Camden - Lead Local Flood Authority (LLFA)	February 2020	FOI request – it was confirmed that the LLFA have no record of surface water flooding.	**Appendix C**
Environment Agency	January 2020	Product data Pre-application enquiry. The EA confirmed that the site does not fall in an area of known flood risk or hold records of any historic fluvial/tidal flooding in the area	**Appendix D**

The Camden LLFA response confirmed that they hold no record of surface water flood incidents in the immediate vicinity of the site.

The Environment Agency response included the following information:

- Because this site does not fall within an area at risk of flooding from rivers or the sea, we do not hold any detailed flood modelling data that would impact your site. As such we are unable to provide a flood risk product.
- We do not hold records of historic flood events from rivers and/or the sea affecting the area local to this site. However, please be aware that this does not necessarily mean that flooding has not occurred here in the past, as our records are not comprehensive.
- This address is in 20m of an area at High risk of surface water flooding.
- Following the Flood and Water Management Act 2010, Lead Local Flood Authorities are responsible for the management of groundwater and surface water flooding. They also maintain a register of property flooding incidents. You may want to seek further advice from the London Borough of Camden who may have further information.

[8] Surface Water Management Plan, Drain London. London Borough of Camden. June 2013

3 SOURCES OF FLOOD RISK

3.1 Criteria

In accordance with the NPPF and advice from the Environment Agency, a prediction of the flood sources and levels is required along with the effects of climate change from the present for the design life of the development (in this case assumed to be 100 years).

Changes to climate change guidance in July 2021 indicate that increased allowances in peak river flow and rainfall intensity should now be incorporated within anyassessment. The appropriate allowance for peak river flow is based on the location of the site in the country, the lifetime of development, the relevant flood zone and the vulnerability of the proposed end use.

- Flooding from Rivers (fluvial flood risk);
- Flooding from the Sea (tidal flood risk);
- Flooding from the Land;
- Flooding from Groundwater;
- Flooding from Sewers (sewer and drain exceedance, pumping station failure etc), and;
- Flooding from Reservoirs, Canals and other Artificial Structures.

The following section reviews each of these in respect of the subject site.

3.2 Definitions of Risk

Table 3.1: Flood Map for Planning Risk Zoning

Flood Zone	Description
Flood Zone 1	Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)
Flood Zone 2	Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year
Flood Zone 3	Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3b	Land having the potential to flood for storm events up to the 1 in 20 year return period (>5% annual probability of flooding occurring). It is classified as ‘functional floodplain’

Table 3.2: Flood Risk from Rivers or the Sea and Flood Risk from Surface Water

Flood Zone	Description
High	High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.
Medium	Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.
Low	Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.
Very Low	Means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.

Table 3.3: Flood Risk category matrix from Reservoirs, Groundwater, sewers and other artificial sources

Threat Probability	Low Impact	Medium Impact	High Impact
High	Medium	Medium	High
Medium	Low	Medium	Medium
Low	Low	Low	Low
Negligible	Very Low		

3.3 Flooding from rivers (fluvial flood risk)

3.3.1 Main river

The Environment Agency Flood Zone mapping study for England and Wales is available on their website at: https://flood-map-for-planning.service.gov.uk.

The latest Environment Agency published flood zone map (**Figure 1.1**), taking into account the presence of flood defences, shows the site to be located in Flood Zone 1 (representing less than a 1 in 1,000 annual probability of river flooding).

In December 2013, the Environment Agency released an additional form of mapping 'Risk of Flooding from Rivers and Sea', which is available at:

https://flood-warning-information.service.gov.uk/long-term-flood-risk

The latest 'Risk of Flooding from Rivers and Sea' flood map (**Figure 3.1**), which shows the Environment Agency's assessment of the likelihood of flooding from rivers and the sea at any location and is based on the presence and effect of all flood defences, predicted flood levels, and ground levels, indicates that the developable area of the site is considered to be at '**very low**' risk of flooding.

