Flood Risk Assessment

Richmond Royal Hospital

November 2018

Client
UKI Richmond Ltd and
RER London Ltd

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Flood Risk Assessment

Richmond Royal Hospital

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Revision	Date	Notes	Prepared by	Checked by	Approved by
Draft	11.10.18	Draft issued for comment	AV	KM	
P01	23.11.18	Issued for planning	KM	JK	JK

Executive Summary

This Flood Risk Assessment has been prepared in accordance with best practice, the National Planning Policy Framework (NPPF) and associated local flood risk guidance.

The existing site is currently operating as Richmond Royal Hospital. The site area is approximately 0.37 Ha and prior to development is considered to be 92% impermeable.

The site is located in Flood Zone 1, classified as an area with a very low probability of flooding from rivers or the sea, by the Environment Agency (EA). The closest watercourse to the site is the River Thames which lies approximately 1km to the west of the site.

The site is located in Flood Zone 1 the lowest risk of fluvial or tidal flooding. The existing site has been identified to have a medium risk of sewer flooding, a low risk of groundwater flooding or surface water flooding with low to negligible risk identified for flooding from all other sources.

The risk of flooding from groundwater will be addressed by a detailed geotechnical assessment prior to design of the basements and providing the appropriate grade of waterproofing where required. The risk of flooding from sewer surcharging has been addressed by specifying anti backflow provision in the drainage strategy, and the risk of surface water flooding will be mitigated by design of the on-site drainage system. The residual risk will be mitigated during the design process, and therefore will not provide a significant hazard to people or property.

As outlined within the drainage philosophy statement, the development's surface water system will be designed so that no flooding will occur during storms up to and including that with an AEP of 1% with a 40% allowance for climate change and implementing sustainable urban drainage systems (SuDS). Surface water flows from the site will be restricted post-development, reducing flood risk both on and off site.

Therefore, it is reasoned that the proposed development will not put the occupants at undue risk of flooding nor increase flood risk off site, in the surrounding areas.

1. Introduction

This report contains a site specific Flood Risk Assessment for the proposed development, Richmond Royal Hospital in the London Borough of Richmond upon Thames. The purpose of this report is to demonstrate the proposed scheme is appropriate in relation to flood risk to support the wider planning application for the development.

This report was commissioned by our Client: UKI Richmond Ltd.

This report has been prepared by Anthony van Eeden, an Infrastructure Engineer with 4 years professional experience under the direction and approval of Jacqui Kantor, a Walsh Associate Director with over 14 years professional experience.. Additional checking has been undertaken by Kate Mackay, a Senior Infrastructure Engineer with over 12 years professional experience.

Sources of Information:

Prior to undertaking the Flood Risk Assessment, a desk top study was undertaken and the following documents obtained which are referenced throughout this report:

- Architects Drawings (Appendix B)
- Environment Agency Flood Maps (Appendix C)
- British Geological Society Maps (Appendix C)
- London Borough of Richmond upon Thames Strategic Flood Risk Assessment Report and Maps (Appendix C)
- Topographical Survey (Appendix D)
- Thames Water Asset Data (Appendix E)
- Geoenvironmental Desktop Study (Arup 247776/4/05 March 2016)

Glossary of Terms:

As referred to multiple times throughout this report the following acronyms are defined as follows:

LBRuT London Borough of Richmond upon Thames, *Local Authority for the Development.*

TW Thames Water, *Water and Sewerage Company for the Richmond Area.*

EA Environment Agency, *Government authority with respect to environmental approvals.*

LLFA Lead Local Flood Authority, *are responsible for developing, maintaining and applying a strategy for local flood risk management in their areas and for maintaining a register of flood risk assets.*

SUDS Sustainable Urban Drainage Systems, *methods to capture, store, treat, control and discharge surface water in urban environment using sustainable techniques.*

SFRA Strategic Flood Risk Assessment, *Flood Risk Assessment at the District Level outlining known flood risk within the borough and Council Strategies for addressing flood risk.*

AEP Annual exceedance probability, *this is the percentage probability that a given event could occur in any given year.*

LFRZ Local Flood Risk Zone, *These are discrete areas/extents of predicted surface water flooding.*

CDA Critical Drainage Area, *This is a discrete geographic area and usually a hydrological catchment, where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more LFRZs.*

2. Background

2.1. Existing Site

2.1.1. Site Information

The site is located at Kew Foot Road, TW92TE in the London Borough of Richmond upon Thames (LBRuT). The approximate grid reference for the centre of the site is: TQ 18164 75568.

The site is currently the location of the Richmond Royal Hospital.

The site is bounded to the north by Evelyn Road, Kew Foot Road to the west, Shaftesbury Road to the south and a private thoroughfare and residential housing to the east. A location plan has been included in Appendix A.

The site is approximately 66m long and 62m wide. The approximate area is 0.37Ha of which 92% is considered to be impermeable roof and hardstanding surfaces with the remainder being permeable soft landscaping and planted areas.

2.1.2. EA Flood Zone

The site is located within Flood Zone 1 on the Environment Agency's Flood Map for Planning (Appendix C).

2.1.3. Existing Flood Protection Measures

There are no notable flood protection measures or defences present on the existing site or within the surrounding area.

