Land Rear of 74 Church Road, Barnes

Flood Risk Assessment

115932/R1.0

August 2016

FAIRHURST

FAIRHURST

CONTROL SHEET

CLIENT: **TURNBERRY PLANNING LIMITED**

PROJECT TITLE: **LAND REAR OF 74 CHURCH ROAD, BARNES**

REPORT TITLE: **ZONE 3 FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY INCLUDING FOUL SEWAGE ASSESSMENT**

PROJECT REFERENCE: **115932**

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	1					
	2					

This document has been prepared in accordance with procedure OP/P02 of the *Fairhurst Quality and Environmental Management System*

CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 Fairhurst has been commissioned by Turnberry Planning Limited to undertake a Flood Risk Assessment (FRA) to accompany a Planning Application for the redevelopment of the premises located at the rear of 74 Church Street, Barnes, London. A site location plan is shown in Appendix A.

1.2 Barnes is a suburban district located to the south west of Central London and falls in an area under the jurisdiction of the London Borough of Richmond. The *'London Borough of Richmond Strategic Flood Risk Assessment (SFRA) Level 1'* is applicable for this site and was issued in June 2008 and updated in 2010 and 2016. Under the new European Floods Directive and in line with the Flood & Water Management Act 2010, this area has also been addressed within the Preliminary Flood Risk Assessment (PFRA) prepared by the London Borough of Richmond in 2011.

1.3 The area is also considered within the *'London – Regional Flood Risk Appraisal (RFRA)'* issued in October 2009 by the Mayor of London in consultation with a number of organisations.

1.4 Following a review of the SFRA, PFRA and RFRA and liaison with the Environment Agency (see Appendix B) the site is noted to be located in a Flood Zone 3 area, which has a high risk of potential flooding. Despite the fact that the Application Site falls within this area, it is currently protected by the River Thames flood defences and it is located outside of the 'areas impacted by flooding if there was to be a breach in defences'.

1.5 This FRA has been compiled in accordance with the SFRA, the 'National Planning Policy Framework' (NPPF) & associated document, the 'Planning Practice Guidance to the National Planning Policy Framework'; as well as the 'CIRIA C624: Development and Flood Risk Guidance' document. A full reference list is detailed in Section 11. The structure of this report corresponds with the site specific FRA checklist advocated in 'A Planning Practice Guidance to NPPF'.

2.0 DEVELOPMENT DESCRIPTION AND LOCATION

Description of Existing Surroundings

2.1 The Application Site is located on Church Road within the suburban district of Barnes of which is bounded to the east, north and west by the River Thames and Roehampton to the south. The post code for the site is SW13 0DQ (refer to Appendix A – Site Location Plan).

2.2 The Application Site to the rear of number 74 Church Road is bounded by this property and Church Road to the North, Elm Grove Road and associated properties to the East, residential properties to the South and Bracken Gardens and associated properties to the West. The surrounding area to the site is densely populated and consists of a combination of commercial and residential properties.

Description of Existing Site

2.3 The Application Site is mostly triangular in shape with the western boundary spanning longer to accommodate car parking. The area totals 690.01 m² of which 617m² is impermeable. The building is located to the southern end of the site and currently takes form as an interior furnishings store and café. The building is single storey. Access is currently provided from two points; a covered passageway from Church Road and an additional access route from Elm Grove Road. Both access points are shared by vehicles and pedestrians alike with no dedicated pedestrian pavements.

2.4 Prior to the current retail operation, the land use of the Application Site was industrial. In 1997 permission was granted for the operation of a retail unit, adjoining workshops and preparation areas. The same year permission was also granted for a section of the development to change use to a food preparation and staff canteen area. In 2011, there was a change of use for part of the retail business to become a café.

Existing Hydrology

2.5 The Application Site is within the immediate proximity of a number of existing watercourses. The nearest is Beverly Brook 235m away from the Application Site, a small river spanning approximately 14.3km from Cuddington Recreation Ground

in Worcester Park to the River Thames above Putney Embankment at Barn Elms. Beverly Brook is protected from tidal flooding by a tidal flap valve.

2.6 The River Thames is within close proximity to the Application Site in three directions; to the East the closest point is 730m, East 1km and North 1.6km.

2.7 It should also be noted that the Barnes Pond. This local amenity is located 235m away from the Application Site and furthermore the WTT London Wetland Centre is located within a close proximity with the nearest water feature being just 330m away. The centre consists of over 40 hectares of land which formerly consisted of four small reservoirs that were converted into the reserve.

Vulnerability Classification, Sequential and Exception Tests

2.8 With reference to Table 2: 'Flood Risk Vulnerability Classification' in the Planning Practice Guidance to the NPPF, the ground floor proposals that includes the commercial units are classified as 'less vulnerable' in terms of planning issues. The proposed portion that includes residential units are classed within the 'more vulnerable' range.

2.9 The EA Flood Map for Planning (Appendix B) shows the proposed development to be located within a Flood Zone 3a area. The EA require a Sequential Test to be carried out to ensure sensitive, critical or vulnerable developments are not located in areas of significant risk of flooding, unless there is a compelling justification for doing so and only if the development takes into account all flood risk issues.

2.10 The local authority should carry out this test to "demonstrate that there are no reasonably available alternative sites in areas with a lower probability of flooding that would be appropriate for the type of development proposed".

2.11 As per section 2.10 above, for the Exception Test to be passed:

- *A: 'It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA'.*

  This development complies with this requirement as a source of employment will be generated by the commercial units and it will contribute to the housing targets set by the Borough.

- *B: 'The development should be on developable previously developed land or, if not, it must be demonstrated there is no such alternative land available'.*

  The site is currently occupied by a furniture retail facility. Roof area and hard surfaced parking make up the surface area of the existing site arrangement.

- *C: A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall.*

  This FRA shows that the proposals do not make the current situation worse than existing and will not increase the risk of flooding elsewhere.

3.0 DEFINITION OF FLOOD HAZARD

Flooding from Rivers

3.1 As outlined in paragraph 2.6, the River Thames flows at a distance of approximately 730m from the western boundary of the site area.

3.2 A review of the mapping provided in the SFRA shows some incidences of historical river flooding incidents in the Barnes locality.

3.3 The SFRA also states that the site is located within an area identified as low risk from flooding from the Beverly Brook.

Flooding from Sewers

3.4 This FRA also outlines the principles of the proposed drainage strategy. These proposals are described in Section 6.

3.5 The site is situated within an area where the SFRA identifies that sewer flooding incidents are fairly high.

Flooding from Groundwater

3.6 A review of the SFRA indicates that no records of historical groundwater flooding in the area have been found. However, the EA published document TE2100 suggests that the area is at risk from groundwater flooding.

Flooding from Artificial Sources

3.7 Flooding from artificial sources can be defined as a failure of man-made infrastructures or human intervention that causes flooding. Consideration should be given to features such as reservoirs, canals and lakes where water is retained above natural ground level.

3.8 With no artificial infrastructures being located in the vicinity of the site there are no records of flooding from artificial sources.

Land Flooding

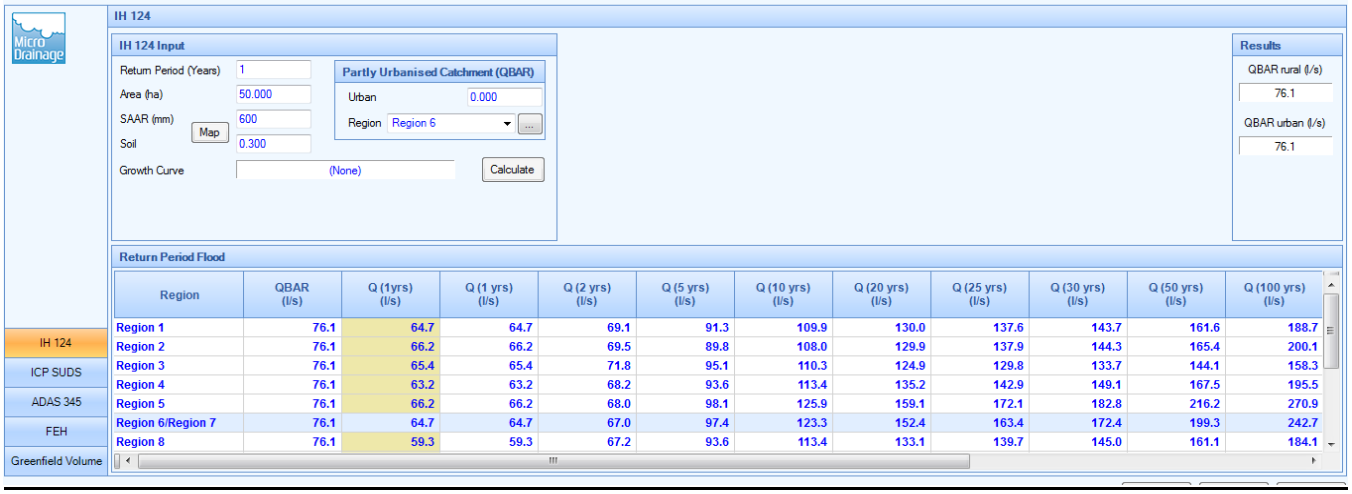
3.9 Flooding from land is caused by very heavy rainfall in areas where natural and artificial channels run at full capacity, unable to cope with the excess of water.