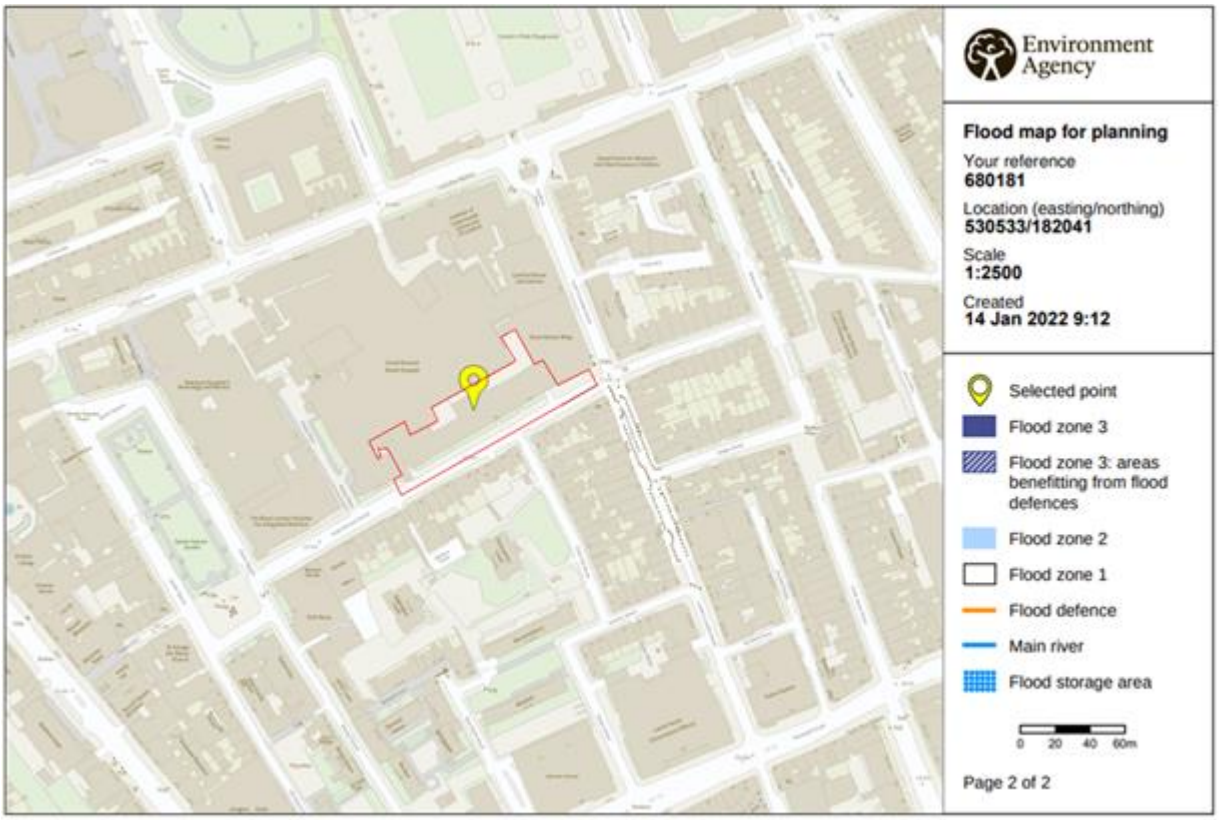


Figure 3.1: Environment Agency Flood Map for Planning (accessed January 2022)

The Environment Agency's Historic Flood Map shows that no flooding has occurred within LBC from fluvial or tidal sources

The resultant fluvial flood risk to the developable area is considered to be **very low**.

3.3.2 Climate change

Fluvial flooding is likely to increase as a result of climate change. A greater intensity and frequency of precipitation is likely to raise river levels and increase the likelihood of a river overtopping its banks. Climate change guidance for river modelling was updated by the Environment Agency in July 2021. The National Planning Policy Framework (NPPF)sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change.

Due to the location of the site in Flood Zone 1 and its isolation from the floodplain, the impacts of climate change on the development site are negligible and the risk remains very low.

3.4 Flooding from the sea (tidal flood risk)

The site is not considered to be at risk from tidal flooding due to its inland location and elevated position, indicating a '**Very Low'** risk of flooding.

3.4.1 Climate change

Climate change is not considered to result in an increased risk of tidal flooding to the site.

3.5 Flooding from the land (overland pluvial flood risk)

If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse.

Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff can occur. Excess surface water flows from the site are believed to drain naturally to the local water features, either by overland flow or through infiltration.

The Environment Agency's surface water flood map (**Figure 3.2**) shows that a low risk of surface water flooding is possible within the confines of the site boundary. These areas are confined to the courtyard areas of the site. Any rainfall in these areas will not originate off site via a flow path and will be drained via the onsite drainage system posing very little risk to the site.