2.1.4. Hydrogeology & Hydrology

According to the EA, the site does not lie within a groundwater source protection zone. The Superficial Drift geology is classified as a Secondary A aquifer, whereas the Bedrock geology is classified as unproductive strata.

The nearest watercourse is the River Thames located approximately 1.3km west of the site boundary.

2.1.5. Topography

A topographical survey was undertaken for the proposed site and the surrounding areas by MSA Surveyors (Appendix D).

The survey shows the surrounding topography to be sloping southeast along Evelyn and Shaftesbury Roads. The highest point on the western boundary being 7.54m Above Ordnance Datum (AOD) and 6.88mAOD being the lowest level on the south-eastern boundary.

2.1.6. Geology

After review of the British Geological Society Maps (Appendix C) and Geo-environmental desktop study, the site is likely to be underlain by Made Ground, Kempton Park River Terrace Deposits (RTD), a significant thickness of London Clay, then Lambeth Group, Thanet Sand and Chalk.

Groundwater was recorded at approximately 5-6m below ground level within a well hole located at the Richmond Athletic Association.

2. 1. 7. Contamination

Potentially contaminative sources have been identified in Arup's Geo-environmental desktop study. The main sources identified were historical and existing site uses and historical Made Ground. Made Ground is likely to be present on-site based on previous ground investigations in the local area. Off-site sources associated with historical dry cleaning and laundries and two garages have also been identified.

The potential for significant contamination onsite is considered to be generally low. It is recommended that a ground investigation is carried out as part of the redevelopment works to confirm the contamination status of the site.

2. 2. Proposed Development

The proposed development consists of the partial demolition of existing buildings and redevelopment of the site to provide 68 residential apartments and healthcare facility together with associated infrastructure works including private and communal space, car parking, plant and cycle storage.

The area of the site is approximately 0.37Ha, the majority of which will be impermeable as the building will take up most of the footprint of the site. A proposed ground floor site plan is included in Appendix B.

Table 1: Summary of Permeable and Impermeable Areas

	Existing (m^2)	Proposed (m^2)
Permeable site area	~290	~150
Green roof or permeable surface above impermeable area		~480
Impermeable site area	~3,430	~3,090
Total area	**3,720**	**3,720**

2. 2. 1. Vulnerability Classification and Development Suitability

The proposed development use type of residential is classified as 'more vulnerable' under EA guidance. Under this guidance, all vulnerable use types are suitable for development within Flood Zone 1.

2. 2. 2. Sequential Test

All new planning applications must undergo a Sequential Test outlined in the Technical Guidance to NPPF (TGNPPF). The sequential test compares the Flood Risk Vulnerability and Flood Zone Compatibility of a site.

This report establishes that the site is located in Flood Zone 1. Table 2 of TGNPPF indicates that the proposed development would be classed as 'appropriate' use in this Flood Zone, and as such the Exception Test is not required for this type of development.

2. 3. Current Policy and Guidance

The Flood Risk Assessment and associated Drainage Impact Assessment have been performed in accordance with the following national, strategic level planning and borough specific guidance adopted by the relevant authorities.

2. 3. 1. National Planning Policy Framework 2018 (NPPF)

The National Planning Policy Framework sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. The NPPF states 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, that is should be made safe without increasing flood risk elsewhere.

The NPPF is set out so that Local Plans should be supported by a Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards. The policies in the Local Plans should outline the consideration to be given to flood risk and the associated issues, whilst also recognizing the uncertainties associated with predicting flood risk. The impact of climate change must also be considered and its effect on increasing flood risk.

The NPPF states that Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change.

2. 3. 2. Flood and Water Management Act 2010 (FWMA)

This Act makes provision about water, including provision about the management of risks in connection with flooding and coastal erosion. Under the Act, the Environment Agency is responsible for developing a new national flood and coastal risk management strategy. The new strategic role applies in relation to all sources of flooding – river (main river and ordinary watercourse), sea water, surface runoff and groundwater. Local authorities have a new role to lead and co-ordinate flood risk management in their areas. Lead Local Flood Authorities (LLFA) will have overall responsibility for development of a Local Flood Risk Management Strategy for their area and for bringing together all relevant bodies to manage local flood risks. The London Borough of Brent (LBB) is the LLFA for the Wembley area.

2. 3. 3. London Plan 2016

The London Plan is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years. The document brings together the geographic and locational aspects of the Mayor's other strategies; including those dealing with transport, economic development, housing, culture, social and environmental issues, and as an essential part of achieving sustainable development. The London Plan was formally adopted in 2016.

The following key policies of the London Plan applicable to this report are Policy 5.12 Flood Risk Management and Policy 5.13 Sustainable Drainage.

Draft London Plan

A draft London Plan has recently gone through public consultation and is expected to be adopted in winter 19/20. Despite not yet being adopted the draft plan is a material consideration for many councils during the planning process and as such has been considered within this report.

The updated policies of the draft London Plan applicable to this report are Policy SI.12 Flood Risk Management and Policy SI.13 Sustainable Drainage.

2. 3. 4. Flood Risk and Coastal Change Guidance (EA)

The National Planning Policy Framework sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed. The guidance outlines the steps to be followed to guarantee developments are designed to ensure that if there are better sites in terms of flood risk, or a proposed development cannot be made safe, it should not be permitted.