3.10 There are no records of land flooding on or in the immediate vicinity of the proposed development site.

Existing Drainage Arrangement

3.11 The existing onsite surface water drainage system is understood to discharge into the Thames Water sewer located in the access road to the site from Elm Grove Road. At present there are no further details concerning this arrangement.

3.12 Although the existing site is a brownfield development, Greenfield run-off rates have been calculated (using IH 124 method as seen on Figure 1). This offers some betterment over the existing development surface water discharge in compliance with the design philosophy promoted in the TE2100 document.



Region	QBAR (l/s)	Q (1yrs) (l/s)	Q (1 yrs) (l/s)	Q (2 yrs) (l/s)	Q (5 yrs) (l/s)	Q (10 yrs) (l/s)	Q (20 yrs) (l/s)	Q (25 yrs) (l/s)	Q (30 yrs) (l/s)	Q (50 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	76.1	64.7	64.7	69.1	91.3	109.9	130.0	137.6	143.7	161.6	188.7
Region 2	76.1	66.2	66.2	69.5	89.8	108.0	129.9	137.9	144.3	165.4	200.1
Region 3	76.1	65.4	65.4	71.8	95.1	110.3	124.9	129.8	133.7	144.1	158.3
Region 4	76.1	63.2	63.2	68.2	93.6	113.4	135.2	142.9	149.1	167.5	195.5
Region 5	76.1	66.2	66.2	68.0	98.1	125.9	159.1	172.1	182.8	216.2	270.9
Region 6/Region 7	76.1	64.7	64.7	67.0	97.4	123.3	152.4	163.4	172.4	199.3	242.7
Region 8	76.1	59.3	59.3	67.2	93.6	113.4	133.1	139.7	145.0	161.1	184.1

Figure 1 Greenfield run-off rates calculations using IH 124 method

3.13 Linear interpolation of the figures for the development area gives:

- 1 in 1 year return period – 0.08 l/s
- 1 in 30 year return period – 0.21 l/s
- 1 in 100 year return period – 0.30 l/s

4.0 PROBABILITY OF FLOODING

Flooding From Rivers

4.1 The proposed development is situated approximately 1km from the River Thames and according to the EA's flood map it is located within Flood Zone 3a area, which is a high risk zone.

4.2 Fairhurst contacted the EA to enquire about modelled flood data relevant to the area in question, records of the historical flooding incidents (if any), information on the existing flood defence structures and any additional information considered pertinent to carry out a FRA. The full EA response can be seen in Appendix D.

4.3 The EA has provided flood modelling details that indicate the predicted flood level of the River Thames upstream of the Thames Barrier at a node relevant for the proposed development site. The most relevant information (node ref. 2.18) is as follows:

- Current highest water level permitted by Thames Barrier – 5.04m AOD
- Future 2065-2100 highest level permitted by Thames Barrier – 5.50m AOD
- Future 2100 highest level permitted by Thames Barrier – 5.94m AOD

4.4 Comparison of these levels with the existing ground levels indicated on the topographical survey, confirms that at present the site is 0.83m lower than modelled flood data for 2065-2100 at its lowest point. It should be however noted that the site and its surroundings benefit from protection offered by the River Thames' flood defences.

4.5 Based on the information provided by the EA publication 'TE2100' the standard level of protection in the area of the River Thames is 0.1% AEP. These defences are all raised, man-made and privately owned, however inspected by the EA twice a year to ensure that they remain fit for purpose. The current grade of the defences is 2 (Good).

4.6 The current and anticipated future levels of flood protection are as follows:

- Current defence level – 5.54m/5.94 AOD
- Future 2065-2100 level of protection – 6.25m AOD
- Future 2100 level of protection – 6.70m AOD

4.7 The Thames Barrier referred to in 4.2 is located downstream of Central London and constructed to prevent London from being flooded by an exceptionally high tide moving up from the sea (backflow). Due to various factors increasing the sea level, the closure rule for the Thames Barrier will be implemented more often in future.

4.8 The LBHF Strategic Flood Risk Assessment states that '*the Thames barrier is designed to be robust and reliable and it is maintained and operated to ensure that the level of security is maintained*.'

4.9 Considering the height of the flood defences and the fact the Thames Barrier is in place, the risk of them being overtopped or breached is low. However, even though the flood defences reduce the risk of flooding they do not eliminate risk completely. The reduction in flood risk that the defence provides depends on the standard of protection, the performance and the reliability of the defence.

4.10 The Action Plan given for the Barnes area (Action one 1) from the EA TE2100 Plan indicates a probability of flooding from Beverly Brook of approximately 10% per annum.

Flooding from Groundwater

4.11 The Action Plan given for the Barnes area (Action Zone 11) from the EA TE2100 Plan suggests that groundwater flooding is a risk in this area.

4.12 Information from the SFRA indicates that the site straddles areas underlain with alluvium deposits and Kempton Park Gravel Formation.

5.0 CLIMATE CHANGE

5.1 Technical Guidance to NPPF provides information on the modelled net sea level rise over approximately the next 100 years resulting from climate change (table 4 of PPS25). In the region of South East England it is estimated that the level rise would be:

- 4.00 mm/yr between years 1990 and 2025
- 8.50 mm/yr between years 2025 and 2055
- 12.00 mm/yr between years 2055 and 2085
- 15.00 mm/yr between years 2085 and 2115

5.2 In terms of tidal flood risk and implications arising as a result of the climate change, it is recognised that with rising sea levels the Thames Barrier would be closed more frequently. In theory that would mean that the critical water levels upstream of the Barrier would not be significantly affected, however the EA now recognises that more future closures will reduce the opportunity for maintenance. As a result the barrier will in the future allow higher water levels through and the height of tidal walls will need to be increased accordingly (as outlined in paragraph 4.6).

5.3 Climate change is expected to have an effect on rainfall intensities which are likely to increase in the next 100 years. Technical Guidance to NPPF recommends that for delivering peak rainfall intensities and peak river flows, the following parameters should be used.

Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

5.4 The proposed onsite drainage network has to be designed so that it has sufficient capacity to accommodate greater water flows caused by increased rainfall

intensities. The local planning authority will require that the drainage system will have sufficient capacity to contain water flows generated by a 1 in 100 year rainfall event which additionally accounts for 20% climate change which complies with the 'Upper end' value for 2040 to 2069. The surface water system has been designed to accommodate flows up to the 1 in 100 year return event with an allowance for 30% uplift for climate change which introduces additional 'betterment' to the design above that which is prescribed in the NPPF.

6.0 DEVELOPMENT PROPOSAL

6.1 The proposed development plans are included in Appendix C. The proposal includes the demolition of the existing buildings with the exception of the retaining wall alongside the Southern face of the building. The footprint of the new building closely follows that of the existing building.

Building and car parking area	**617 m²**
TOTAL IMPERMEABLE AREA	**617 m²**

6.2 The ground floor of the new building will comprise five commercial units and two two-bedroom apartments.

6.3 The first floor will be occupied by two two-bedroom apartments and two 1-bedroom apartments.

6.4 Car parking will be provided to the North of the new building. It will be accessed via the road connecting the building to Elm Grove Road.

7.0 FLOOD RISK MANAGEMENT MEASURES

Safe Access and Egress & Finished Floor Level

7.1 It is proposed that the ground floor of the development is set at level of 4.9m AOD, this is the ground floor level of the existing building and therefore does not alter the current situation.

7.2 Although the proposed ground floor level of 4.9m is 0.14m below the highest level permitted by the Thames barrier of 5.04m it is considered to be more suitable for the locality as the building will not impede flood water flows and deflect them towards another area in the locality as it would if it was set at a higher level than existing. If more flood water was encouraged to collect at the building entrance by building the ground floor at a higher level, safe access and egress to the building in the event of a flood would be more difficult.

7.3 The ground floor will be 0.6m below the EA's design water level for 2065 to 2100 (5.5m).

7.4 The first floor will be set 2.822m above the ground floor level (7.722m) which situates the first floor apartments 2.222m above the EA's design water level for 2065 to 2100 (5.5m).

7.5 The developer will liaise with Richmond Borough Council to develop a suitable flood evacuation scheme for the development or updating the existing scheme for the current building use. It is envisaged that the evacuation plan will encourage people to exit the building onto the parking area.

7.6 Future occupants will be advised to register with the EA's flood warning service 'Floodline' to receive early warning of flooding events.

Building Resilience

7.7 The Action Plan given for the Barnes area (Action Zone 1) from the EA TE2100 Plan indicates that the proposed development is located within an area where building resistance measures are recommended. Government guidance on building resilience suggests that techniques are integrated into the building design to prevent or minimise the amount of water that may enter a building up to 0.6m in depth. Building resilience measures are also recommended to be used alongside resistance measures.

