

**Hannah Reed**

29 CHARLES STREET,  
BARNES  
SW13 0NZ

**FLOOD RISK  
ASSESSMENT**

Country Gate Properties Limited  
The Tannery  
Crossgoats  
Beacon Road  
Ditchling  
West Sussex  
BN6 8XB



Hannah, Reed and Associates Limited  
Telford House  
Fulbourn  
Cambridge  
CB21 5HB

C-211156/AJB/June 2012

Revision: P2

**29 CHARLES STREET, BARNES**  
**FLOOD RISK ASSESSMENT**

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## **EXECUTIVE SUMMARY**

### **1. INTRODUCTION**

The following Flood Risk Assessment (FRA) has been prepared on behalf of County Gate Properties Limited to accompany the planning application for 6 residential dwellings and offices on Charles Street, Barnes, to replace existing lock up garages and garage workshop. The report has been prepared in accordance with National Planning Policy Framework (NPPF).

### **2. SITE LOCATION**

#### **2.1 Location and existing development**

##### 2.1.1 Description of existing site

The existing site is approximately 0.11ha and is located at the eastern end of Charles Street, to the south of the River Thames. The site is bounded by All Angels Church to the east, the rear of existing residential development on Elm Bank Gardens to the north and Charles Street to the south. The location plan is enclosed in **Appendix 1**.

##### 2.1.2 Site Topography

The topographical survey of the site enclosed in **Appendix 2** indicates levels in the development area range between 5.72mAOD on the gully in the eastern half of the site and 6.42mAOD in the western half of the site.

##### 2.1.3 Current drainage systems

The topographical survey identifies a private drain on the western half of the site, with a number of gullies shown within the site. It is assumed at this stage that the gullies are connected to the private drain and discharges into the existing sewer in Charles Street.

##### 2.1.4 Nearby watercourses, water-bodies and structures

There are no watercourses adjacent to the site, with the River Thames approximately 200m to the north of the site.

##### 2.1.5 Site geology and indication of permeability

The site surface geology is sand and gravel as part of the Kempton Park Gravel underlain by Oxford Clay, as shown in the BGS extract in **Appendix 3**.

An additional ground investigation was available for plots 42-44 Charles Street, this provided information that no groundwater was encountered down to 5m below existing ground level. In addition the Kempton Park Gravel formation was found to a depth of at least 5m below ground level.

### 2.1.6 Existing defences

The site currently benefits from flood defences along the River Thames as well as the tidal protection from the Thames Barrier downstream of the site, as shown in Plan D in **Appendix 6** from the London Borough of Richmond Upon Thames Strategic Flood Risk Assessment (June 2008).

### 2.1.7 Reference to local development documents

The proposed site is not discussed in the Local Development Framework. An extract is shown in **Appendix 4** identifying conservation areas to the east and west of the proposed site.

### 2.1.8 Sequential test and Exception test

The majority of the site is located in defended Flood Zone 2 with the central part of the site located in the defended Flood Zone 3 on the Environment Agency flood map enclosed in **Appendix 5**. In comparison with the available flood level data the site has significant freeboard above the Environment Agency modelled flood level data. Therefore the Sequential Test and Exception Test are not applicable.

## **3. ASSESSMENT OF EXISTING FLOOD HAZARD TO THE SITE**

### **3.1 Environment Agency Flood Zones**

The site is located in Flood Zone 2 and 3, both of which benefit from flood defences on the Environment Agency flood map.

As outlined above the site levels are above the Environment Agency modelled flood level data, which confirms the site location in Flood Zone 1.

### **3.2 Strategic Flood Risk Assessment**

The Strategic Flood Risk Assessment produced for London Borough of Richmond upon Thames (June 2008) by Jacobs, use the Environment Agency flood outline, therefore showing part of the site in Flood Zone 3. The extract relating to Barnes highlighting known areas with flooding problems is enclosed in **Appendix 6** along with the accompanying maps for reference. The extract confirms the development area has no known flooding problems.

The 'Hazard Map' locates the development site within an area of 'low' risk in terms of inundation, with the area also in close proximity to the proposed emergency routes running to the north of the site. The maps also indicate that the site benefits from local defences. The flood zone map in the report based on the Environment Agency maps shows the majority of the site within Flood Zone 3a, with the climate change map extending the floodplain to the southern and western boundary of the site.

### 3.3 Potential sources of flooding and a description of flooding from potential sources with reference to historical records and any Environment Agency data including any modelling work

#### 3.3.1 Fluvial flooding from main rivers

The Environment Agency flood maps show the site is located in Flood Zone 2 and 3, benefiting from defences along the River Thames and the impact of the Thames Barrier. The data issued by the Environment Agency is enclosed in **Appendix 7**. The flood risk to the site includes a tidal component and the benefit from the Thames Barrier which will reduce flood levels when climate change is considered, due to the proposed increased use of the Barrier as climate change impact increases with sea level rise.

The modelled tidal flood level data outlined in Table 1 below shows the flood levels for the 100 year and 1000 year events, decreasing from 5.19mAOD down to 5.13mAOD for the 100 year event and under the 1000 year event decreasing from 5.24 down to 5.14mAOD at node 2.17 closest to our site.

Table 1: Modelled Flood Data (2008 model)

Nodes	100yr (2005)	100yr (2055)	100yr (2107)	1000yr (2005)	1000yr (2055)	1000yr (2107)
2.16	5.22	5.21	5.16	5.28	5.24	5.18
<b>2.17</b>	<b>5.19</b>	<b>5.17</b>	<b>5.13</b>	<b>5.24</b>	<b>5.19</b>	<b>5.14</b>
2.19	5.14	5.11	5.09	5.19	5.14	5.11

As outlined previously in section 2.1.8 and 3.1, based on the modelled flood levels provided and comparison with the existing site levels, the site is located in Flood Zone 1, with a minimum freeboard of 530mm above the 1 in 100 year event.

#### 3.3.2 Fluvial flooding from minor watercourses

There are no minor watercourses in close proximity to the site.