The steps to be followed are (in order of action); assessing the flood risk, avoiding flood risk, managing and mitigating flood risk.

2. 3. 5. London Borough of Richmond upon Local Plan July 2018

The London Borough of Richmond upon Thames has adopted its Local Plan. This has been built on the Core Strategy and includes more detailed policies on the management of development. A number of specific policies guide future developments within the Borough that may be affected by flooding, and set out objectives and minimum requirement for Sustainable Drainage.

Key policies on flood risk and drainage include, Policy LP11 Subterranean developments and basements, Policy LP 17 Green roofs and walls, Policy LP 20 Climate Change Adaption, and Policy LP 21 Flood Risk and Sustainable Drainage.

Within LP21 the statement regarding Sustainable drainage reads;

The Council will require the use of Sustainable Drainage Systems (SuDS) in all development proposals. Applicants will have to demonstrate that their proposal complies with the following:

1. A reduction in surface water discharge to greenfield run-off rates wherever feasible.

2. Where greenfield run-off rates are not feasible, this will need to be demonstrated by the applicant, and in such instances, the minimum requirement is to achieve at least a 50% attenuation of the site's surface water runoff at peak times based on the levels existing prior to the development.

2. 3. 6. London Borough of Richmond upon Thames Strategic Flood Risk Assessment 2016 (SFRA)

In June 2008, Jacobs completed the London Borough of Richmond upon Thames (LBRuT) (Level 1) Strategic Flood Risk Assessment (SFRA). The 2008 SFRA provided a robust assessment of flood risk across the Borough. The main outputs from the study were a set of maps and GIS data delineating fluvial and tidal flood zones to meet the requirements of the then prevailing Planning Policy Statement 25: Development and Flood Risk.

The London Borough of Richmond upon Thames updated the 2008 SFRA in August 2010, referred to hereafter as the 2010 SFRA, to reflect the changes in national, regional and local planning policies and guidance as well as the changes in legislation (including Flood Risk Regulations 2009 and Flood and Water Management Act 2010). The update also took account of new flood risk related plans/documents and maps, such as the Thames Estuary 2100 Plan and the Areas Susceptible to Surface Water Flooding maps.

2. 3. 7. London Borough of Richmond upon Thames Surface Water Management Plan 2011 (SWMP)

The Surface Water Management Plan (SWMP) was released in September 2011 and was delivered as part of the Tier 2 package of works of the Drain London Project. The document outlines the preferred surface water management strategy for the London Borough of Richmond upon Thames. It includes consideration of flooding from sewers, drains, groundwater and runoff from land, small water courses and ditches that occur as a result of heavy rainfall.

In additional to the action plan the report outlines planning recommendations for surface water management for new developments within CDAs.

2. 3. 8. The CIRIA C753 – The SUDS Manual 2015

The SuDS Manual incorporates the very latest research, industry practice and guidance. In delivering SuDS there is a requirement to meet the framework set out by the Government's 'non statutory technical standards' and the revised SuDS Manual complements these but goes further to support the cost-effective delivery of multiple benefits including technical design and maintenance of SuDS systems.

3. Flood Risk Assessment

3. 1. Sources of Flooding

3. 1. 1. Tidal Flooding and Fluvial Flooding

The site is located in Flood Zone 1 on the EA's Flood Map for Planning (Appendix C). Flood Zone 1 consists of land which has been assessed by the EA as having a very low probability of river and sea flooding, this equates to land assessed as having less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).

The closest source of fluvial flood risk is the River Thames which is located over 1.3km from the site. The site is well outside any modelled flood extent from this source and it is considered that this level of risk will remain unchanged throughout its operational life.

Therefore the risk of flooding from tidal and fluvial sources is considered to be very low.

3. 1. 2. Coastal Flooding

The site is located some 60km from the south and east coast, the site is not susceptible to coastal flooding or erosion.

3. 1. 3. Pluvial & Surface Water Flooding

The EA and LBRuT SFRA flood risk maps show that the site is predominantly at very low risk of surface water flooding. There is a small area of low risk flooding isolated within the central courtyard of the existing site. This risk can be attributed to localised topographic depressions in the existing courtyard paving levels.

This courtyard will be demolished and redesigned as part of the proposed works. As such the finished levels and drainage design will do not create any risk of surface water flooding therefore no residual risk will remain post development.

The maps to do not show any instances of the overland flow from pluvial flooding through the site boundary.

Therefore, this site has a low risk of surface water flooding predevelopment.

3. 1. 4. Sewers

Historical incidents of localised flooding have been captured within the LBRuT SFRA Maps where possible (Appendix C), review of these maps show one to five (1-5) recorded incidents of sewer flooding within the area surrounding the site.

Thames Water asset plans indicate that there are existing 225mm surface water sewers that run east along both Shaftesbury Road and Evelyn Road. 225mm diameter foul sewers run on three sides of the site, east along Shaftesbury Road and Evelyn Road and south along Kew foot Road. The foul sewer invert in Evelyn Road where the existing connection from the site discharges is approximately 3.5mAOD.