7.8 Resilience measures for the ground floor could take the form the following, non-exhaustive list of suggestions:-

- Use of low permeability materials (up to 0.3m above floor level)
- Ensure all spaces can be accessed easily for cleaning and drying
- Locate electrical sockets at a minimum of 0.6m above floor level
- Design levels to drain water away from flooding
- Accept passage of water through building at higher water depths
- Consider sacrificial materials such as gypsum plaster board
- Use of flood resilient fittings such as tiles

7.9 There is no evidence that the site or its environs have experienced surface water flooding in the past and the proposal will not increase the risk of this occurring.

Proposed Surface Water Drainage Strategy

7.1 The current arrangement of surface water drainage is believed to discharge into the Thames Water sewer in the access road to Elm Grove Road and the proposal will assume a similar strategy.

7.2 A Section 106 Connection Agreement will be required with Thames Water so that the site would discharge into the public sewer at an agreed rate. In line with current policies the discharge rate and volume are likely to be restricted below the current rate and volume which are unrestricted.

7.3 In order to achieve the restricted surface water discharge rate and comply with current design standards, the system will be designed to include an attenuation tanks providing an adequate storage volume for the 1 in 100 year plus 30% climate change rainfall event.

7.4 The application of the SUDS hierarchy as outlined in *The London Plan 2011, Policy 5.13 Sustainable Drainage*, to the proposed development indicates that given the ground conditions, amount of available space and volume of water to be retained onsite prior to discharge into the Thames Water sewer, the most appropriate option in this instance is to provide attenuation using a below ground storage tank and discharging at a rate off site restricted to a greenfield run-off rate for the site.

Most suitable	*SUDS drainage hierarchy*	*Physical Constraints*	*Feasibility*
	Store rainwater for later use	There is no space available for rainwater harvesting.	Not feasible
	Use infiltration techniques, such as porous surfaces in non-clay areas	Ground conditions are unsuitable and there is no space available.	Not Feasible
	Attenuate rainwater in ponds or open water features for gradual release	There is no space available for ponds or open water features.	Not feasible
	Attenuate rainwater by storing in tanks or sealed water features for gradual release	Rainwater can be stored in tanks below the basement level with a restricted discharge to the Thames Water sewer.	Feasible
	Discharge rainwater direct to a watercourse	There is no watercourse nearby to discharge to.	Not feasible
	Discharge rainwater to a surface water sewer/drain	There is no surface water sewer nearby to discharge to.	Not feasible
Least Suitable	Discharge rainwater to a combined sewer.	There is a Thames Water combined sewer in New King's Road which can be used to discharge to.	Feasible

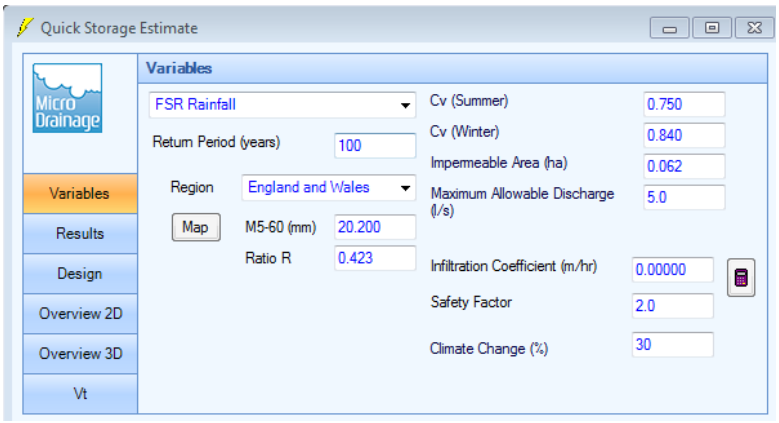
Table 1 – SUDS Hierarchy

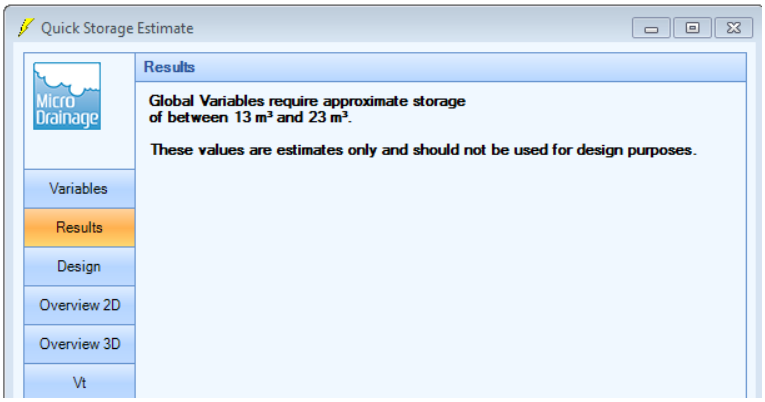
7.5 All drainage would be designed in accordance with '*BS EN 752 –Drain and sewer systems outside buildings'* and '*Building Regulations – Part H (2002)*'.

7.6 A discharge rate of 0.3 l/s (see 3.13) is considered impractical as any orifice through which the flow will discharge will be extremely small and will block frequently, thus increasing the risk of flooding in the immediate vicinity.

7.7 A discharge rate of 5 l/s is proposed for the development as this is the minimum rate that can be discharged through a reasonably sized orifice or flow control device.

7.8 For a discharge rate of 5l/s and using the other design parameters described in this report, the preliminary upper estimate for the volume of attenuation required is 23m². See Appendix C for the drainage strategy drawing illustrating the proposals.





7.9 It is proposed that due to the limited area of external space available, that underground tanks or cellular storage are used to provide this attenuation volume.

7.10 The surface water run-off from car parks, yards and road areas will be collected using positive drainage systems in the form of linear drainage channels and gullies positioned at strategic locations around the site that would discharge to a below ground positive drainage network. This will then drain to the outfall point prior to discharging offsite.

7.11 All surface water run-off from external hardstanding areas that are susceptible to oil spillages (such as service yards, car parks, internal roads etc) will pass through a petrol interceptor (as outlined in PPG3 – Pollution Prevention Guidance) before discharging offsite.

Proposed Foul Water Drainage Strategy

7.12 It is understood that the existing building discharge foul water into the Thames Water adopted foul water sewer in the access road to the site.

7.13 It is proposed that the existing foul water connection is investigated further and if it is in good repair and of sufficient diameter to accommodate the anticipated foul water flows from the new development, it can be re-used.

7.14 If the re-use of existing connection is not a feasible solution, a new connection will be made under a Section 106 sewer connection agreement with Thames Water.

8.0 OFFSITE IMPACTS AND MITIGATION MEASURES

8.1 Once the detailed drainage strategy is established the new development will discharge surface water off-site at agreed discharge rates.

8.2 In view of the above it is considered that once the detailed drainage strategy has been agreed the new development will not have a negative effect on flows in the local sewer system, nor would it increase flows in downstream areas.

9.0 MANAGEMENT OF RESIDUAL RISKS

9.1 Residual risks are the outstanding risks which cannot be eliminated as part of flood risk management measures.

9.2 There is a residual risk of a breach in the defences, which could be a result of a number of factors, such as deterioration due to ageing flood defences (however the Environment Agency inspects them twice a year) or mechanical damage i.e. ship collision or deliberate damage to defences.

9.3 There is a residual risk of the failure of the proposed water mains serving the site. However, flooding that would occur as a result of this should be intercepted by the proposed surface water system and conveyed away from the building entrances on the site.

9.4 There is a risk of failure of the drainage network serving the proposed development site. The proposed levels will be set in order that the ground would fall away from the proposed buildings in order to re-route any water flows and prevent them from entering the premises.

10.0 CONCLUSIONS

10.1 Based on the predicted critical water level in the River Thames the site is classed as being in Flood Zone 3a area. It is however protected by existing flood defence structures such as tidal walls and the Thames Barrier.

10.2 The ground floor level will be set at 4.9m AOD which is the same as the ground floor level of the existing building.

10.3 The impermeable area of the site will not be increased by this development.

10.4 Building resilience techniques will be incorporated into the design strategy and materials used for the development.

10.5 It is considered that once the detailed drainage strategy has been agreed the new development should not have a negative effect on flows in the local sewer system, nor would it increase flows in downstream areas.

10.6 Betterment is provided by designing the attenuation to accommodate flows generated by rainfall events up to the 1 in 100 return event with an allowance for 30% for climate which is greater than the 20% uplift as recommended in the NPPF guidance.

10.7 Residual risks of flooding involving drainage failure will be dealt with by providing a regular schedule of inspections and maintenance.

10.8 Having completed a Level 3 Flood Risk Assessment it is considered that potential flood risks have been recognised and addressed. The flood mitigating measures covered in this report comply with the principles promoted by the EA and with the requirements of NPPF and the guidance given in CIRIA C624.