#### 3.3.3 Flooding from high groundwater levels and springs

Local ground investigation work has confirmed no groundwater was encountered to a depth of 5m below the surface, which ties in with the EA data enclosed in **Appendix 7** which outlined groundwater 5.1m to 5.4m below ground level, recorded to the west of the site in 2004.

#### 3.3.4 Overland Flow

The site topography shows there are no significant falls within the site vicinity therefore overland flow is not anticipated to be a risk to the proposed development.

#### 3.3.5 Flooding from sewers

The condition and capacity of the existing sewers onsite is unknown and therefore the risk of flooding is unknown. Consultation for a site at 42-44 Charles Street, which

involved diversion works and a new connection to the existing network in Charles Street did not raise any problems with capacity in the existing network, or flooding in the area.

### **3.4 Probability**

#### **3.4.1 Site specific assessment of the probability of flooding**

The site is located in Flood Zone 1 based on existing site levels in excess of 5.72mAOD, with the modelled 100 year flood level being 5.19mAOD.

#### **3.4.2 Description of any structures in proximity of the site that may influence flooding**

There are no local structures which would influence flood risk at the site, however the site benefits from protection provided by the Thames Barrier downstream of the site.

### **3.5 Climate Change**

#### **3.5.1 Estimated effects of climate change on the site**

The estimated impacts of climate change on the site can be seen in the extract from the SFRA in **Appendix 6**, however the predicted impacts from NPPF Technical Guidance Table 5 predict rainfall will increase by 5% between 1990 and 2025, increasing up to 10% by 2055, 20% by 2085 and finally 30% by 2115. The peak river flows are predicted to increase by 10% between 1990 and 2025, increasing by 20% between 2025 and 2115.

## **4. DEVELOPMENT PROPOSAL**

### **4.1 Description of proposed development**

The proposed development is for 6 residential properties and offices on Charles Street, Barnes, as shown in **Appendix 8**. The site is bounded by existing residential development to the north, south and west, with All Angels Church to the east.

The existing site is 100% impermeable with the proposed development introducing some permeable area for gardens at the front of the properties.

### **4.2 Vulnerability classification of site**

The site is classified as More Vulnerable for the residential element and less vulnerable for the office component. Both classifications are considered appropriate for the site in Flood Zone 2.

### **4.3 Proposed location plans highlighting areas of concern and any flood protection measures planned (Byelaw Distance from Main River)**

The modelled flood level data confirm the site is located in Flood Zone 1 and therefore the flood risk is considered low.

#### **4.4 Finished Floor Levels and other relevant levels relative to the source of flooding**

A comparison of the modelled flood level data and the site levels shows significant freeboard above the 1 in 100 year plus climate change flood level. The proposed finished floor levels of the properties, range from 6.35mAOD for properties 1 and 2, 6.2mAOD for properties 3 to 6 and the ground floor office finished floor level at 6.0mAOD.

Site access off Charles Street is at approximately 6.05mAOD.

#### **4.5 Proposed site drainage and its capacity during flood events**

The existing site is 100% impermeable with surface water discharging into gullies onsite, before discharging into existing sewers in Charles Street. It is proposed to connect the development to the existing foul and surface water sewers in Charles Street, see **Appendix 9**. The Surface water runoff is reduced by the introduction of gardens on the proposed residential properties.

The introduction of gardens and permeable paving will reduce the current surface water run-off by approximately 29%.

#### **4.6 Post development surface water runoff**

The surface water runoff from the existing site calculated using the Wallingford Modified Rational method assuming a rainfall of 50mm/hr is 17.9 l/s. The proposed site will reduce the impermeable area to 0.078ha reducing the runoff to 12.78l/s. The calculations are enclosed in **Appendix 10** for reference.

### **5. IMPACTS & MITIGATION**

#### **5.1 Impacts**

The proposed development will provide betterment to the existing drainage regime by incorporating permeable garden areas to the proposed properties. Further to EA confirmation the site is located in Flood Zone 1 and therefore no flood water displacement will occur.

#### **5.2 Mitigation measures**

No mitigation measures are required, with the proposed development located in Flood Zone 1 and betterment is achieved by the proposed 29% reduction in impermeable area.

#### **5.3 Impact of flooding on the site**

The site is located in Flood Zone 1 as confirmed by the modelled flood level data. Therefore the site is considered to be at a low risk of flooding, with the SFRA hazard maps and inundation mapping showing the site outside the inundation zone if local defences failed.

## **6 RESIDUAL RISKS**

### **6.1 Remaining risks after mitigation measures are in place**

The proposed development has significant freeboard above the modelled flood level, with existing site levels between 5.72mAOD and 6.42mAOD providing a minimum of 480mm freeboard above the 1 in 1000 year flood level of 5.24mAOD, therefore no mitigation measures are required. The proposed finished floor levels of the properties are approximately 6.350mAOD for houses 1 and 2, 6.3mAOD for houses 3 to 6 and 6.0mAOD for the ground floor offices.

### **6.2 Pollution Prevention**

The existing site use as garages may contain some contamination risks due to the unknown uses. Therefore a site investigation will be required prior to development to ensure there are no contamination or pollution risks to the proposed development in the long term or during the construction phase. During construction 'Planning Policy Guidance 6: Working at construction and demolition sites' will be adopted, with any remediation or contamination problems treated in accordance with Planning Policy Guidance 8. The proposed development as residential will not require pollution prevention measures.

## **7 SUMMARY & CONCLUSION**

The proposed development comprising residential and commercial development is compatible with the site location as the site levels confirm the site is located in Flood Zone 1. The layout of the site has located the main access from the south of the site in the area of lowest risk on the site.

A comparison of the modelled flood level data and the ground levels of the site confirm the risk of flooding is low.

In accordance with NPPF as outlined in the above report we consider the proposed development is appropriate for the development in Flood Zone 1 and therefore that the application be approved.