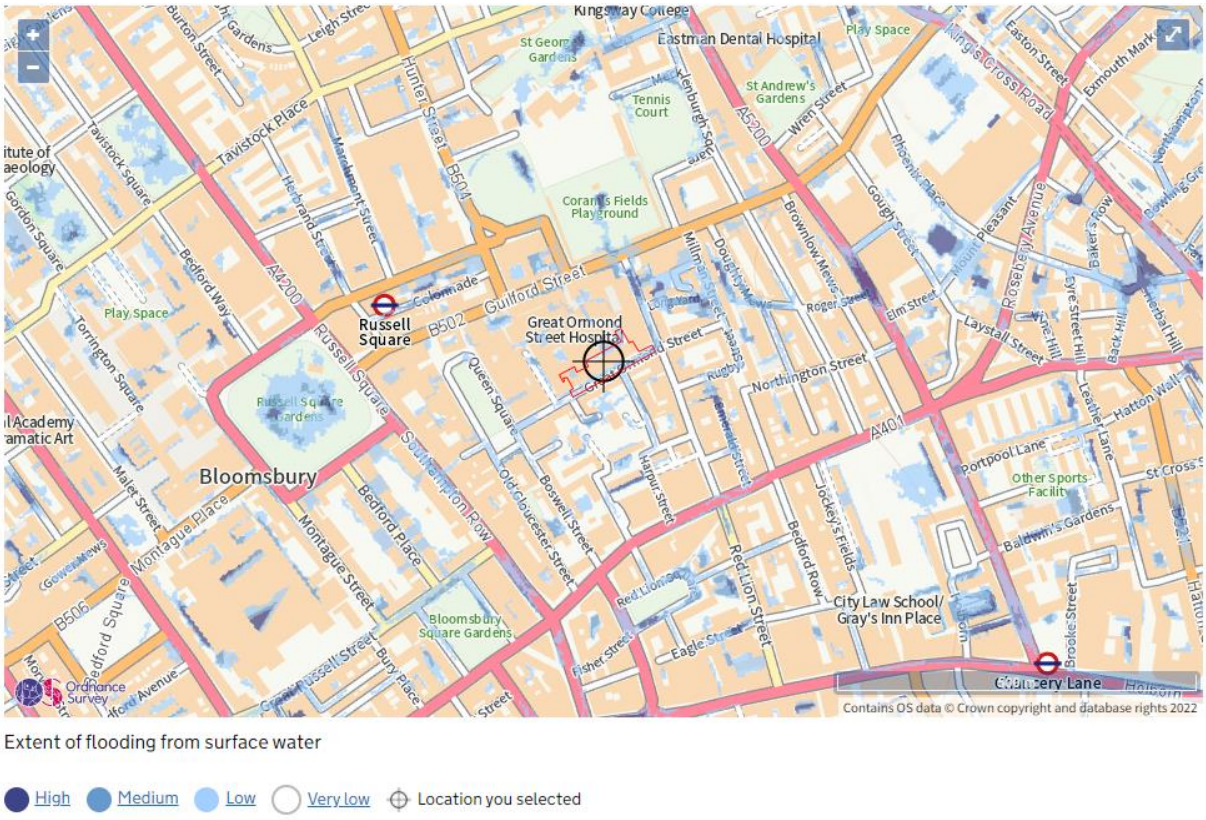


Figure 3.2: Environment Agency 'Flood risk from surface water' map (accessed January 2022)

The risk of surface water flooding at the site is considered to be **Very Low – Low.**

3.5.1 Climate change

Surface water flooding is likely to increase as a result of climate change in a similar ratio to fluvial flooding. Increased intensity and frequency of precipitation is likely to lead to reduced infiltration and increased overland flow. Climate change guidance for rainfall intensity has recently been updated by the Environment Agency. Whilst climate change is expected to result in increased intensity of rainfall, due to the low risk of flooding to the site from this source, the impacts of climate change are expected to remain minor and are considered in the surface water management put forward for the development.

3.6 Flooding from groundwater

Groundwater flooding tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

The site is underlain by a secondary A aquifer relating to the superficial Lynch Hill deposits. This is underlain by the London Clay formation, classified as an unproductive aquifer. The presence of low permeability London Clay at relatively shallow depths beneath the site, while restricting downwards migration, may increase the potential for lateral migration of shallow groundwater through any perched groundwater in the Lynch Hill Gravel Member. The Factual report[1] for the site recorded ground water response zone to be approx. 1m bgl.

From the above and due to the sporadic nature of groundwater flooding, the design of the development and the possibility of groundwater emergence at the site, it is possible that groundwater flooding could affect the development, however as the subsurface aspects of the development are currently in situ, the resultant groundwater flood risk is considered to be **low**.

3.6.1 Climate change

Climate change could increase the risk of groundwater flooding as a result of increased precipitation filtering into the groundwater body. If winter rainfall becomes more frequent and heavier, groundwater levels may increase. Higher winter recharge may however be balanced by lower recharge during the predicted hotter and drier summers. This is less likely to cause a significant change to flood risk than from other sources, since groundwater flow is not as confined. It is probable that any locally perched aquifers may be more affected, but these are likely to be isolated. As much of the catchment is artificially drained, the recharge of the aquifer is very limited and therefore, the change in flood risk is likely to be low.

[9] Great Ormond Street Hospital, Factual Report November 2021 12921-A2SI-XX-XX-RP-X-0003-00

3.7 Flooding from sewers

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its conveyance capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. A sewer flood is often caused by surface water drains discharging into the combined sewer systems; sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes.

Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption[9]. One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30 year rainfall event. By definition a 1 in 100 year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage.

When exceeded, the surcharged pipe work could lead to flooding from backed up manholes and gully connections. This could lead to immediate flooding within highways surrounding the site.

The SFRA shows that 8 properties have been affected by internal sewer flooding in the past 10 years in two separate areas in South Hampstead and north-west of Primrose Hill. In Hampstead, including an area in Hampstead Heath, 4 properties have been affected by internal sewer flooding. A small number of properties (1-2 properties) have experienced internal flooding in three separate areas in Camden Town, West Hampstead and Kilburn. In addition, external flooding is concentrated in the west of the borough in the South Hampstead and Kilburn areas. An area of South Hampstead has 18 recorded incidents of external sewer flooding, with adjacent areas experiencing between 1 and 4 recorded external flooding incidents in the past 10 years. One external flooding incident has also been recorded in the Hampstead area. The site or the surrounding areas are not mentioned.