REFERENCES

- CIRIA 2004. Development and Flood Risk Guidance for the Construction Industry-C624. CIRIA, London.
- Department for Communities and Local Government, 2012. National Planning Policy Framework. London.
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- Communities and Local Government. Improving the Flood Performance of New Buildings. May 2007
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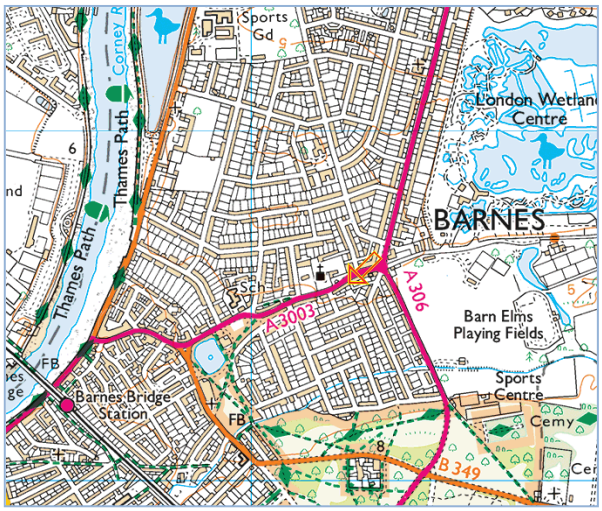
- London Borough of Richmond upon Thames, Planning Guidance Document, Delivering SuDS in Richmond. February 2015
- London Borough of Richmond upon Thames, Local Flood Risk Management Strategy. Capita Aecom August 2015
- London Borough of Richmond upon Thames, Local Flood Risk Management Strategy Action Plan. August 2015
- Environment Agency, TE2100 Plan Consultation Document, April 2009

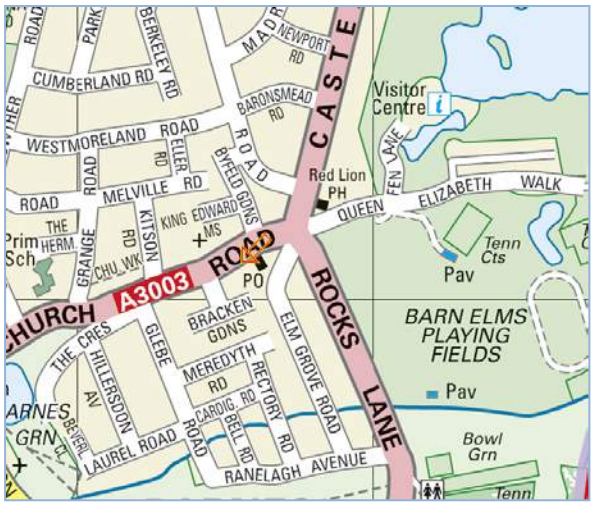
APPENDIX A

SITE LOCATION PLAN

FAIRHURST

74 CHURCH RD, LONDON SW13 0DQ



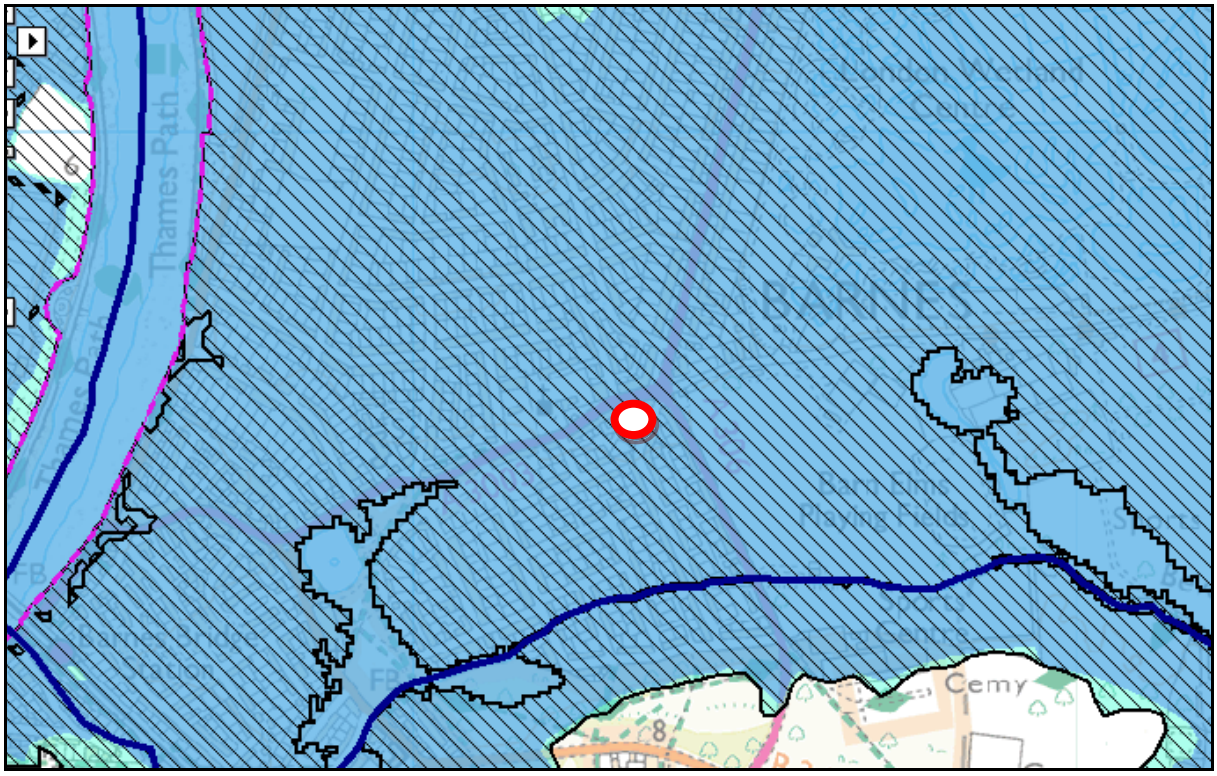


Grid Reference	TQ222765
Nearest Post Code	SW13 0DQ

APPENDIX B

EA Flood Map for Planning

THE ENVIRONMENT AGENCY'S FLOOD MAP



Key

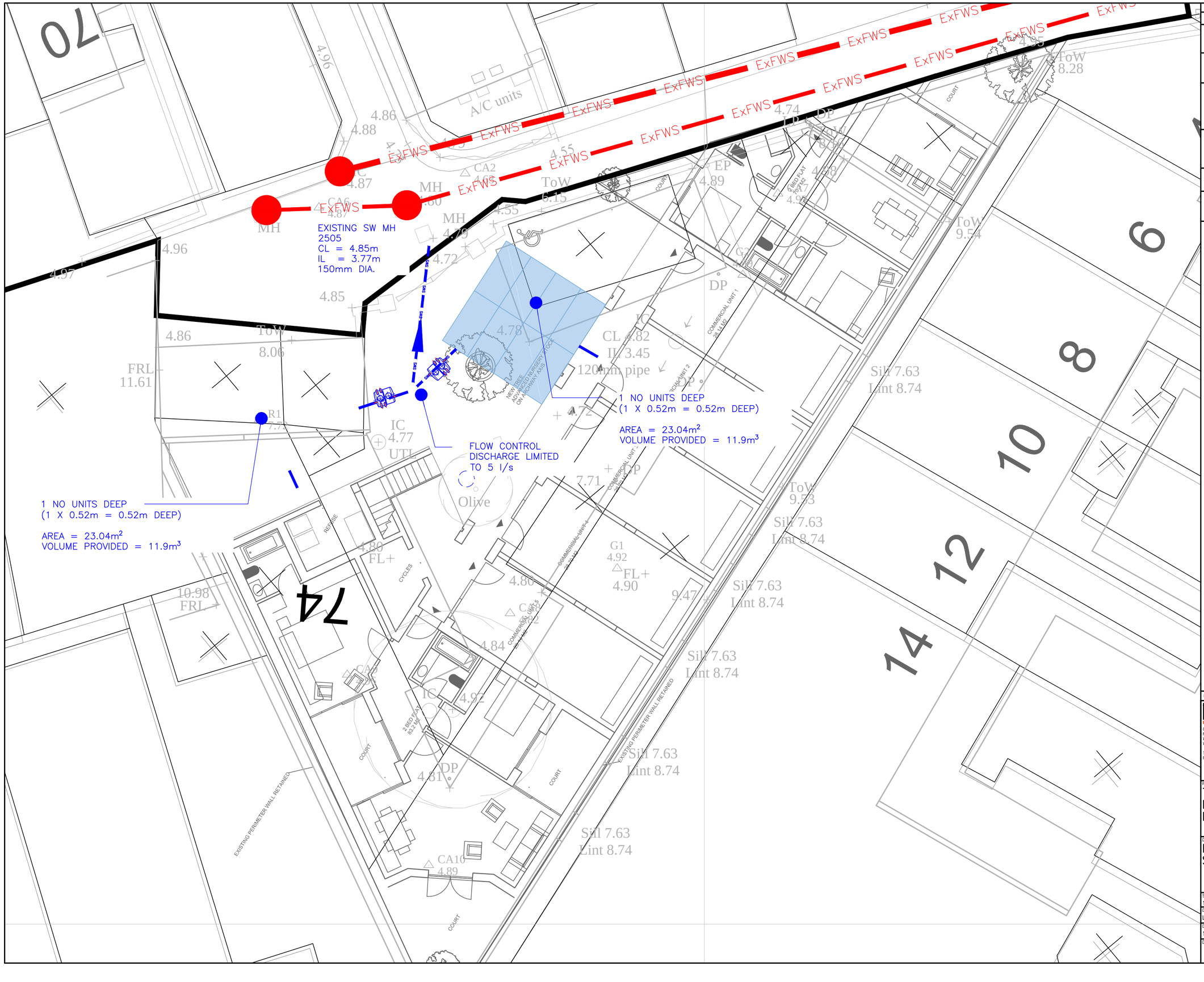
A floodplain is the area that would naturally be affected by flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas.