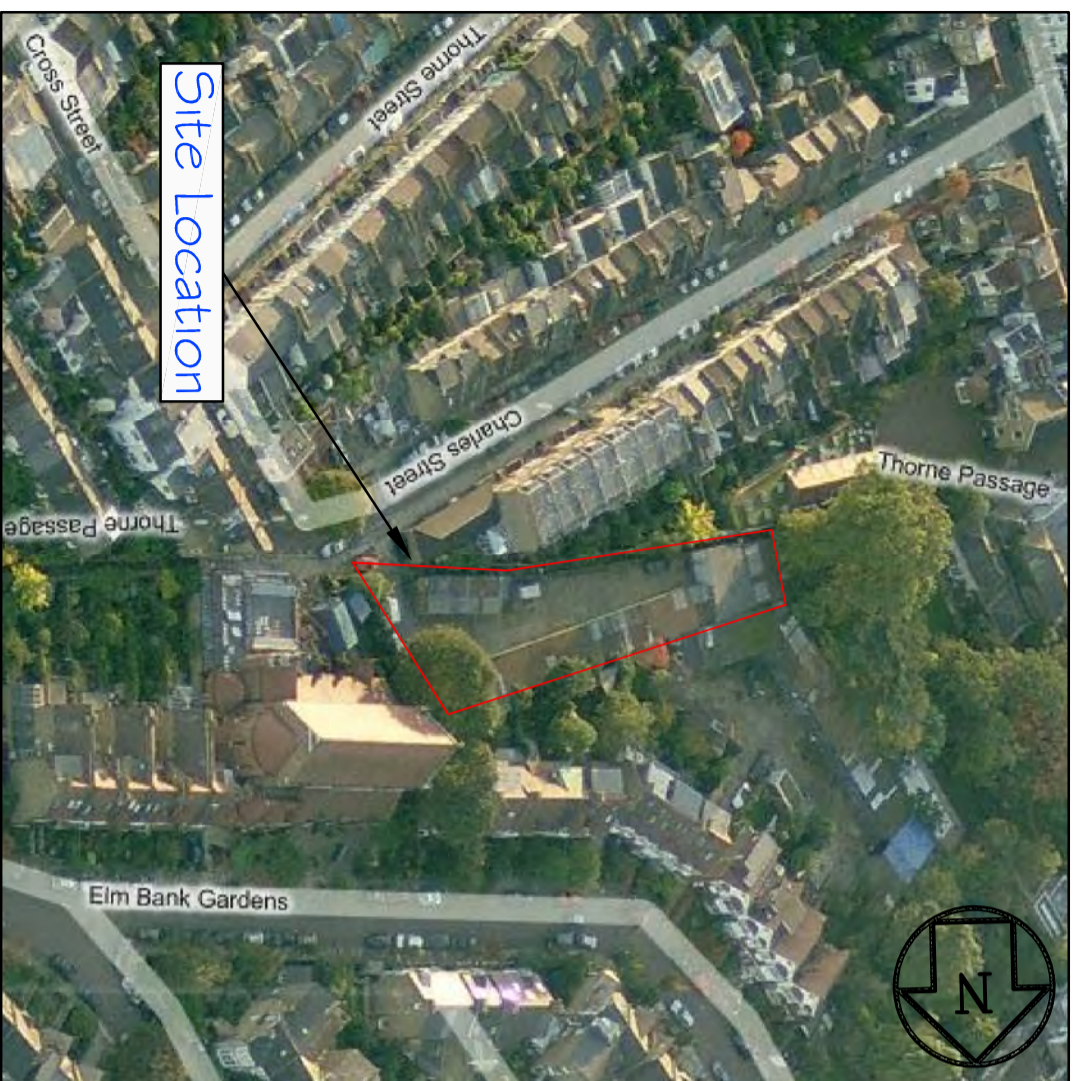
For a glossary of terms used in the above report please refer to **Appendix 11**.



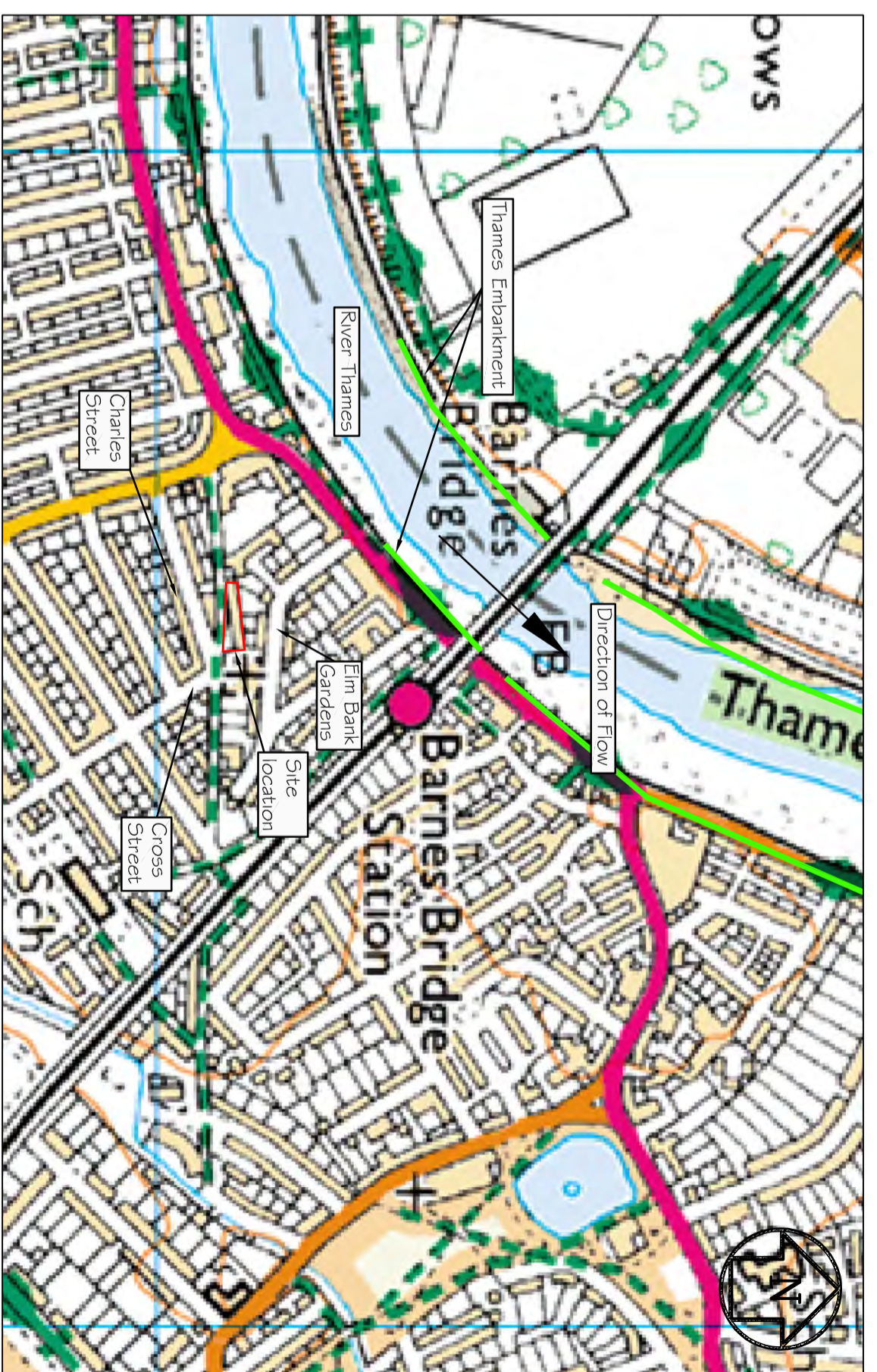
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**APPENDIX 1**