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and a consequent potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure. The proposed development for this site does not alter the impermeable area being drained and will utilise any existing offsite surface and foul water connections.

To ensure that sewer and surface water flooding is not exacerbated; surface water must be considered within the design of the site. This ensures that any additional surface water and overland flows are managed correctly, to minimise flood risk to the site and the surrounding area. Any new sewer network associated with the development should be designed to ensure exceedance of the network has been considered.

Whilst the proposed building footprint is larger than the existing Frontage Building, the space around the existing Frontage Building is hard landscaping and therefore the proposed development does not increase impermeable area and uses an area of currently drained land. Any precipitation falling on this area will be retained in the roof garden area before draining into the traditional drainage system, as such there will be an increased lag time in the surface water generated being discharged off site from the existing situation.

The resultant sewer flood risk is considered to be **very low.**

There are 2 attenuation tanks that sit between the Frontage building and PICB, these are

proposed to be over-pumped and demolished as part of the proposed works. The tanks hold the surplus rainwater and foul water from the north side of the site prior to it being discharged into the Thames Water sewer in Great Ormond Street. During construction there is potential for additional water to be over pumped to these tanks to dewater the construction area. This risk will be monitored and managed within the Demolition and Construction Management Plan (DCMP).

3.7.1 Climate change

The impact of climate change is likely to be negative regarding flooding from sewers. Increased rainfall and more frequent flooding put existing sewer and drainage systems under additional pressure resulting in the potential for more frequent surcharging and potential flooding. This would increase the frequency of local sewer flooding but will not impact the site as flood flows would be directed away from the site.

3.8 Other sources of flooding

3.8.1 Reservoirs

Flood events can occur from a sudden release of large volumes of water from reservoirs, canals and artificial structures.

Reservoir flooding is also extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to ensure reservoirs are maintained.

The Environment Agency reservoir flood map (reproduced as **Figure 3.3**) shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large. According to the Environment Agency Reservoir flood maps the site nor the surrounding areas are at potential risk of flooding from reservoirs.

The resultant flood risk to the proposed dwellings is considered to be **Very Low**.

Extent of flooding from reservoirs

Maximum extent of flooding Location you selected

Figure 3.3: Environment Agency 'Flood risk from reservoirs' map (accessed July 2021)

3.8.2 Climate change

Reservoirs can be managed over time, controlling inflow/outflow of water and therefore there is the capacity to control the effects of climate change. Increased rainfall has the potential to increase base flow, but this should be minimal. It is unlikely that there will be a substantial change to the risk of flooding for this site.

3.8.3 Canals

There are no canals in close proximity to the site.

3.8.4 Blockages of artificial drainage systems

There is a possibility that flooding may result due to culverts and/or sewers being blocked by debris or structural failure. This can cause water to backup and result in localised flooding, as well as placing areas with lower ground levels at risk. There are no known artificial drainage systems on site that could impact the development.

The risk of flooding from artificial drainage systems is considered to be **very low**.

Climate change is unlikely to affect the flooding risk to the site from such blockages.

4 FLOOD MITIGATION MEASURES

4.1 Overview

The site lies within Flood Zone 1. To facilitate the development of the site considering the risk from fluvial flooding, the developable areas of the site are limited to Flood Zone 1 and on ground situated above the peak water levels for the extreme events, including allowance for climate change.

4.2 Flood compensation

The developable area of the site is shown to be outside the 1 in 1000 year and 1 in 100-year climate change floodplain, therefore floodplain compensatory measures are not deemed necessary for these areas.

4.3 Finished floor levels

As the developable area will not be affected by fluvial flooding there is no need to incorporate any freeboard levels into the finished floor levels of the design.

4.4 Safe access/egress

The site access point and proposed development lie outside of the 1 in 1000-year flood extent, therefore safe access and egress can be achieved from the site.

5 PLANNING CONTEXT

5.1 Application of planning policy

Section 14 of the NPPF includes measures specifically dealing with development planning and flood risk using a sequential characterisation of risk based on planning zones and the Environment Agency Flood Map. The main study requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

5.2 Land use vulnerability

Planning Practice Guidance (PPG) includes a list of appropriate land uses in each flood zone dependent on vulnerability to flooding. In applying the Sequential Test, reference is made to Table 5.1 below, reproduced from Table 3 of PPG.

Table 5.1: Flood risk vulnerability and flood zone 'compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate
	Zone 2	Appropriate	Appropriate	Exception Test Required	Appropriate	Appropriate
	Zone 3a	Exception Test Required	Appropriate	Should not be permitted	Exception Test Required	Appropriate
	Zone 3b functional floodplain	Exception Test Required	Appropriate	Should not be permitted	Should not be permitted	Should not be permitted

With reference to Table 2 of the PPG, the proposed development, based on its hospital use, is classed as 'Highly Vulnerable'. This classification of development is appropriate for areas within Flood Zone 1. As the proposed developable area is located wholly within Flood Zone 1, the sequential test is deemed to have been passed.