There are two different kinds of area shown on the Flood Map. They can be described as follows:-

- Dark blue ■ shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:
- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year
- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.
- Light blue □ shows the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.
- These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.
- These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. [3]
- Flood Defences
- Areas benefiting from flood defences

APPENDIX C

Proposed Development and Drainage Strategy



Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO.

CONSTRUCTION

DEMOLITION

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

TOTAL VOLUME PROVIDED = 23.8m³
TOTAL VOLUME REQUIRED = 23.0m³

GEOCELLULAR STORAGE WITH NO INFILTRATION (BASED ON HYDRO INTERNATIONAL 'STORMCELL' UNITS 1.2m X 2.4m X 0.52m DEEP)

PROPOSED SURFACE WATER PIPE

EXISTING SURFACE WATER SEWER

EXISTING FOUL WATER SEWER

EXISTING SURFACE WATER MANHOLE

EXISTING FOUL WATER MANHOLE

INTERCEPTOR

Rev.	Date	Description	Drwn.	Chkd.	Appd.

FAIRHURST
Oak House
Reeds Crescent
WATFORD
WD24 4PH
Tel: 01923 210 460
Fax: 0844 381 4412

Client:

Project Title:
74 CHURCH ROAD
BARNES
LONDON

Drawing Title:
PROPOSED DRAINAGE STRATEGY

Scale at A2:	Status:	
1:200	Preliminary	
Drawn:	Checked:	Approved:
LA	LMC	MJT
Date:	Date:	Date:
15/08/16	15/08/16	15/08/16

Drawing No.: 115932/2000 Revision: –

APPENDIX D

Correspondence with Environment Agency

creating a better place

Environment Agency

Aleksandra Zmijewska
Fairhurst
Oak House Reeds Crescent
Watford
WD24 4PH

Our ref: SL/2016/116082/01-L01
Your ref: Email 06/07/2016

Date: 26 July 2016

Dear Aleksandra

Existing brownfield site to be redeveloped. Proposal consists of residential and commercial units.

74 Church Road, London, Richmond Upon Thames, SW13 0DQ.

Thank you for your enquiry. The development raises some environmental concerns/issues and the developer will need to undertake further work to show how these issues can be satisfactorily addressed to ensure no adverse environmental impacts.

Sequential Test
In the first instance we recommend you liaise with the Local Planning Authority (LPA) to undertake the Sequential Test in accordance with the National Planning Policy Framework (NPPF). The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. The LPA will be able to discuss further with you how the flood risk Sequential Test will affect your proposed development. If the sequential test can be demonstrated, a flood risk assessment will also need to be submitted with your planning application

Flood Risk Assessment requirements
The site is situated within Flood Zone 3, the high risk zone. The proposed development falls into a flood risk vulnerability category and flood zone that requires the exception test to be passed according to Tables 2 and 3 of the National Planning Policy Framework (NPPF) Planning Policy Guidance.

The River Thames flood defences in this area defend the site to a 1 in 1000 year annual probability of river flooding in any year (<0.1%). Areas of residual flood risk can occur due to failure of the flood defences or a design flood event greater than that mentioned above. According to the best information available the site lies in an area of residual risk of flooding.

At planning submission stage we will require a detailed flood risk assessment (FRA) for formal approval. This should include detailed flood levels for a range of flood

Environment Agency
Ergon House, Horseferry Road, London, SW1P 2AL
Telephone: 03708 506 506
Email: enquiries@environment-agency.gov.uk
Website: www.gov.uk/environment-agency

events, as well as information to demonstrate how the development will mitigate against flooding, including flood warning and flood resilience.

The Environment Agency can provide any flooding information which we have available – such as predicted flood levels and historical flood data – for use in FRAs. Please note that there may be a charge for this information. Please contact our Customers & Engagement team on 01732 223202 or email kslenquiries@environment-agency.gov.uk for further details.

Please refer to the guidance notes here for further information on FRAs.

Please note that there may be other sources of flooding that affect this site, for example, surface water, sewer, or groundwater flooding. Under the Flood and Water Management Act the local authority has the lead role in these matters and consideration of these other sources of flooding may be necessary to inform suitable mitigation measures to reduce the impact of flooding.

We recommend you speak with the local planning authority about producing or updating any existing flood evacuation plan for this site. Advice is available from the emergency services when producing an evacuation plan for a development. Where warning and emergency response is fundamental to managing flood risk, we advise local planning authorities to formally consider the emergency planning and rescue implications of new development in making their decisions.

We recommend that future occupants register with the Environment Agency's flood warning service, 'FloodLine', so that they may prepare themselves in case of flooding. They can do this by calling 0845 988 1188.

Please note that the views expressed by the Environment Agency in this letter are in response to this pre-application meeting and correspondence only and do not represent our final views on any future planning applications made in relation to this site. We reserve the right to change our position in relation to any such planning applications. You should seek your own expert advice regarding technical matters relevant to any planning application prior to submission.

We have provided this initial preliminary opinion in response to the pre application enquiry. If you would like any further detailed advice we would be happy to provide this subject to a charge.

As part of this service you would have a dedicated project manager to coordinate the advice from different teams within the Environment Agency. It would also include bespoke technical and planning advice if you request this.

This will allow you to have greater clarity about the assessments you need to accompany your planning application and certainty about whether the development is acceptable before you submit.

I hope our comments are helpful if you have any questions please contact me.

Yours sincerely

Joe Martyn
Planning Advisor

Direct dial 020 3025 5546
Direct e-mail kslplanning@environment-agency.gov.uk

Environment Agency
Ergon House, Horseferry Road, London, SW1P 2AL
Telephone: 03708 506 506
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Website: www.gov.uk/environment-agency

Environment Agency

Product 4 (Detailed Flood Risk) for: 74 Church Rd, London SW13 0DQ
Requested by: Aleksandra Zmijewska, Fairhurst
Reference: KSL 17425 ES
Date: 13th July 2016

Contents

The information provided is based on the best data available as of the date of this letter.

You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements to the data for this location have been made. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

This information is provided subject to the enclosed notice which you should read.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Customer services line: 01732 223 202
Email: kslenquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Flood Map for Planning (Rivers and Sea)

The Flood Map:

Our Flood Map shows the natural floodplain for areas at risk from river and tidal flooding. The floodplain is specifically mapped ignoring the presence and effect of defences. Although flood defences reduce the risk of flooding they cannot completely remove that risk as they may be over topped or breached during a flood event.

The Flood Map indicates areas with a 1% (0.5% in tidal areas), Annual Exceedance Probability (AEP) - the probability of a flood of a particular magnitude, or greater, occurring in any given year, and a 0.1% AEP of flooding from rivers and/or the sea in any given year. In addition, the map also shows the location of some flood defences and the areas that benefit from them.

The Flood Map is intended to act as a guide to indicate the potential risk of flooding. When producing it we use the best data available to us at the time and also take into account historic flooding and local knowledge. The Flood Map is updated on a quarterly basis to account for any amendments required. These amendments are then displayed on the internet at

https://www.gov.uk/government/organisations/environment-agency.

At this Site:

The Flood Map shows that this site lies within the outline of Flood Zone 3. This zone comprises land assessed as having a 0.5% (1 in 200) or greater annual probability of tidal flooding

Enclosed is an extract of our Flood Map which shows this information for your area.

Method of production

The Flood Map at this location has been derived using detailed modelling of the Thames Tidal Defences Study completed in 2006 by Halcrow Ltd.