Site Location Plan  
(Hannah-Reed drawing C-211156/101)



Scale 1:2,000



Scale 1:5,000

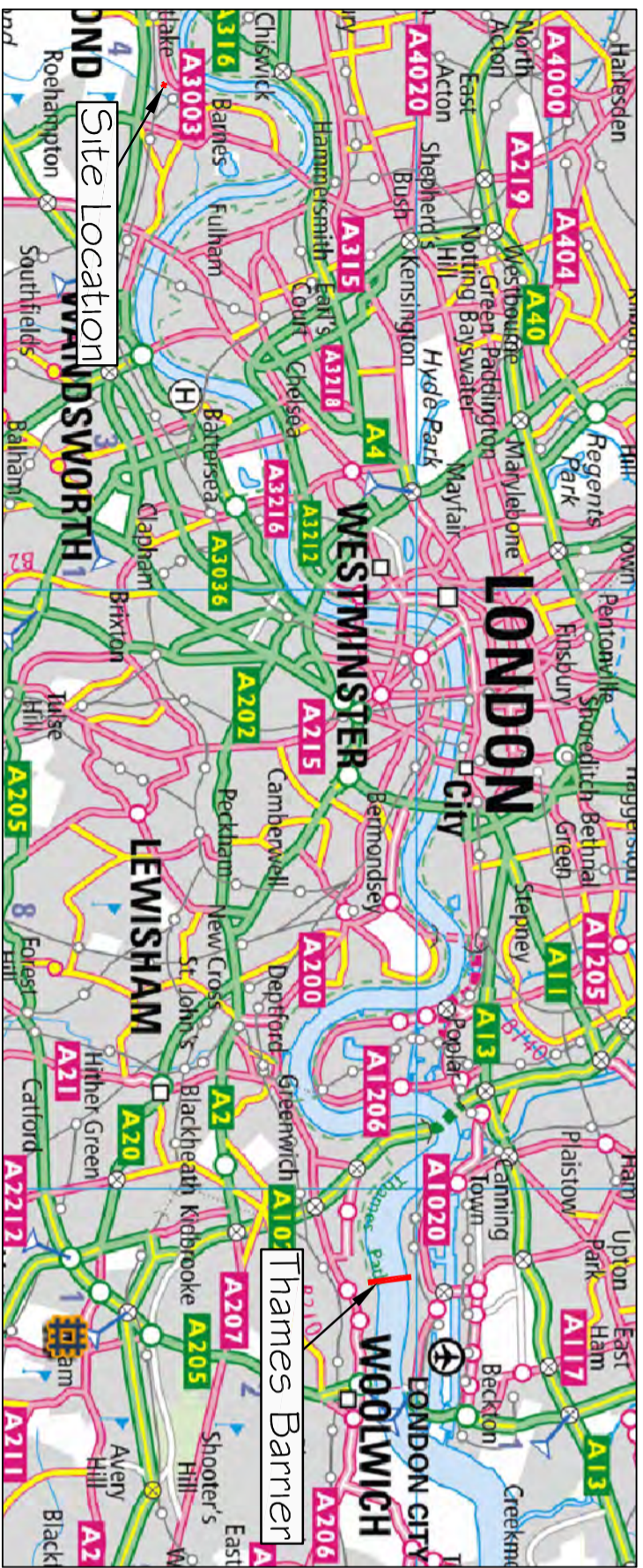
# REPORT DRAWING

Client	County Gate Properties		
Project	29 Charles Street, Barnes Flood Risk Assessment		
Title	Site Location Plan Appendix 1		
Rev	Description	Dr	Ch
P1	Initial issue	AJB	28/09/11

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<b>Hannah Reed</b>		Sheet Size	A3	Scale	As shown
Telford House, Fulbourn, Cambridge, CB1 5HB		Drawn	AJB	Drawing Number	
Telephone: 01223 882900		Checked		C211156/101	
Fax: 01223 881888		Approved		Rev	
e-mail: cambridge@hannahreed.co.uk				P1	



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**APPENDIX 2**

Topographic survey

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	CHECKED BY: [Signature]