Because the site has a basement level which is below street level, with connections to both the foul water and surface water sewers in the road ways, if the public sewers surcharge or a blockage occurs, rain water or foul water may not be able to discharge from the site to the sewer, or backflow may occur.

Based on the information available, it is considered that the site is medium risk of flooding from sewers predevelopment.

3. 1. 5. Reservoirs

The EA Flood Maps do not identify the site as being within an area which is at risk of flooding due reservoirs.

Therefore this site can be considered to be at very low risk of flooding due to reservoirs.

3. 1. 6. Groundwater

As noted within the LBRuT SFRA, *"areas adjoining the River Thames corridor however are often characterised by deposits of gravel above the clay layer. These are referred to as 'Thames Gravels' and there is evidence within adjoining Boroughs of groundwater flooding occurring some distance from the river as a result of water finding a pathway through the gravels during high river levels."*

The LBRuT SFRA Maps highlights areas which may be susceptible to elevated groundwater levels based on geological indicators. Based on these maps the site is classified as having potential for groundwater flooding to occur at the surface.

Limited records of groundwater flooding incidents across the Borough have been sourced, with only one incident recorded by the EA to date. However, it should be noted that there has not been a statutory obligation to record incidences of groundwater flooding in the past, and it is therefore likely that this list is not exhaustive.

The site has basements, and the courtyard which are set below the surrounding ground level. There is also an existing soakaway, which indicates the groundwater at the site was at least a metre below the courtyard level at the time it was constructed and borehole logs record ground water at around 5-6m below ground level Groundwater flooding incidences have not been noted at the site.

Therefore, the site is assessed as having a low risk of groundwater flooding predevelopment.

3. 1. 7. Historic Flooding

Analysis of the West London SFRA historic flood maps show one instance of historic flooding within or near the site. The closest recorded flood event was ground water flooding within near the corner of Lower Mortlake Road and Tersha Street approximately 350m south-east of the proposed site.

The type of flooding was identified as groundwater flooding. We note the area also coincides with medium to high risk surface water flooding meaning this area is likely lower topographically than the proposed site.

Provided the risk of ground water flooding identified above is properly addressed, this historic flooding event can be considered to represent a low risk to the proposed development.

3. 1. 8. Overland Flow (Other Sources)

Likely sources of overland flow (surface water flooding and ground water) are discussed in previous paragraphs. Another source of overland flow could be from a burst water main. Water mains are commonly

laid in road carriageways, based on the topography of the site and the surrounding area it is assumed that any flooding caused by a burst water main should be contained within the road corridors.

As such it is considered that the site is not susceptible to flooding from overland flows from other sources.

3. 1. 9. Summary

Based on the assessment above, the relevant risk level for all sources of flooding can be summarised as follows;

Table 1: Summary of level of flood risk by source

Source of Flood	Risk Level
Tidal	Very Low
Fluvial	Very Low
Coastal (Erosion)	Very Low
Pluvial/Surface Water	Low
Sewers	Medium
Reservoirs	Very Low
Groundwater	Low
Historic Flooding	Low
Overland Flow (Other Sources)	Very Low

3. 2. Flood Risk Management

3. 2. 1. Post development flood risk

The impervious area of the site will increase marginally due to the development. A drainage strategy and SuDS strategy has been developed based on the principles of the London Plan and is outlined in the drainage philosophy statement (4655-181025-KM-Drainage Strategy-Rev2) which includes the provision of a sustainable drainage system that contains rainfall from the site without flooding for events up to and including the 1% AEP rainfall with an appropriate allowance for climate change.

Finished levels on site should slope away from building entrances for vulnerable uses at ground and lower ground levels, including substations, plant rooms and commercial spaces.

It is therefore considered that the risk of on site and offsite flooding will not increase due to the development and should in fact decrease.

The proposed development includes a central basement area that will be deeper than the current basements. Further site specific geotechnical and hydromorphic investigation is required to determine the groundwater characteristics of the site and inform risk of groundwater flooding to the site, however, through implementation of best practice dewatering or waterproofing the risk of groundwater flooding to the site will remain low.

By implementing the above strategy it is considered that the residents and occupants of the proposed development will not be at undue risk of flooding.

3. 2. 2. Flooding Overland Flow Paths

As discussed in Section 3.1.3 no identified overland flow paths from surrounding properties have been reasoned to exist on the site and therefore we do not believe the development will impact any current flood flow paths. Due to the impervious nature of the proposed development consideration will need to be given to proposed levels to see that any risk from overland flow is not increased and appropriately managed.

3. 2. 3. Displaced Flood Volumes

As the site is not within an active flood plain, therefore no flood plain storage will be displaced.

3. 2. 4. Impact on Fluvial Morphology

The western point of the site boundary is over 1.3km from the banks of The River Thames (above ground), therefore the development will not impact fluvial morphology.

3. 2. 5. Allowance for Climate Change

As noted within the SFRA, the potential impact that climate change may have upon the likelihood of flooding over the life time of a development should be taken into account and this should be addressed in site level Flood Risk Assessments. The revised EA guidance for climate change allowances should be applied for fluvial and surface water flooding.

Peak River Flow Allowance

Not applicable to assessment of developments in Flood Zone 1.