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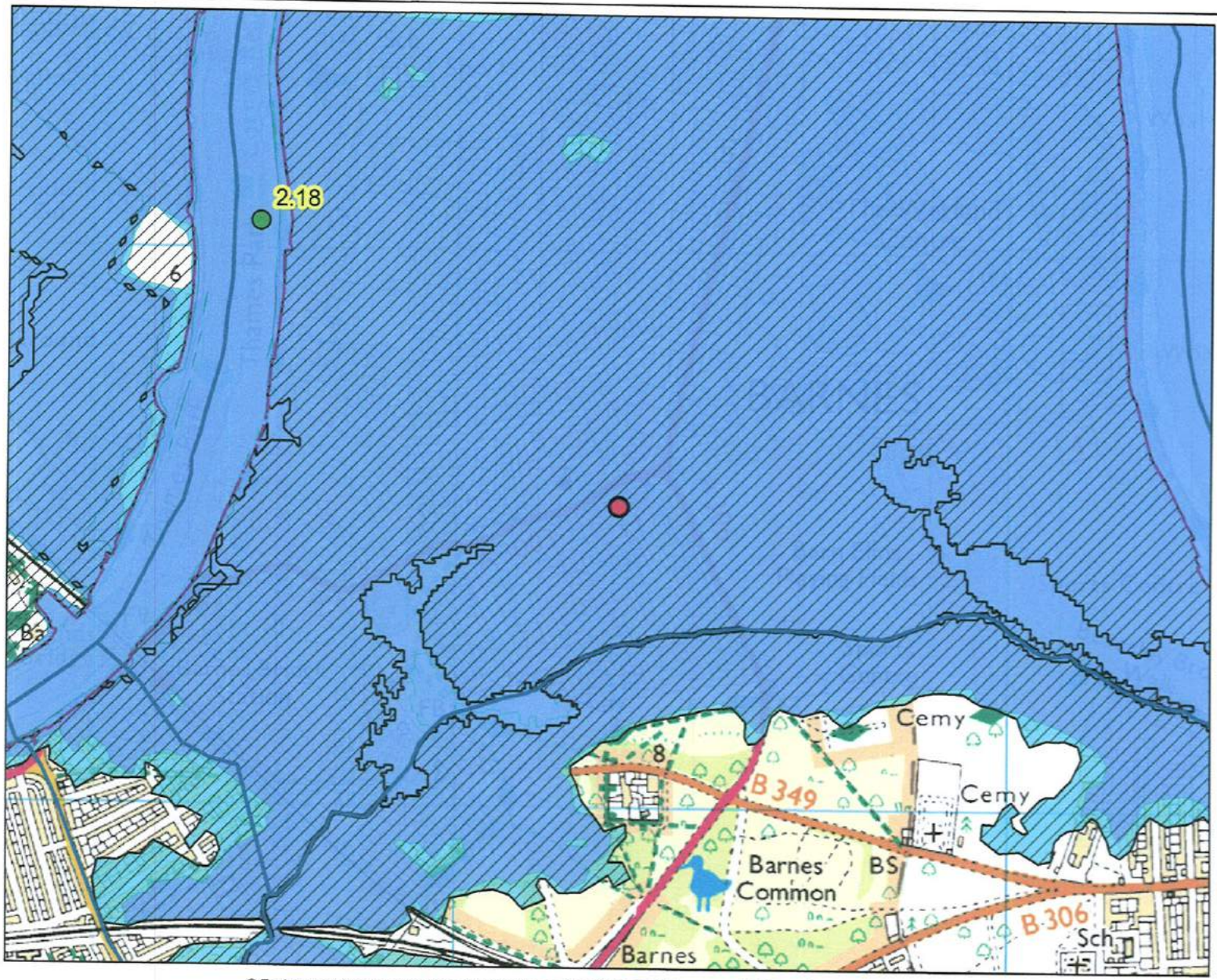
Detailed FRA Map centred on SW13 0DQ created 13 July 2016 [Ref: KSL 17425 ES]



Environment Agency

Scale 1: 10,000

Legend

- Main Rivers
- Site
- TE2100 Model Nodes
- Flood Map - Defences
- Areas Benefitting from Flood Defences
- Flood Storage Areas
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2

Flood Map for Planning (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of occuring each year
- or from a river with a 1% or greater chance of occuring each year

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 0.1% chance of occuring each year.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Thames Estuary 2100 (TE2100)

You have requested in-channel flood levels for the tidal river Thames. These have been taken from the Thames Estuary 2100 study completed by HR Wallingford in 2008. The modelled node closest to your site is 2.18; the locations of nearby nodes are also shown on the enclosed map.

Details about the TE2100 plan

The TE2100 plan is now live and within it are a set of levels on which the flood risk management strategy is based. The plan is the overarching flood management strategy for the Thames Estuary and therefore any development planning should be based on the same underlying data.

Details about the TE2100 in-channel levels

The TE2100 in-channel levels take into account operation of the Thames Barrier when considering future levels. The Thames Barrier requires regular maintenance and with additional closures the opportunity for maintenance will be reduced. When this happens, river levels – for which the Barrier would normally shut for the 2008 epoch – will have to be allowed through to ensure that the barrier is not shut too often. For this reason, levels upriver of the barrier will increase and the tidal walls will need to be heightened to match.

Why is there no return period for levels upriver of the barrier?

The levels upriver of the barrier are the highest levels permitted by the operation of the Thames Barrier. If levels and flows are forecast to be any higher, the Thames Barrier would shut, ensuring that the tide is blocked and the river maintained to a low level. For this reason the probability of any given water level upriver of the Barrier is controlled and therefore any associated return period becomes irrelevant. The Thames Barrier and associated defence system has a 1 in 1000 year standard which means it ensures that flood risk is managed up to an event that has a 0.1% annual probability. The probability of water levels upriver is ultimately controlled by the staff at the Thames Barrier.

Why are the levels in west London higher than the defence crest levels?

In west London there is a heavy influence from upriver flows (fluvial flows). The flood defences are built to manage tidal flood risk only. With very high fluvial flows, the river levels in west London could be above the 0.1% annual probability tidal level.

Why are the climate change/future west London levels lower than the 2008 levels?

The climate change levels are assessed to determine the future tidal defence levels. For this reason they only account for extreme tidal events and not extreme fluvial flow events. The 2008 levels include extreme flows from upriver (fluvial events) as well as extreme tidal events.

For further information about the Thames Barrier please visit our website at:

https://www.gov.uk/the-thames-barrier

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Website: https://www.gov.uk/government/organisations/environment-agency

Environment Agency

TE2100 2008 levels:

Levels downriver of the Thames Barrier are 0.1% AEP (1 in 1000) and levels upriver are the highest levels permitted by the Thames Barrier, described as the Maximum Likely Water Levels (MLWLs). The defence levels (left defence, right defence) are the minimum levels to which the defences should be built.

Location	Node	Easting	Northing	Extreme water level (m)	Left defence (m)	Right defence (m)	Allow for future defence raising to a level of...	
							Left Bank (m)	Right Bank (m)
Brentford	2.17	521099	176083	5.17	5.94	5.94	6.70	6.70
	2.18	521644	177047	5.04	5.54	5.94	6.40	6.40
	2.18a	521776	177707	5.04	5.54	5.94	6.40	6.40
Barnes	2.19	522080	177994	5.03	5.54	5.94	6.40	6.40
	2.2	522963	178079	5.01	5.54	5.94	6.40	6.40

TE2100 climate change levels:

The water levels in west London are lower than the current day extreme levels because they do not take into account extreme fluvial events; they are tidal only levels.

				2065 to 2100		2100	
Location	Node	Easting	Northing	Design water level	Defence level (both banks)	Design water level	Defence level (both banks)
Brentford	2.17	521099	176083	5.55	6.25	6.00	6.70
	2.18	521644	177047	5.50	6.25	5.94	6.70
	2.18a	521776	177707	5.50	5.95	5.94	6.40
Barnes	2.19	522080	177994	5.49	5.95	5.93	6.40
	2.2	522963	178079	5.48	5.95	5.92	6.40

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Thames Tidal Breach Modelling

The table below displays site-specific modelled flood levels at your site. These have been taken from the Thames Tidal Breach Modelling Study 2015 completed by CH2M HILL in March 2015. The exact location of the given site-specific levels and the extent of the breach are shown on the enclosed map.

This modelling simulates tidal breaches along the Thames from Teddington to the Mar Dyke and River Darent. A series of 113 tidal models were developed for the Environment Agency at pre-determined breach locations. These were chosen using a risk-based approach by examining critical locations based on low floodplain topography. For hard and composite defences breaches are set at 20 m wide; for soft defences, breaches are 50 m wide. In both cases, the defence breach scour distance was assumed to extend into the floodplain by the same distance as the breach width.

Based on the 2008 TE2100 in-channel levels, the 0.5% (1 in 200 year) and 0.1% (1 in 1000 year) annual probability of exceedance tidal events were modelled for all breach locations downriver of the Thames Barrier. These were modelled for the 2014 year epoch, as well as a 2065 and 2100 epoch which include allowances for climate change.

For breaches upriver of the Thames Barrier, there is no return period for modelled levels as the levels are controlled by barrier closures. The levels used are referred to as Maximum Likely Water Levels (MLWLs). Therefore 2014, 2065 and 2100 epochs were modelled on that basis.

The modelled levels shown assume that the Thames defences have been breached at locations 'Barn01, 'Barn02' and 'Barn03'. The most critical breach location was 'Barn01' (NGR TQ2154176396).

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			Barn01		
	National Grid Reference		Modelled levels in mAODN		
Node	Easting	Northing	2014	2065	2100
1	522307	176523	nil return	nil return	4.72
2	522377	176609	nil return	nil return	nil return
3	522364	176456	nil return	4.37	4.68
4	522417	176542	nil return	nil return	nil return
5	522305	176598	nil return	nil return	nil return
6	522222	176545	nil return	nil return	nil return
7	522138	176527	nil return	4.53	4.86
8	522247	176478	nil return	nil return	4.72
9	522230	176630	nil return	nil return	nil return
10	522306	176394	nil return	4.39	4.71

barrier 4.87m.