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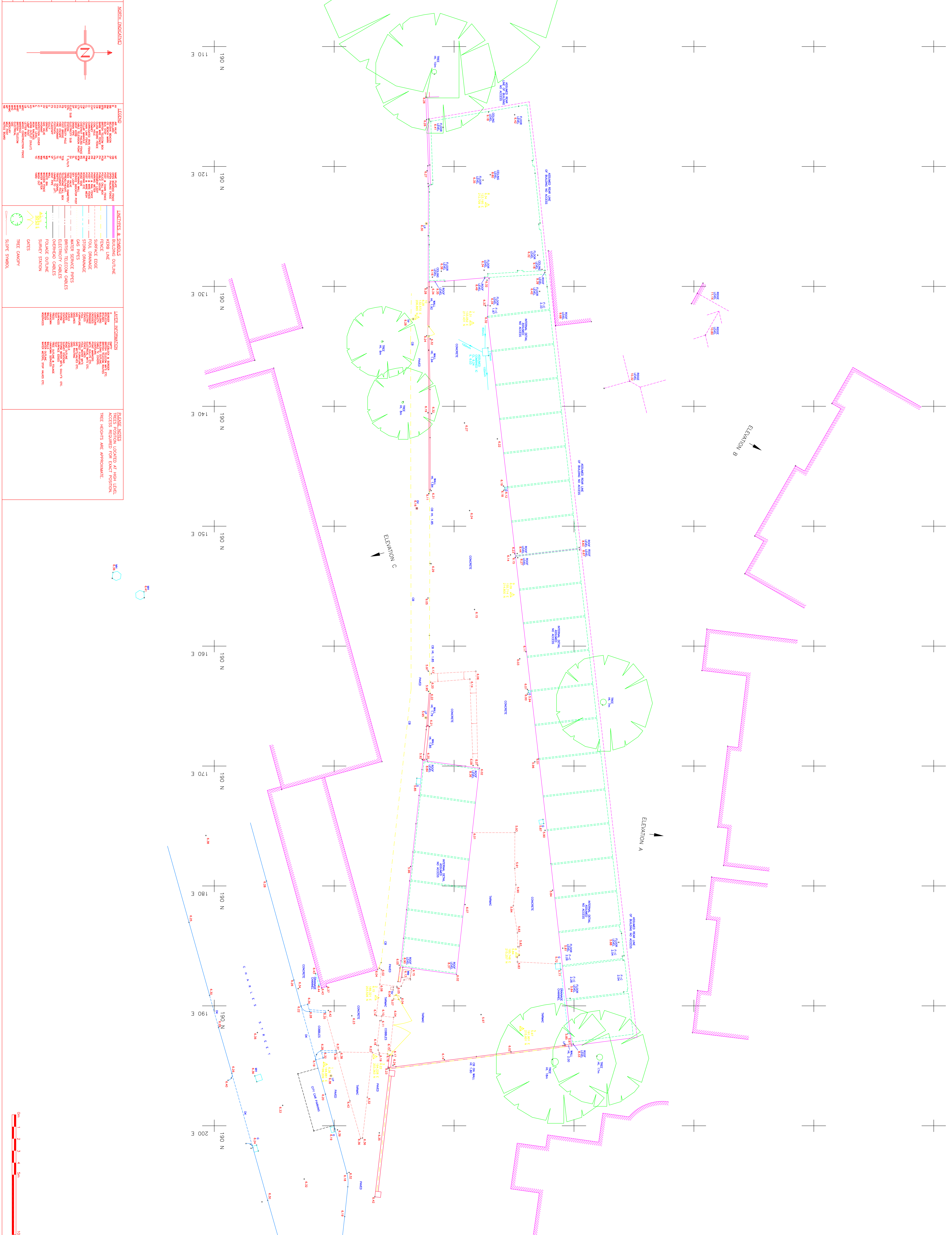
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**APPENDIX 3**

Geology map of site area,  
provided by the British Geological Survey

**Superficial deposits**

These include fairly recent geological deposits, such as river sands and gravels, or glacial deposits, which lie on the bedrock in many areas (an alternative term for Superficial deposits is 'Drift Deposits')



Scale: 1:25000 (1cm = 250m)



SITE LOCATION

**Key to Superficial deposits:**

Map colour	Computer Code	Rock name	Rock type
	KPGR	KEMPTON PARK GRAVEL FORMATION	SAND AND GRAVEL
	TPGR	TAPLOW GRAVEL FORMATION	SAND AND GRAVEL
	ALV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL
	ALV	ALLUVIUM	SILTY PEATY SANDY CLAY
	HEAD	HEAD	CLAY, SILT, SAND AND GRAVEL

**Bedrock**

Bedrock forms the ground underlying the whole of an area, upon which the other geological layers listed above may lie (an alternative term for Bedrock is 'Solid Geology')



Scale: 1:25000 (1cm = 250m)



SITE LOCATION



Fault



Coal, ironstone or other mineral vein

Note: Faults and Coals, ironstone & mineral veins are shown for illustration and to aid interpretation of the map. Not all such features are shown and their absence on the map face does not necessarily mean that none are present