5.3 Sequential and Exception Test

The Sequential Test is required to assess flood risk and the PPG recommends that the test be applied at all stages of the planning process to direct new development to areas with the lowest probability of flooding (Flood Zone 1). As the developable area of the site is located in flood zone 1 it passes the sequential test and thus the exception test will not be required.

6 CONCLUSIONS AND RECOMMENDATIONS

This FRA complies with the NPPF and Planning Practice Guidance and demonstrates that flood risk from all sources has been considered in the proposed development. It is also consistent with the Local Planning Authority requirements with regard to flood risk.

The whole of the site lies in an area designated by the Environment Agency as Flood Zone 1, outlined to have a chance of flooding of less than 1 in 1,000 (<0.1%) in any year, however the site is shown to be partially location in an area at potential risk from surface water flooding.

NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. This flood risk assessment demonstrates that the requirements of the Sequential Test have been met, with the developable area of the site located within Flood Zone 1 and 'Highly Vulnerable' classification of the development.

The proposals do not increase impermeable area and surface water generated from the site will be managed and discharged to the existing sewer system at a rate not exceeding the existing rates. Drainage of the site will be assessed as part of the drainage assessment for the site.

This flood risk assessment has considered multiple sources of flooding and concluded the following:

Table 6.1: Flood risk summary

Source	Level of risk	Mitigation
Fluvial	Very Low	The latest Environment Agency published flood zone map, shows the site to be located in Flood Zone 1 (representing less than a 1 in 1,000 annual probability of river flooding).
Tidal	Very Low	The site is inland and elevated.
Surface water	Very Low - High	The development does not increase the area of hardstanding and therefore does not impact on the flood risk from this source. The roof garden areas will retain and slow the flow of surface water generated on site, offering an improvement on the current situation. Some areas of the siteare shown to be at potential risk and this will be considered in the drainage layout of the site.

Groundwater	Low	Groundwater levels are unlikely to impact on the development as there is to be no significant groundworks associated with the development. From the above and due to the sporadic nature of groundwater flooding, the design of the development and the possibility of groundwater emergence at the site, it is unlikely that groundwater flooding would affect the development.

Source	Level of risk	Mitigation
Reservoirs	Very Low	The site is not in an area shown to be at risk from reservoir flooding.
Sewers	Very Low	The development does not seek to increase impermeable area and a connection to the sewer for foul and surface water will be maintained and utilised.
Artificial sources	Very Low	There are no known artificial drainage systems on site that could impact the development.

Overall, taking into account the above points, the development of the site should not be precluded on flood risk grounds.

APPENDIX A
RSK GROUP SERVICE CONSTRAINTS

1. This report and the drainage design carried out in connection with the report (together the "Services") were compiled and carried out by RSK LDE Ltd (RSK) for RSK ADAS (the "client") in accordance with the terms of a contract between RSK and the "client". The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable civil engineer at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.

2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

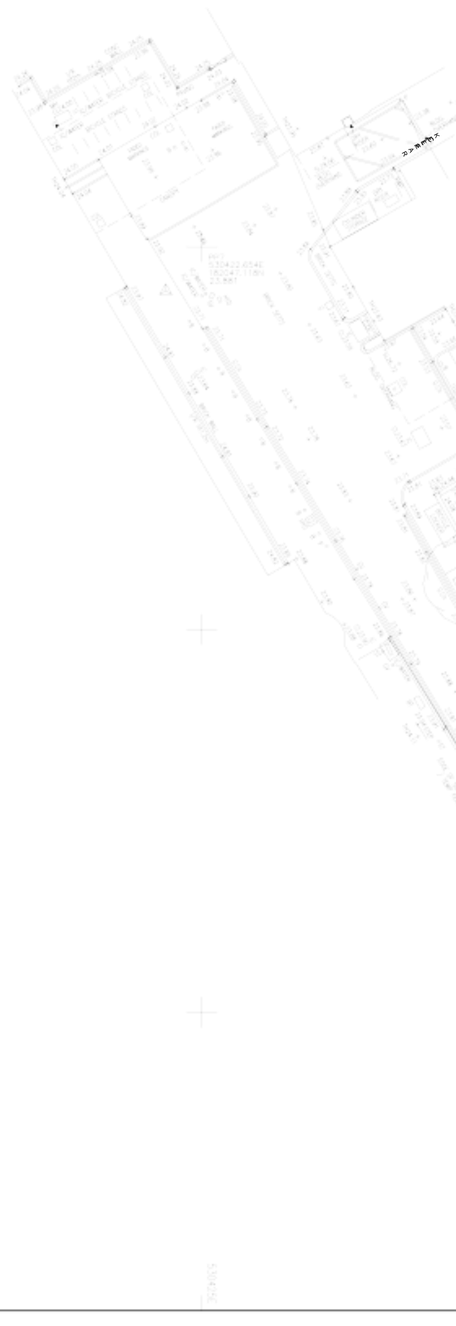
6. The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.