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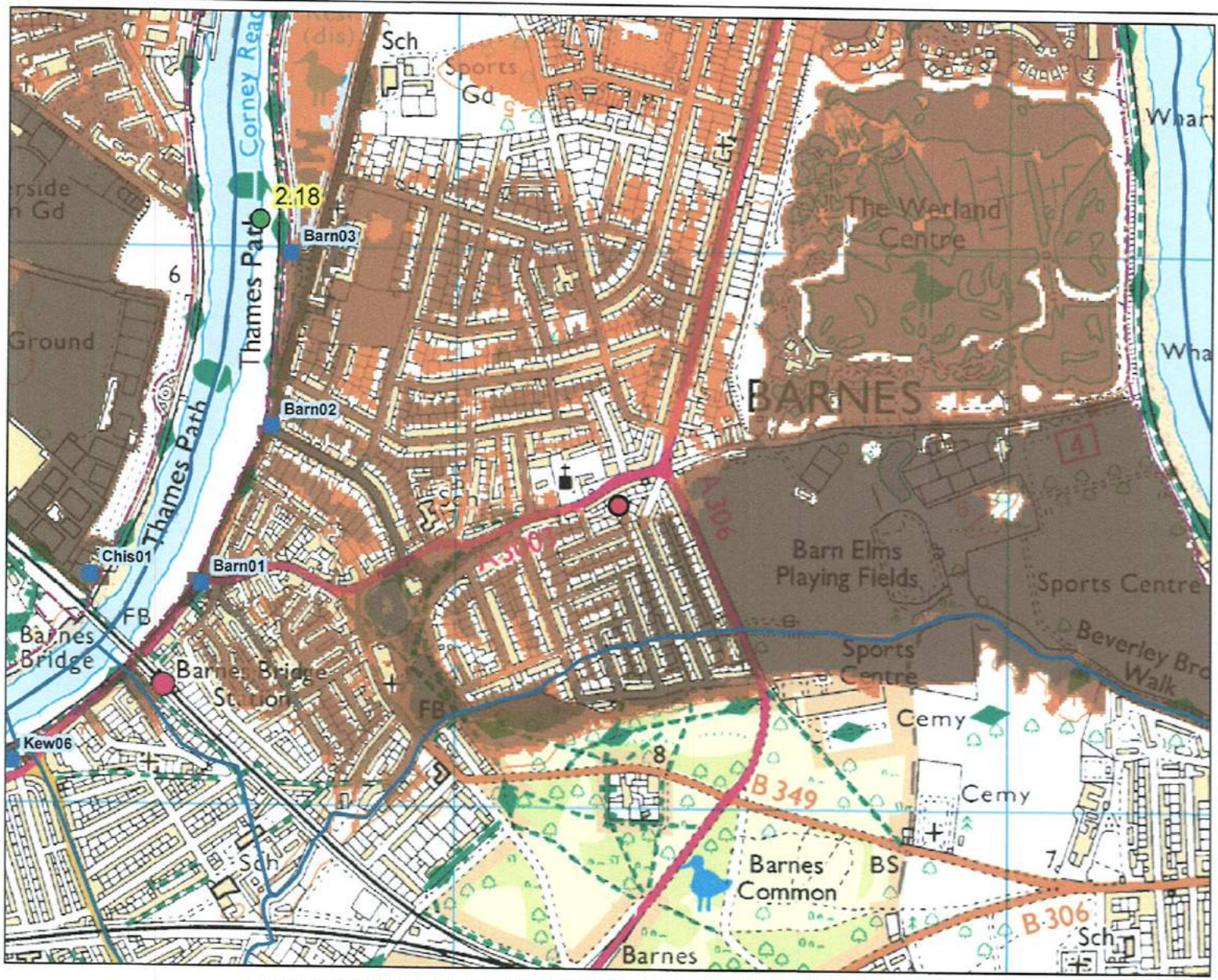
Breach Modelling Map centred on SW13 0DQ created 13 July 2016 [Ref: KSL 17425 ES]



Environment Agency

Scale 1: 10,000

Legend

- Main Rivers
- Site
- TE2100 Model Nodes
- Breach Locations
- Flood Map - Defences

Upriver MLWL Outlines

Epoch

- 2014
- 2065
- 2100

Thames Tidal Breach Modelling 2015

A modelled representation of tidal breaches along the Thames from Teddington to the Mar Dyke and River Darent, based on low floodplain topography. For hard and composite defences breaches are set at 20 m wide; for soft defences, breaches are 50 m wide. In both cases, the defence breach scour distance was assumed to extend into the floodplain by the same distance as the breach width.
The modelling is based on the 2008 TE2100 in-channel levels, with an allowance for climate change for epochs 2065 and 2100.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Environment Agency

Thames Tidal Upstream Inundation Modelling

The enclosed map shows results for the Thames Tidal Upstream Inundation Modelling Study 2015 completed by CH2M HILL in March 2015.

Upriver of the Thames Barrier, there is no return period for modelled levels as the levels are controlled by barrier closures. Therefore 2014, 2065 and 2100 epochs were modelled on that basis.

Using the domains updated as part of the Thames Tidal Breach Modelling Study 2015 completed by CH2M HILL in March 2015, the project generated outputs for water depths, velocity, levels and hazard. However the scenario modelled is that the Thames Barrier is operational but all linear defences have been removed. It uses the TE2100 in-channel levels calculated in 2008 and only provides data for embayments upriver of the Thames Barrier.

	National Grid Reference		Modelled levels in mAODN		
Point	Easting	Northing	2014	2065	2100
1	522307	176523	nil return	5.05	5.57
2	522377	176609	nil return	5.33	5.68
3	522364	176456	4.13	5.19	5.61
4	522417	176542	nil return	5.33	5.70
5	522305	176598	nil return	nil return	nil return
6	522222	176545	nil return	5.02	5.57
7	522138	176527	nil return	5.02	5.57
8	522247	176478	nil return	5.04	5.57
9	522230	176630	nil return	nil return	5.42
10	522306	176394	nil return	5.08	5.57

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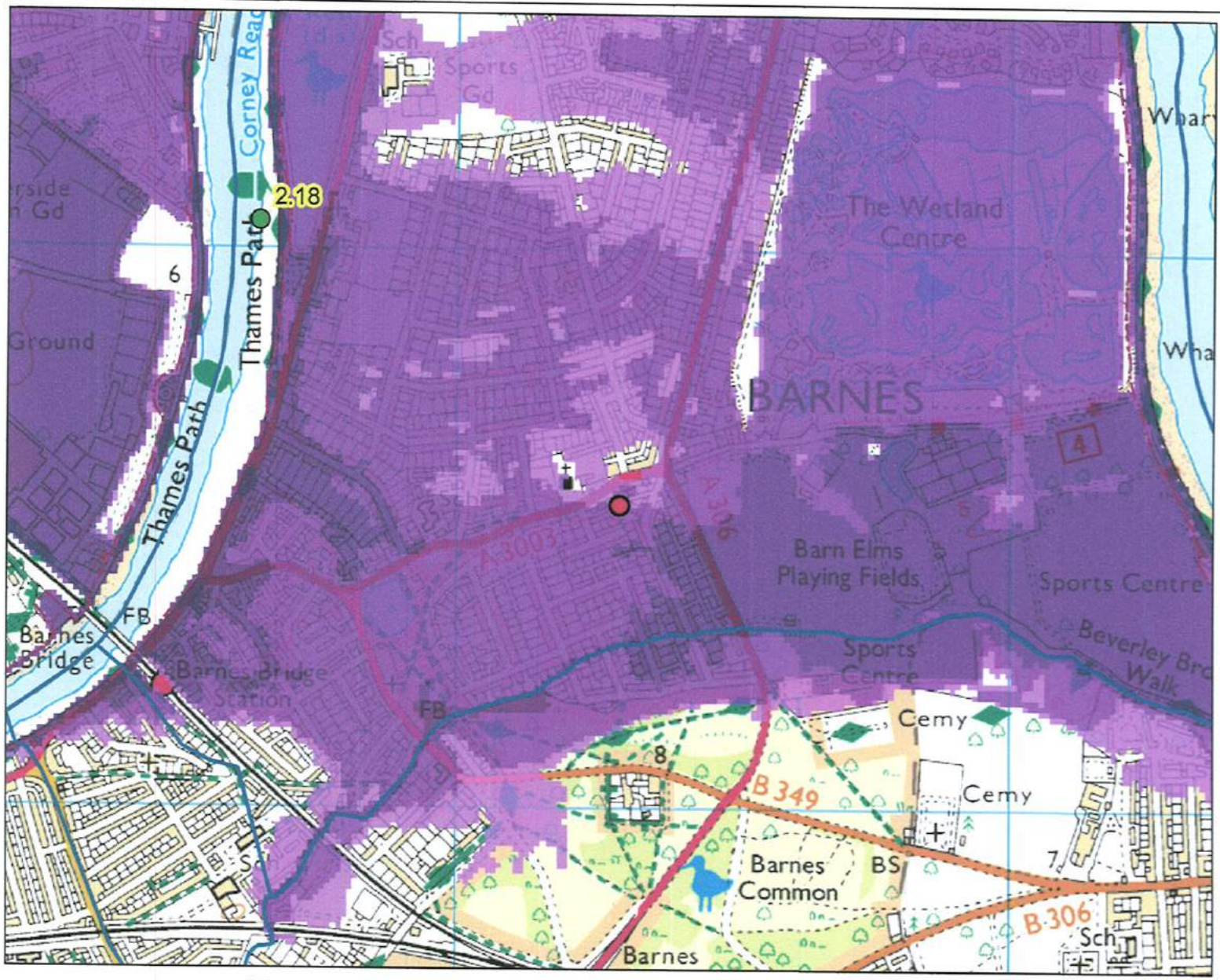
Email: kslenquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Upstream Inundation Modelling Map centred on SW13 0DQ created 13 July 2016 [Ref: KSL 17425 ES]