**Key to Bedrock geology:**

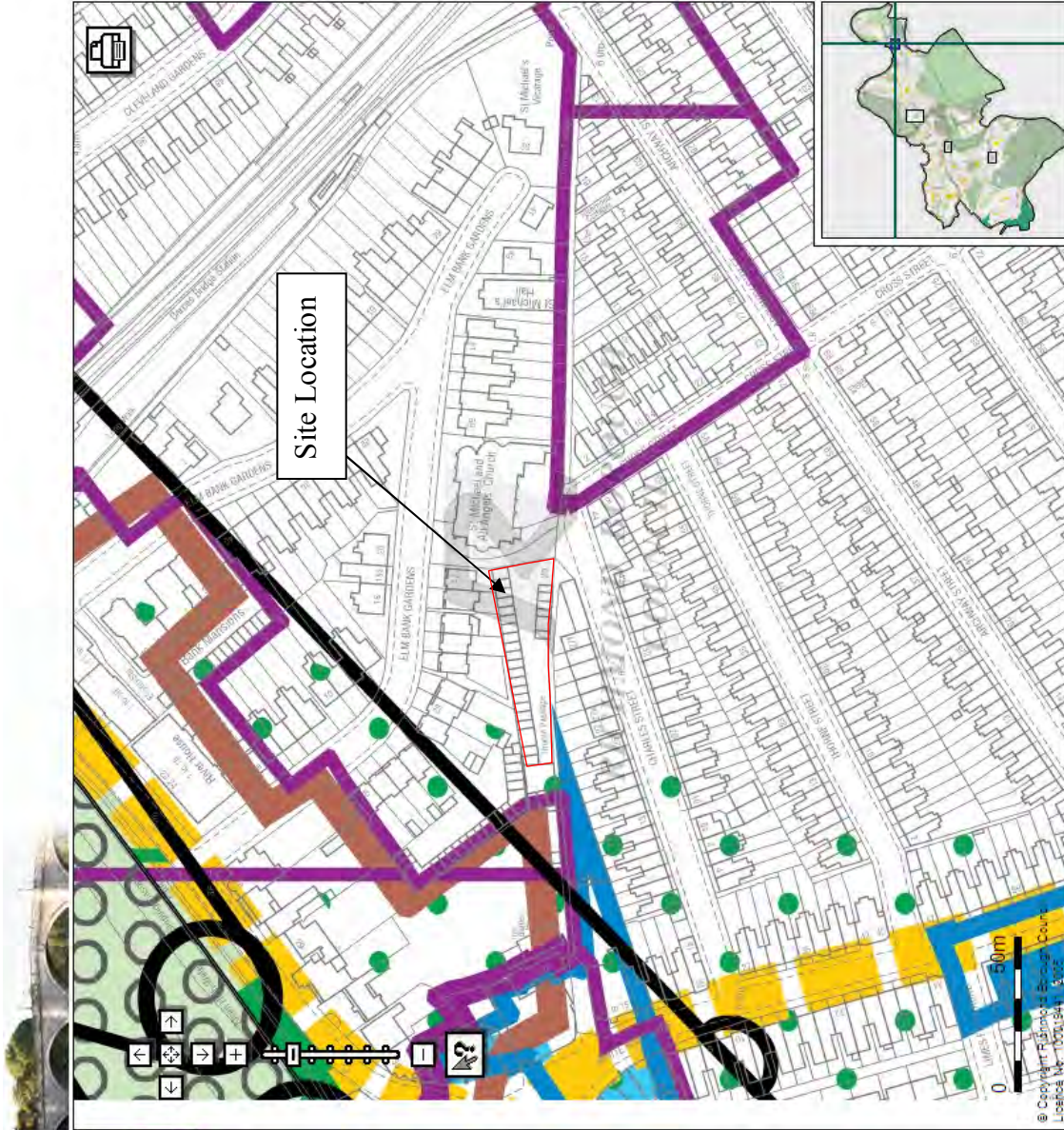
Map colour	Computer Code	Rock name	Rock type
	LC	LONDON CLAY FORMATION	CLAY AND SILT

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**APPENDIX 4**

Local Planning Extracts





LINKS		KEY	
HELP	POLICY INFO	SEARCH	WRITTEN STATEMENT
<b>KEY</b>	<b>POLICY AREAS</b>	<b>POLICY No.*</b>	
	Thames policy area	ENV26	
	Green belt	ENV2	
	Major developed site in Green belt	ENV2A	
	Metropolitan open land	ENV1	
	Public open space	ENV11	
	Other open land of townscape importance	ENV3	
	Green corridor	ENV20	
	Conservation area	BLT1	
	Historic parks & gardens	ENV10	
	Site of special scientific interest	ENV18	
	Other site of nature importance	ENV18	
	Proposed area for tree planting	ENV9	
	Vista / landmark	ENV5	
	View	ENV5	
	Scheduled ancient monument	BLT3	
	Proposed area for environmental improvement	BLT26	
	Area poorly provided with public open space	CP 10	
	Area of mixed use	EMP2, IMP2, HSG5, CCE18	
	Key shopping frontage	TC5	
	Secondary shopping frontage	TC6	
	Primary/secondary road (map 9)	TRN16	
	Local distributor road / Crown road	TRN16	
	River Crane area of opportunity	CP 12	
	Area at risk from flooding (please check with the Environment Agency at www.environment-agency.gov.uk)	ENV94	
	Borough boundary		
<b>SITE SPECIFIC PROPOSALS</b>			
	Site	K3	
	Junction	B4	
	Routes (footpath/cycle route/bridleway)	D13	
	Road safeguarding line	T19	
	Other transport	D5	

\* Numbers in the key apply to saved policies in the UDP  
 First Review, except those with the prefix CP which are Core Strategy policies. All policies apply to the whole Borough, unless specifically stated otherwise.

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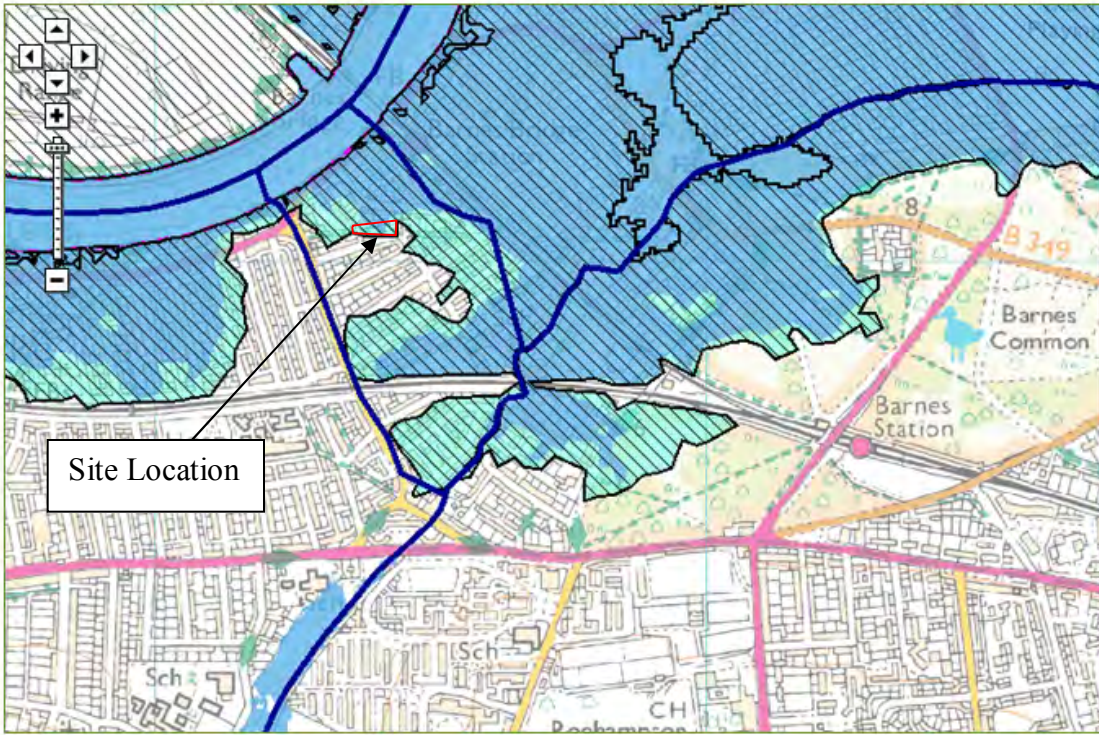
**APPENDIX 5**