7. The Services are based upon RSK's observations of existing physical conditions at the site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.

8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (boreholes, trial pits etc) annotated on site plans are not drawn to scale but are centred over the appropriate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX B
EXISTING SITE SURVEY



Survey Notes

Grid: Local Plane Grid fixed to National Grid

Levels: OS Datum from GNSS positioning converted using the National Geoid Model OSGM15

Notes

Topographical Survey Legend

BUILDINGS AND WALLS

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FENCE STYLES AND DESCRIPTIONS

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WATER FEATURES

ROADS

RELIEF AND VEGETATION

STREET FURNITURE

LEVEL AND HEIGHT INFORMATION

INSPECTION CHAMBERS AND PIPES

SURVEY INFORMATION SIGNS

GEOTECHNICAL INFORMATION

Rev.	Date	Description

HW Surveying and Consulting

Accreditations

RICS · THE SURVEY ASSOCIATION · FCES · FS 14126

Client

JOHN SISK & SONS LTD

1760 SOLIHULL PARKWAY

BIRMINGHAM BUSINESS PARK, B37 7YD

Project

GREAT ORMOND STREET HOSPITAL

LONDON

WC1N 3JH

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By: AW 13/03/20

Survey Date: February 2020

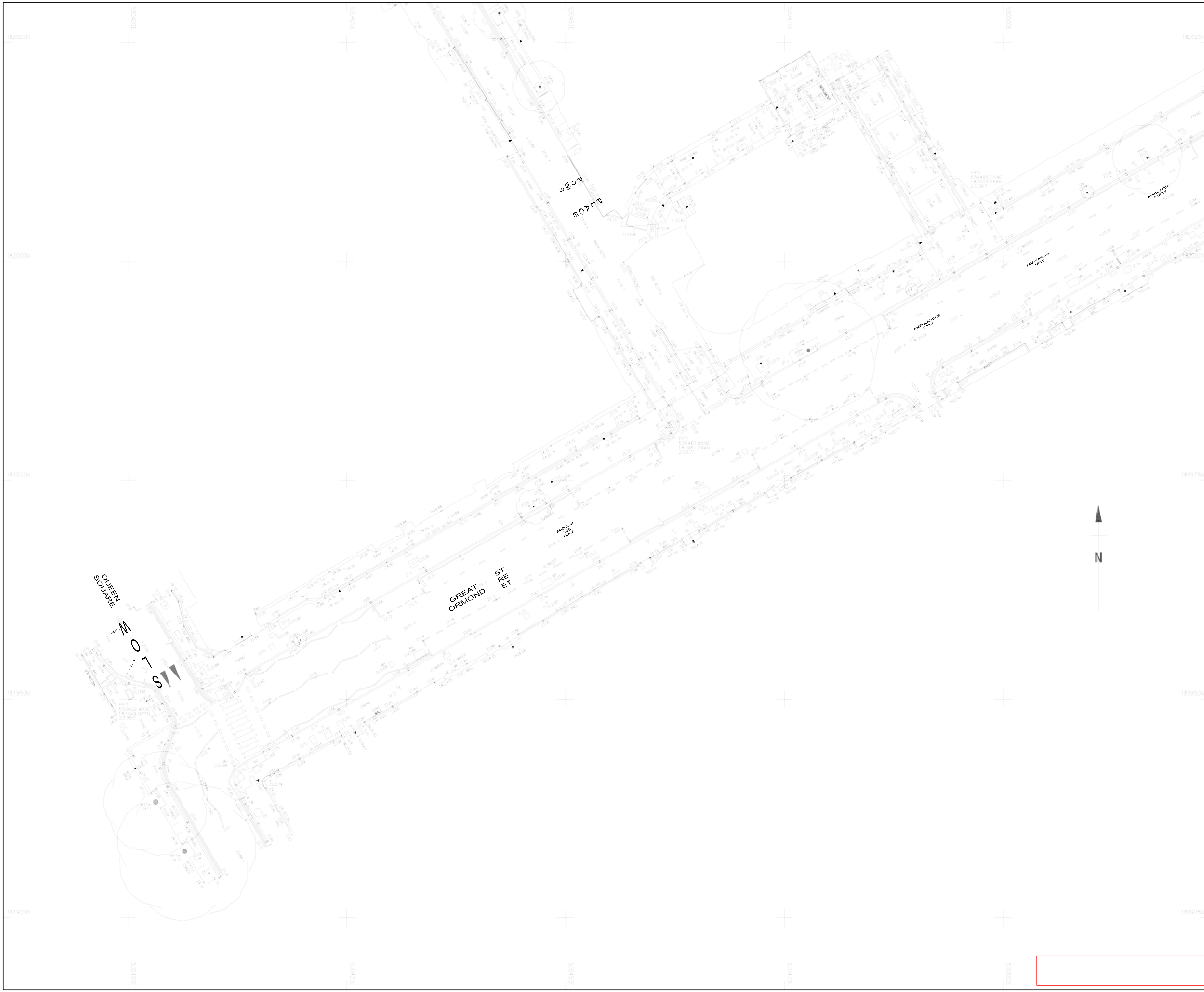
Checked by: EAD 13/03/20

Scale: A1@1:200

Drawing No

50984 / 1

Revision
A



Survey Notes
Grid: Local Plane Grid fixed to National Grid
Levels: OS Datum from GNSS positioning converted using the National Geoid Model OSGM15