Peak Rainfall Allowance

For design life extending into 2070-2115 the EA recommends both the central (20%) and upper end (40%) allowances are considered to ensure there is no undue flood risk to persons or property. Therefore, the surface water drainage system will be designed and modelled with a 40% allowance for climate change.

3. 3. Mitigation Measures

3. 3. 1. Finished Floor Levels (FFL)

As the development is not located within an active flood plain there are no relevant flood levels to address.

Finished levels on site should slope away from building entrances for vulnerable uses at ground level, and basement level.

3. 3. 2. Flood Protection Measures

It is recommended that careful monitoring of groundwater is undertaken when the central area is lowered to create a deeper basement. The basement will need to be constructed to an appropriate grade of waterproofing for the use proposed.

It is recommended the proposed development drainage system adopts backflow prevention measures to protect the levels within the development in line with Building Regulations Approved Document Part H.

3. 3. 3. Flood Warning Strategy

As the site has not been identified to be at higher risk of flooding from any source a flood warning strategy is not required.

3. 3. 4. Improvements for Flood Defence

There are currently no flood defences benefitting the site so improvements to flood defence are not deemed necessary as a result of the proposed development.

3. 3. 5. Residual Risk

Following the flood risk assessment, the development is shown to be at very low to negligible risk of flooding by addressing the identified medium risk of flooding from sewers and low risk of groundwater or surface water flooding.

Therefore, it is reasoned that the proposed development will not put the occupants at undue risk of flooding nor increase flood risk in the surrounding areas as a result.

4. Drainage Impact Assessment

A Drainage Design Philosophy, including a sustainable drainage strategy was produced to support the planning application for the site.

The SuDS hierarchy has been followed, and sustainable drainage features, including permeable surfacing and green roof areas, are proposed to limit peak flows, control the volume of surface water runoff from the site and mitigate the small increase in impermeable area. Attenuation storage is proposed to restrict runoff from the site in line with sustainable principles. Further attenuation is not achievable due to the refurbishment nature of the scheme and the requirement to maintain operation of the internal road during the construction period.

The strategy proposes attenuating flows from the majority of the site (2530m^2) to 3.2l/s in events up to and including the 1% AEP plus 40 % climate change, representing a discharge rate equivalent to the calculated 1 in 100 year (1% AEP) greenfield rate for the catchment. Post development the total peak discharge to the sewer will be approximately 50% of the pre-development peak discharge.

All lower ground foul drainage will discharge via a back-flow prevention valve, which will shut-off and raise an alarm during a surcharge event. A pump, either built-in to the valve or located just off-line, will then pump flows to by-pass the effects of the surcharged flows and maintain discharge from the basement and adjoining property during such an event.

All foul water from ground floor and above will discharge via a separate high-level system to the existing outfall, connecting downstream of the backflow prevention valve.

Flow from the surface water attenuation tank will be pumped, and therefore backflow from the sewer will not enter the tank.

Residual risk from surface water or sewer flooding on site will only result from storms larger than the 1% AEP rainfall event in line with current standards and best practice, or from a blockage.

Refer to Appendix E for the Drainage Philosophy Statement for the site including the proposed Drainage Strategy.

5. Conclusions and Recommendations

This Flood Risk Assessment has been prepared in accordance with best practice, the National Planning Policy Framework (NPPF) and associated local flood risk guidance. This flood risk assessment demonstrates that the proposed development will not be unduly at risk from flooding post development.

The existing site is occupied by the Richmond Royal Hospital. The site area is approximately 0.37 ha and is predominantly covered in impermeable surfaces.

The site is located in Flood Zone 1 the lowest risk of fluvial or tidal flooding. The existing site has been identified to have a medium risk of sewer flooding, a low risk of groundwater flooding and low risk of surface water flooding with low to negligible risk identified for flooding from all other sources.

The risk of flooding from groundwater will be addressed by a detailed geotechnical assessment prior to design of the basements and providing the appropriate grade of waterproofing where appropriate. The risk of flooding from sewer surcharging has been addressed by specifying anti backflow provision in the drainage strategy, and the risk of surface water flooding will be mitigated by design of the on-site drainage system. The residual risk will be mitigated during the design process, and therefore will not provide a significant hazard to people or property.