Environment Agency Flood Zone Map and guidance notes

# Environment Agency Flood Map

X: 521,725;Y: 175,802 at scale 1:10,000

Text only version



© Environment Agency copyright and database rights 2011.  
© Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380,  
contains Royal Mail data © Royal Mail copyright and database right 2011.



**Before viewing the floodplain maps please read and understand the guidance notes below (as provided by the Environment Agency on their website: [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)).**

## CONTENTS

- 1. Understanding the Flood Map**
- 2. Your Questions Answered**
- 3. Flood likelihood explained**

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### 1. Understanding the Flood Map

The map and associated information is intended for guidance, and cannot provide details for individual properties.



To find out how to be prepared for all types of flooding go to our Floodline pages or call Floodline on tel: 0845 988 1188.

#### Key

##### 1. Floodplain

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.

For a fuller explanation of flood likelihood, follow the link at the bottom of the page.

##### 2. Flood Defences

The purple line  shows all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods. Flood defences that are not yet shown, and the areas that benefit from them, will be gradually added.

Hatched areas  benefit from the flood defences shown, in the event of a river flood with a 1% (1 in 100) chance of happening each year, or a flood from the sea with a 0.5% (1 in 200) chance of happening each year. If the defences were not there, these areas would be flooded.

Flood defences do not completely remove the chance of flooding, however, and can be overtopped or fail in extreme weather conditions.

For information on flood defences which are not yet shown on the map, contact your local Environment

Agency office.

### **3. Significant, Moderate or Low Likelihood of Flooding**

Our assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels, and ground levels. By clicking within either of the blue areas of floodplain, you can see which of three further categories of likelihood of flooding (significant, moderate, or low) apply there.

For a fuller explanation of flood likelihood, follow the link at the bottom of the page.

### **4. Flood Warning - Flood Warning Areas**

Flood warning schemes have been set up for a number of areas that are considered to be at particular risk from flooding. These areas are called Flood Warning Areas. Within these areas, we can warn residents in advance when flooding may be likely and how severe the flooding could be.

For advice about flood warning please click here. We also publish a number of flood warnings that are in force on this site.

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## **2. Your Questions Answered**

### **1. What is the Flood Map?**

The Flood Map is a new multi-layered map which provides information on flooding from rivers and the sea for England and Wales. The Flood Map also has information on flood defences and the areas benefiting from those flood defences.

### **2. What does it show?**

The key for Flood Map consists of the following layers of information:

- § Flooding from rivers or sea without defences – the natural flood plain area that could be affected in the event of flooding from rivers and the sea
- § For flooding from rivers the map indicates the extent of a flood with a 1% ( 1 in 100) chance of happening each year
- § For flooding from the sea the map shows the extent of a flood with a 0.5% ( 1 in 200) chance of happening each year
- § Extent of extreme flood – the extent of a flood with a 0.1% ( 1 in 1000) chance of happening each year
- § Flood defences – flood defences built to a certain standard in the last five years
- § Areas benefiting from flood defences – areas that benefit from the flood defences shown, in the event of a river flood with a 1% ( 1 in 100) chance of happening each year, or a flood from the sea with a 0.5% ( 1 in 200) chance of happening each year. If the defences were not there, these areas would flood.

The Flood Map does not provide information on flood depth, speed or volume of flow. It doesn't show flooding from other sources, such as groundwater, direct runoff from fields, or overflowing sewers. Your local Environment Agency office may have more information on these.

### **3. How does the Flood Map differ from the map previously available online?**

We have published floodplain maps on our website since December 2000. The previous version, known as the Indicative Floodplain Map (IFM), used information from a variety of sources, from flood events of differing severity and from some basic modelling – it could tell you where there was a risk of flooding but not how often and not very reliably.

The new Flood Map combines detailed local data with information from a new national model of England and Wales, which gives a more consistent picture of flood risk and also enables us to identify flooding associated with smaller rivers than the IFM.

The Flood Map shows the potential extent of an extreme flood, which may be experienced as a result of climate change, and it also starts to show flood defences and indicate where the risk is reduced because of these defences.

### **4. Who will use the Flood Map and why?**

The Flood Map is designed to increase awareness among the public, local authorities and other organisations of the likelihood of flooding, and to encourage people living and working in areas prone to flooding to find out more and take appropriate action.

The Flood Map can also be used by those people who wish to apply for planning permission in England to see whether the site they plan to develop is in a flood risk area. Further information is available by following the link to Development and Land Use Planning at the bottom of the page.

#### **5. Will the Flood Map be updated?**

As further appropriate information becomes available, it will be included in quarterly updates to the published Flood Map. It is anticipated that this will take place in January, April, July and October.

Flood defences not yet shown will be added gradually through these quarterly updates.

#### **6. Why will you need to update the map?**

We are committed to provide the best latest information to the public on flood risk. Our models are predictive and in the event of actual flooding we will need to revise the maps to take account of the new information received.

We also have an ongoing programme of improvement; as more detailed models are developed, we will have access to more information and will update the maps with it.