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SURVEY INFORMATION SIGNS

GEOTECHNICAL INFORMATION

Rev.	Date	Description
A	16/03/20	Format details updated

Surveying and Consulting

Accreditations

FS 14126

Client
JOHN SISK & SONS LTD
1760 SOLIHULL PARKWAY
BIRMINGHAM BUSINESS PARK, B37 7YD

Project
GREAT ORMOND STREET HOSPITAL
LONDON
WC1N 3JH

Drawing Title
TOPOGRAPHICAL SURVEY

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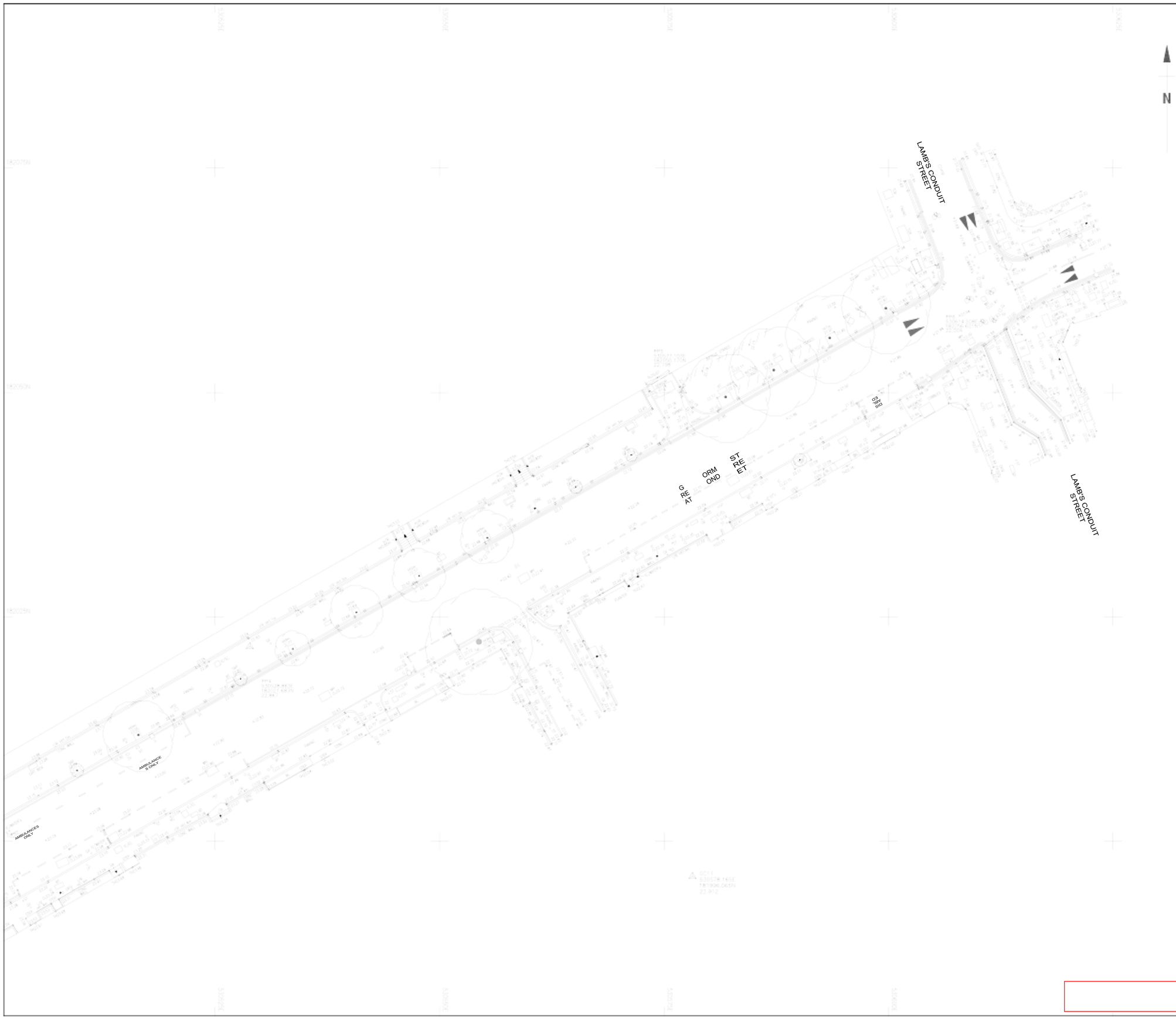
Drawing No