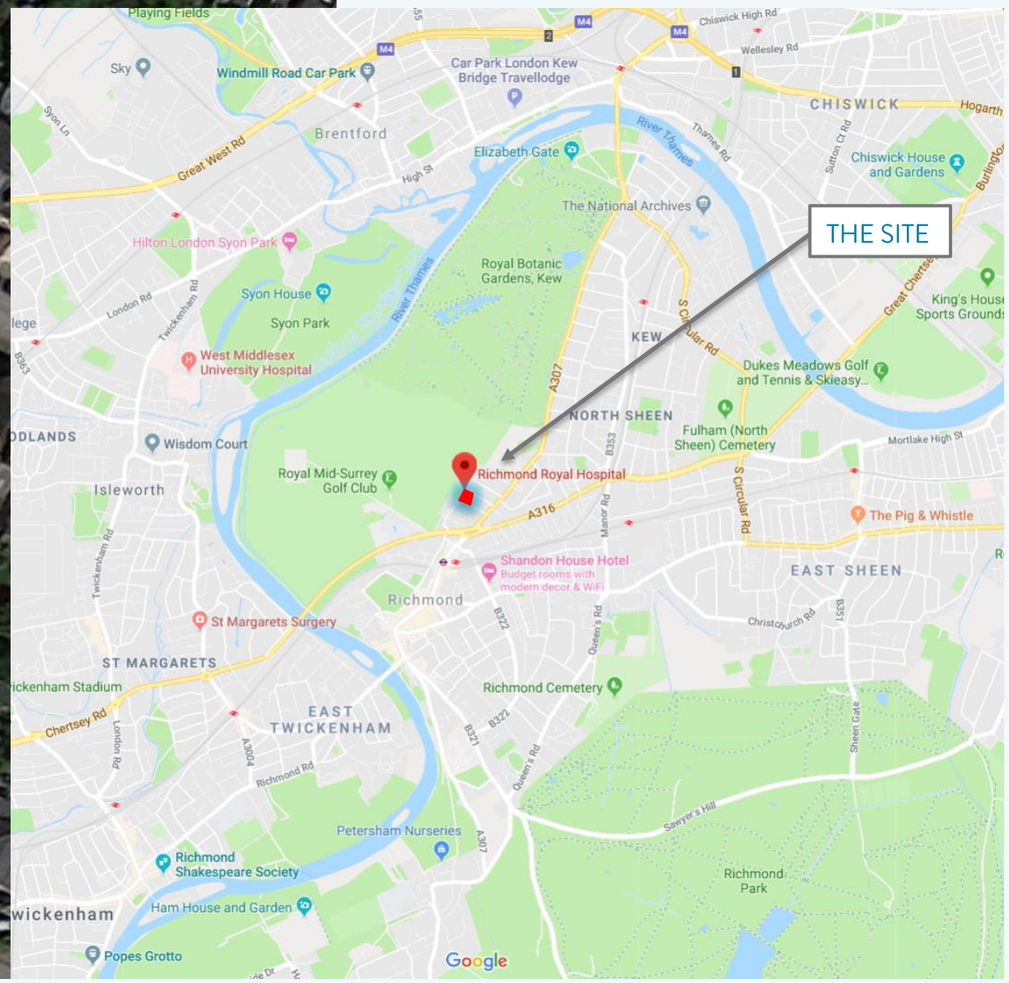
As outlined within the drainage philosophy statement, the developments surface water system will be designed so that no flooding will occur during storms up to and including that with an AEP of 1% with a 40% allowance for climate change and implementing sustainable urban drainage systems (SuDS). Surface water flows from the site will be restricted post-development, reducing flood risk both on and off site.

Therefore, it is reasoned that the proposed development will not put the occupants at undue risk of flooding nor increase flood risk off site, in the surrounding areas.

Appendix A **Location Plan**

Location Plan

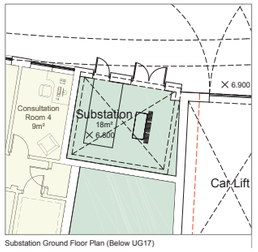
Richmond Royal Hospital, Richmond



Richmond Royal Hospital, Richmond TW9 2TE

TQ 18164 75568

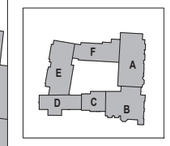
Appendix B **Proposed Site Plans**



Substation Ground Floor Plan (Below UG17)

NOTES

1 The Contractor must check and confirm all dimensions
2 All discrepancies must be reported and resolved by the Architect before works commence
3 This drawing is not to be scaled
4 All work and materials to be in accordance with current applicable Statutory Legislation and to comply with all relevant Codes of Practice and British Standards
5 This drawing is based on a measured survey by MSA



Note:

All noted dimensions, levels, areas & head heights indicative and subject to design development

Legend

- Studio 1 Person
- 1 Bed 2 Person
- 2 Bed 3/4 Person
- 3 Bed 5 Person
- 4 Bed 6 Person

Rev	Description	Date
1K	General revisions	16/11/18
1J	General revisions	06/11/18
1H	General Revisions	08/10/18
1G	General layout amended	19/09/18
1F	Issued for information. General layout amended	07/09/18
1E	Duplex Apartments added to top floor Minor Amendments	15/08/18
1D	Various amendments, unit mix updated	06/08/18
1C	Issued for information	01/08/18
1B	Issued for information	24/07/18
1A	Issued for information	18/07/18

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Client
UKI Richmond Ltd

Project
NHS Site
Richmond Royal Hospital Site

Drawing
Scheme 17
Proposed Upper Ground Floor Plan

Scale	Date	Status
1:100 (A0)	July 18	Information

Job Number	Drawing Number	Revision
5831	Z17_3_20P00_A0	1K

G:\5831\Z_Dezign\Scheme 17\Z20\Z17_3_20P00_A0

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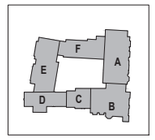

Note:

All noted dimensions, levels, areas & head heights indicative and subject to design development

Legend

- Studio 1 Person
- 1 Bed 2 Person
- 2 Bed 3/4 Person
- 3 Bed 5 Person
- 4 Bed 6 Person