Environment Agency

Scale 1: 10,000

Legend

- Main Rivers
- Site
- TE2100 Model Nodes
- Flood Map - Defences

Upriver MLWL Outlines

Epoch

- 2014
- 2065
- 2100

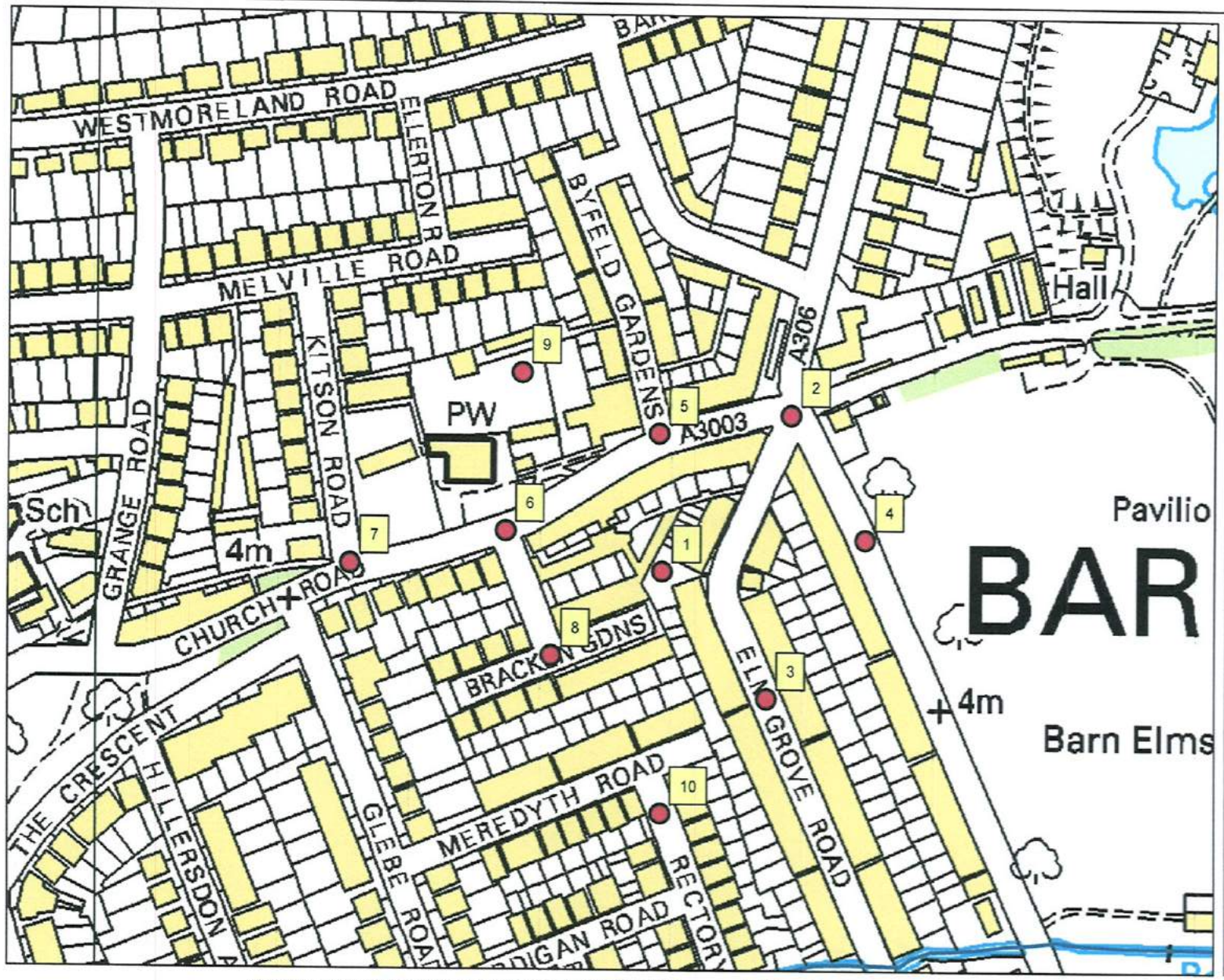
Upstream Inundation Modelling 2015

The modelled scenario is that the Thames Barrier is operational but all linear defences have been removed. The modelling is based on the 2008 TE2100 in-channel levels including an allowance for climate change.

Upstream of the Thames Barrier, there is no return period for modelled levels as the levels are controlled by barrier closeres. Therefore 2014, 2065 and 2100 epochs were modelled using Maximum Likley Water Levels (MLWLs).

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

2D Node Location Map centred on SW13 0DQ created 13 July 2016 [Ref: KSL 17425 ES]



Environment Agency

Scale 1: 3,000

Legend

- Main Rivers
- 2D Nodes

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Defence Details

The design standard of protection of the flood defences in this area of the Thames is 0.1% AEP; they are designed to defend London up to a 1 in 1000 year **tidal** flood event. The defences are all raised, man-made and privately owned. It is the riparian owners' responsibility to ensure that they are maintained to a crest level of 5.94 m AODN (the Statutory Flood Defence Level in this reach of the Thames). We inspect them twice a year to ensure that they remain fit for purpose. The current condition grade for defences in the area is 2 (good), on a scale of 1 (very good) to 5 (very poor). For more information on your rights and responsibilities as a riparian owner, please see our document 'Living on the edge' found on our website at:

https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities

There are no planned improvements in this area. Please see the 'Thames Estuary 2100' document on our website for the short, medium and long term Flood Risk Management strategy for London:

https://www.gov.uk/government/publications/flooding-thames-estuary-2100-te2100-plan

Areas Benefiting from Flood Defences

This site is within an area benefiting from flood defences, as shown on the enclosed extract of our Flood Map. Areas benefiting from flood defences are defined as those areas which benefit from formal flood defences specifically in the event of flooding from rivers with a 1% (1 in 100) chance in any given year, or flooding from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would be flooded. An area of land may benefit from the presence of a flood defence even if the defence has overtopped, if the presence of the defence means that the flood water does not extend as far as it would if the defence were not there.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Customer services line: 01732 223 202
Email: kslenquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Recorded Flood Events Data

We hold records of historic flood events from rivers and the sea. Information on the floods that may have affected the area local to your site is provided below and in the enclosed map (if relevant).

Flood Event Data

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.

Due to the fact that our records are not comprehensive, we would advise that you make further enquiries locally with specific reference to flooding at this location. You should consider contacting the relevant Local Planning Authority and/or water/sewerage undertaker for the area.

We map flooding to land, not individual properties. Our historic flood event record outlines are an indication of the geographical extent of an observed flood event. Our historic flood event outlines do not give any indication of flood levels for individual properties. They also do not imply that any property within the outline has flooded internally.

Please be aware that flooding can come from different sources. Examples of these are:

- from rivers or the sea;
- surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system);
- overflowing or backing up of sewer or drainage systems which have been overwhelmed,
- groundwater rising up from underground aquifers

Currently the Environment Agency can only supply flood risk data relating to the chance of flooding from rivers or the sea. However you should be aware that in recent years, there has been an increase in flood damage caused by surface water flooding and drainage systems that have been overwhelmed.

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Additional Information

Use of Environment Agency Information for Flood Risk/Flood Consequence Assessments

Important

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

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

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

https://www.gov.uk/flood-risk-standing-advice-frsa-for-local-planning-authorities

https://www.gov.uk/government/publications/national-planning-policy-framework-technical-guidance

https://www.gov.uk/government/publications/development-and-flood-risk-practice-guide-planning-policy-statement-25

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk/Consequence Assessment (FRA/FCA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires a FRA/FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.
4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

Surface Water

We have provided two national Surface Water maps, under our Strategic Overview for flooding, to your Lead Local Flood Authority – London Borough of Richmond upon Thames – who are responsible for local flood risk (i.e. surface runoff, ground water and ordinary watercourse), which alongside their existing local information will help them in determining what best represents surface water flood risk in your area.

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Email: kslenquiries@environment-agency.gov.uk
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London Borough of Richmond upon Thames have reviewed these and determined what it believes best represents surface water flood risk. You should therefore contact this authority so they can provide you with the most up to date information about surface water flood risk in your area.

You may also wish to consider contacting the appropriate relevant Local Planning Authority and/or water/sewerage undertaker for the area. They may be able to provide some knowledge on the risk of flooding from other sources. We are working with these organisations to improve knowledge and understanding of surface water flooding.

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Website: https://www.gov.uk/government/organisations/environment-agency

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