Survey Notes

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Rev.	Date	Description

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FS 14126

Client

JOHN SISK & SONS LTD

1760 SOLIHULL PARKWAY

BIRMINGHAM BUSINESS PARK, B37 7YD

Project

GREAT ORMOND STREET HOSPITAL

LONDON

WC1N 3JH

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By AW 13/03/20

Survey Date February 2020

Checked by EAD 13/03/20

Scale A1@1:200

Drawing No

APPENDIX C
CAMDEN LLFA CORRESPONDENCE

Date: 25 February 2020
Our reference: FOI13974
Email: foi@camden.gov.uk

Information and Records Management
Corporate Services
London Borough of Camden
Town Hall
Judd Street
London
WC1H 9JE

Phone: 020 7974 7857

camden.gov.uk

Dear Requester

Thank you for your request for information dated about flood risk data. We have dealt with this under the Environmental Information Regulations 2004.

Response

The council holds the information requested and the answers to your questions are:-

Please could I request information pertaining to flooding and flood risk (to support a Planning application) for the following site and its immediate surroundings (see also attached):

Paul O'Gormon Building,
Great Ormond Street Hospital,
Great Ormond Street,
London
WC1N 3JH

Please could you provide full details of any known flooding incidents and any modelled flood levels. We are in contact with the EA for flood risk mapping and related data.

We can confirm that as Lead Local Flood Authority (LLFA) we have no record of surface water flood incidents in the immediate vicinity of the above address. Such information is available via a LLFA enquiry to Camden.

Please find below a publicly available web page with documents containing the remainder of the information you seek, including:

- Groundwater flooding incidents
- Sewer flooding incidents (internal & external)
- Historically flooded streets
- Modelled flood risk and flood hazard

https://www.camden.gov.uk/sustainable-drainage-systems

Please scroll down to download the borough's Strategic Flood Risk Assessment (SFRA), and study the maps in the appendices. This information is in the public domain.

Further Information:

Why not check our Portal Open Data Camden before making a new request as your question may already be answered by a previous FOI response or in one of our many useful and interesting datasets.

Your Rights

If you are not happy with how your response was handled you can request an Internal Review within 2 months of this letter by email to foireviews@camden.gov.uk or post: Information and Records Management Team, London Borough of Camden, Town Hall, Judd Street, London WC1H 9JE. Please quote your case reference number. If you are not satisfied with the Internal Review outcome you can complain to the Information Commissioner's Office at casework@ico.org.uk telephone 0303 123 1113, or post to Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF. The ICO website www.ico.org.uk may be useful.

Yours sincerely

Peter Williams
Information Rights Officer

Telephone: 020 7974 7857

APPENDIX D
ENVIRONMENT AGENCY CORRESPONDENCE

Colin Whittingham

From: NET Enquiries <HNLenquiries@environment-agency.gov.uk>
Sent: 06 February 2020 11:10
To: Vicky Stockley
Subject: RE: HNL160092NR - 200122/GS08 FW: Flood Risk data request

Follow Up Flag: Follow up
Flag Status: Completed

Dear Vicky

Thank you for your request dated 21 January 2020 to use Environment Agency data.

The information on Flood Zones in the area relating to Paul O'Gormon Building, Great Ormond Street Hospital, Great Ormond Street, London WC1N 3JH, is as follows:

The property is in an area located within Flood Zone 1 shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named site is in and is not specific to the property/proposed development itself.

Because this site does not fall within an area at risk of flooding from rivers or the sea, we do not hold any detailed flood modelling data that would impact your site. As such we are unable to provide a flood risk product.

We do not hold records of historic flood events from rivers and/or the sea affecting the area local to this site. However, please be aware that this does not necessarily mean that flooding has not occurred here in the past, as our records are not comprehensive.

This address is in 20m of an area at Low High risk of surface water flooding.
Following the Flood and Water Management Act 2010, Lead Local Flood Authorities are responsible for the management of groundwater and surface water flooding. They also maintain a register of property flooding incidents. You may want to seek further advice from the London Borough of Camden who may have further informaiton.

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments

https://www.gov.uk/planning-applications-assessing-flood-risk
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

You can also view and print surface water flood maps online at: http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=ufmfsw#x=357683&y=355134&scale=2

This information is provided subject to the Open Government Licence, which you should read.

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

Data Available Online

Many of our flood datasets are available online:

- **You can view and download flood risk maps from our website at:** http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=357683&y=355134&scale=2
- **Flood Map For Planning** (Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)
- Risk of Flooding from Rivers and Sea
- Historic Flood Map
- Current Flood Warnings
- Open data

I hope that we have correctly interpreted your request. If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.

Kind regards,

Naoimh Richardson
Customers and Engagement Officer

☎ 0203 0257507 HNLenquiries@environment-agency.gov.uk
✉ **Environment Agency, Hertfordshire and North London**
Alchemy, Bessemer Road, Welwyn Garden City, Hertfordshire, AL7 1HE
Pronouns: she/her (why is this here?)

Working days: Monday to Friday 7am – 3pm