Rev	Date
1L General revisions	16/11/18
1K General revisions	06/11/18
1J Unit G04 enlarged	31/10/18
1H General Revisions	08/10/18
1G General layout amended	19/09/18
1F Issued for information. General layout amended	07/09/18
1E Duplex Apartments added to top floor Minor Amendments	15/08/18
1D Various amendments, unit mix updated	06/08/18
1C Issued for information	01/08/18
1B Issued for information	24/07/18
1A Issued for information	18/07/18

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Client
UKI Richmond Ltd

Project
NHS Site
Richmond Royal Hospital Site

Drawing
Scheme 17
Proposed Ground Floor Plan

Scale	Date	Status
1:100 (A0)	July 18	Information

Job Number	Drawing Number	Revision
5831	Z17_3_20P-1_A0	1L

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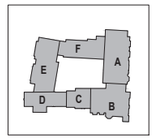
NOTES

1 The Contractor must check and confirm all dimensions
2 All discrepancies must be reported and resolved by the Architect before works commence
3 This drawing is not to be scaled
4 All work and materials to be in accordance with current applicable Statutory Legislation and to comply with all relevant Codes of Practice and British Standards
5 This drawing is based on a measured survey by MSA



N

Note:

All noted dimensions, levels, areas & head heights indicative and subject to design development

Legend

- Studio 1 Person
- 1 Bed 2 Person
- 2 Bed 3/4 Person
- 3 Bed 5 Person

Rev	Description	Date
1J	General revisions	16/11/18
1H	General revisions	06/11/18
1G	General Revisions	08/10/18
1F	General layout amended	19/09/18
1E	Issued for information. General layout amended	07/09/18
1D	Duplex Apartments added to top floor Minor Amendments	15/08/18
1C	Issued for information	01/08/18
1B	Issued for information	24/07/18
1A	Issued for information	18/07/18

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Client
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Project
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Richmond Royal Hospital Site

Drawing
Scheme 17
Proposed Third Floor Plan

Scale	Date	Status
1:100 (A0)	July 18	Information

Job Number	Drawing Number	Revision
5831	Z17_3_20P03_A0	1J

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Appendix C **Flood Risk and Geological Maps**

Flood map for planning

Your reference	Location (easting/northing)	Created
Richmond	**518154/175563**	**3 Oct 2018 9:41**

Your selected location is in flood zone 1, an area with a low probability of flooding.

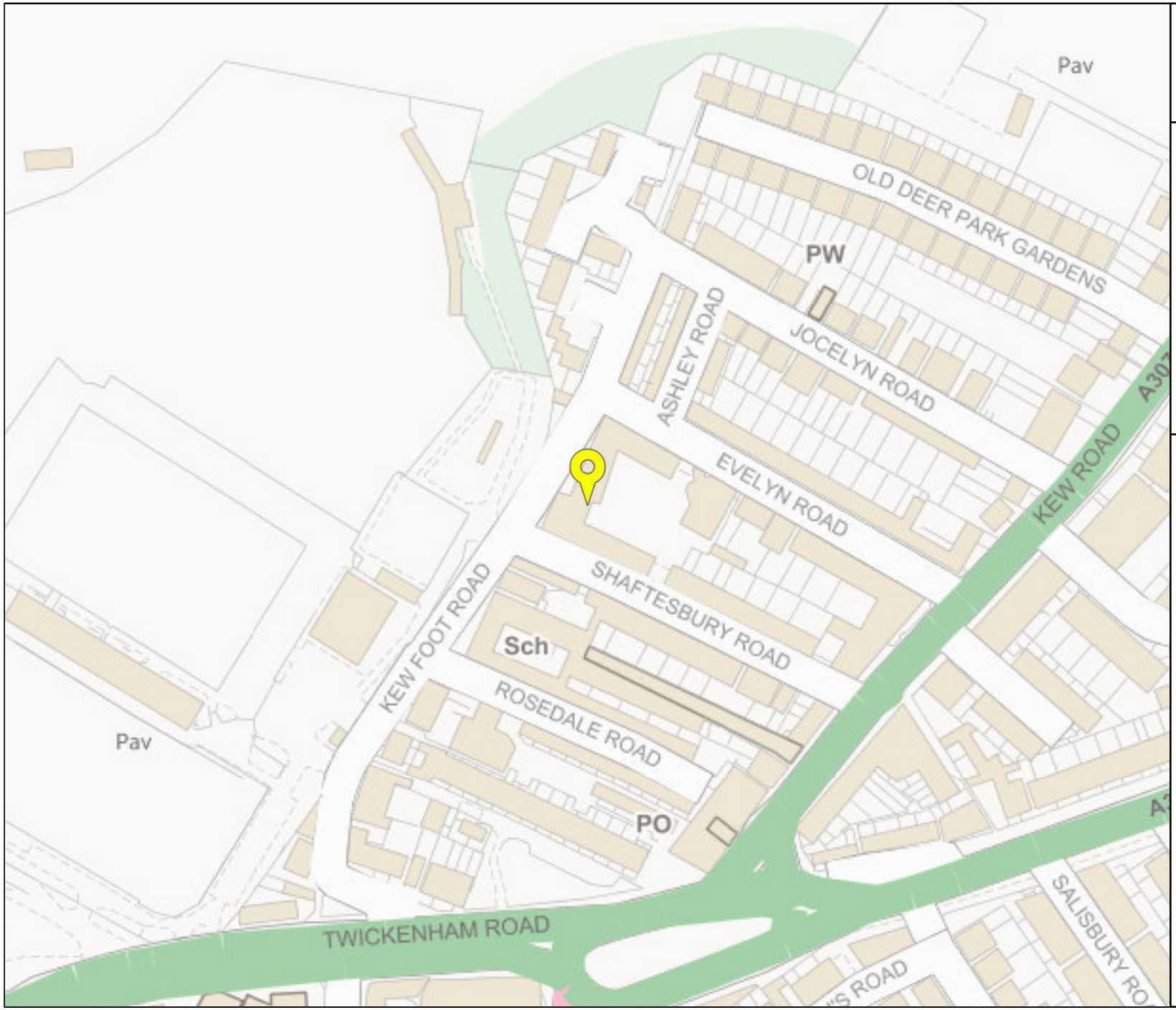
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
Richmond

Location (easting/northing)
518154/175563

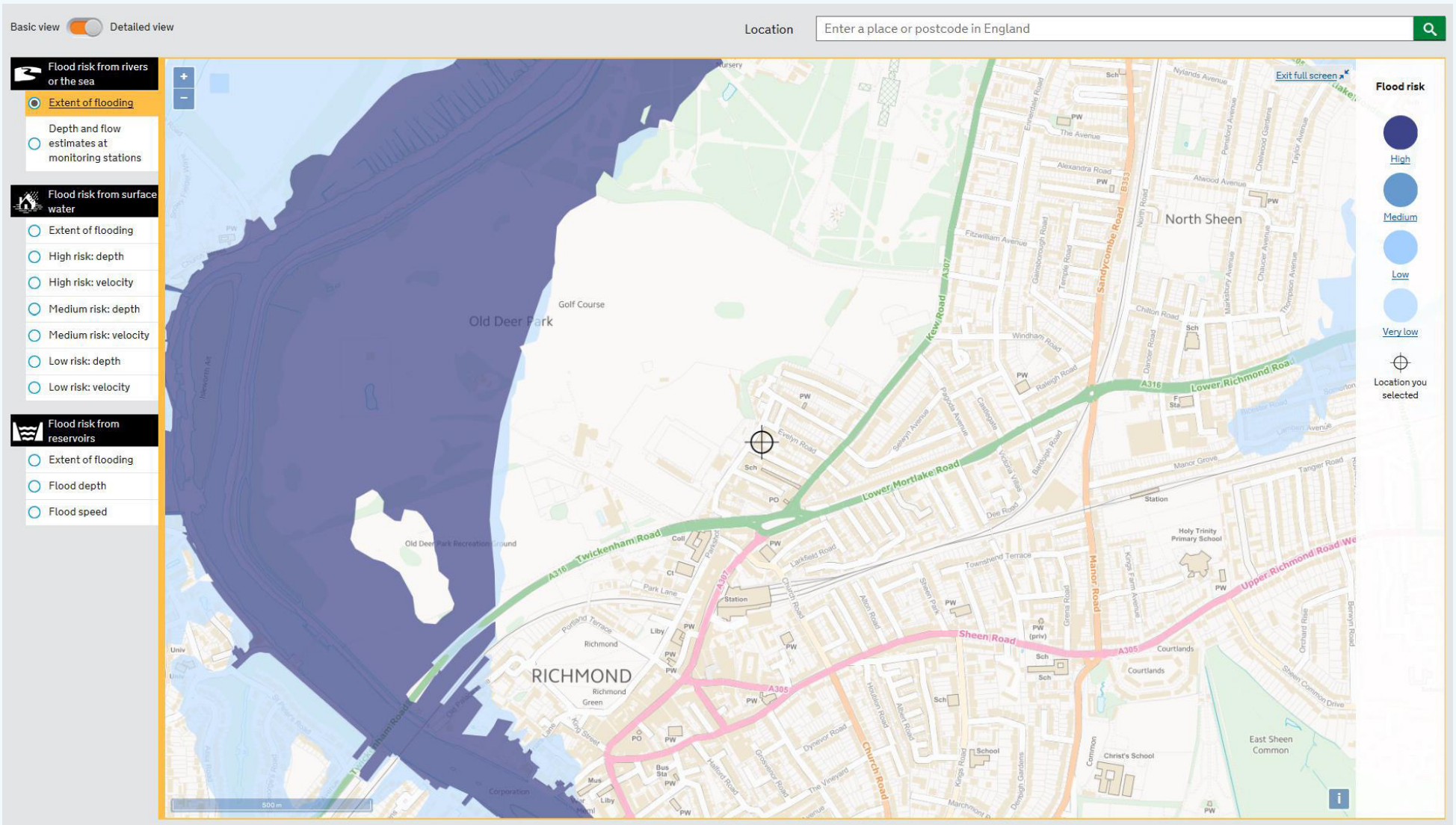
Scale
1:2500

Created
3 Oct 2018 9:41

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

Environmental Agency Flood Maps – Fluvial or Tidal Flood Extent



Environmental Agency Flood Maps – Surface Water (Pluvial) Flood Extent