#### **7. How accurate is the data?**

Flood mapping is a complex, detailed and extensive process which will never be completely accurate, but we will always provide the best currently available information, using national consistent data. The Flood Map gives a good indication of the areas at risk of flooding in England and Wales. However it cannot provide detail on individual properties.

#### **8. I thought that I was protected by a flood defence but it isn't shown on your map**

Not all defences are shown yet; only defences built in the last five years to a certain standard are currently shown. More will be added as part of the updating process.

#### **9. What do you mean by likelihood of flooding?**

The probability or likelihood of flooding is described as the chance that a location will flood in any one year. The likelihood is expressed as a percentage i.e. 1%, or as a chance expressed for example as 1 in 100 chance in any given year. Find a link at the bottom of the page to this, labelled 'Flood likelihood explained'. It is important to remember that the risk of a flood occurring is there at all times - this year, next year and future years.

#### **10. How do I find out whether I can insure my home for flooding?**

Insurance companies decide whether to offer flood insurance to properties. However, an agreement reached between the ABI and Government in 2002 known as the ABI Statement of Principles, means that insurance companies will be able to offer insurance to many more properties that are at risk of flooding.

The Agency has helped to ensure that as many people as possible are able to obtain insurance by providing information on the risk of flooding across the whole of England and Wales from a National Flood Risk Assessment. This is a snapshot of flood risk at a national scale taken in summer 2004. The information from this assessment is provided on the website to support the Flood Map. By clicking on the "learn more" button anyone can find out what insurance category the general area where they live is in, either significant, moderate or low. These categories are based upon the likelihood of flooding from rivers and the sea at a location, taking into account the presence and effect of flood defences. As it is a national assessment, it is not able to state what the actual likelihood of flooding is to any specific property.

#### **11. Will my insurer use the Flood Map?**

Insurers have been given the same information on flood risk as that on the Internet. The flood maps do not show the risk at a particular property as the Environment Agency carries out flood mapping for areas of land. This is because we cannot know all details about all properties, for example how high the floor level is above ground level. Insurers can therefore only use the information as a first stage in assessing the flood risk for a general location. For more information, follow the link below to "Does this affect my home insurance".

#### **12. How has the likelihood of flooding been calculated?**

The likelihood of flooding has been calculated using predicted water levels and taking the location, type and condition of any flood defences into account, whether or not they are currently shown on the Flood

Map.

**13. Why is there no information on the likelihood of flooding for my area?**

The method for calculating the likelihood of flooding is independent of the method for calculating flood extents. The likelihood calculations are more complex and require more detailed input datasets. For some locations this extra data was not available at the time of production of the likelihood of flooding. We are working to update the data and fill in the data gaps over the next few months.

**14. Why does 'learn more' tell me that my area is outside the extent of an extreme flood, when the map shows my area clearly in the floodplain?**

The information accessed through 'learn more' is a snapshot of flood likelihood, at a national scale. There are two possible reasons why it may tell you that you are outside the extent of an extreme flood when the map shows your area in the floodplain. One possible reason is that the area you are looking at falls in or within three metres of a river, estuary or sea. In this case you may wish to try clicking slightly further away.

The second possible reason is that we have updated the mapped extent of extreme flood – which we will do every three months if we have better information – but have not yet updated the assessment of likelihood of flooding. The likelihood of flooding is based on an assessment that we intend to carry out annually.

**15. Why does an area behind a defence still have a “significant” or “moderate” flood likelihood?**

Flood defences do not completely remove the risk of flooding, but they do reduce it. Defences are built to withstand a flood of a certain magnitude but can be overtopped or fail either in extreme weather conditions or due to poor condition. Defences are built to different design standards according to local needs. Information on the likelihood of flooding takes account of the condition of defences as well as the standard of protection they provide. Your local Agency office may be able to provide more information on the defences in your area.

**16. Why does the flood probability data occasionally indicate a significant risk for locations within the light blue shaded area?**

The flood extents shown on the Flood Map and the flood probability data accessible by clicking on the 'learn more' button above the map have been calculated using two different and independent methodologies. The flood probability data takes account of defences which could be breached or fail in a major event.

**17. I don't agree with the map for my area. I want to challenge your information.**

If you believe that a particular property is not at flood risk or if you have information that you believe we may not have taken into account, please contact your local Environment Agency office, who will consider your comments and will advise on the appropriate procedure. However we would be unlikely to be able to consider an amendment to the Flood Map based only on anecdotal evidence.

**18. My property has never been shown as being in the floodplain before but it is now, why is this?**

The floodplain as defined in the new Flood Map is more extensive in some areas than that in our previous map for two reasons. Firstly we are now able to identify flood risk areas associated with smaller rivers, and secondly the Flood Map shows the extent of the flood with a 0.1% ( 1 in 1000) chance of happening in any year. New information from local studies is continually becoming available and will be used to update the flood map quarterly.

**19. Is a flood warning service available to me?**

By using the link on the flood map, you will be able to find out whether you can get an advance flood warning. To find out how to be prepared for all types of flooding go to our Floodline pages or call our 24 hour Floodline service on tel: 0845 988 1188.

**20. I've lived in my village for 50 years and I know this property has never flooded. Why is it shown on your Flood Map?**

A flood with a 1% ( 1 in 100) or 0.1% ( 1 in 1000) chance of happening in any one year may well not occur within the space of 50 years. Being in a floodplain doesn't mean your home or business will definitely be flooded - many other factors come into the equation. The maps are a guide and should prompt people who live near a river or the sea to be aware and find out more.

**21. I don't live near a river or the sea, why am I shown on your Flood Map?**

Flood flows follow the natural contours of the ground – therefore the area that may flood could be some distance from a river. The location may be on a route that floodwater will take. Alternatively there may be culverted watercourses under the property or nearby, which you may not be aware of - during a flood these may not be able to carry all of the flood flow, and some water will flow above ground. Flooding can occur from other sources such as groundwater and surface water runoff, but flooding from these sources is not shown on our map.

---

### 3. Flood likelihood explained

#### **What we mean by the likelihood or probability of flooding**

The probability or likelihood of flooding is described as the chance that a location will flood in any one year.

If a location has a 1.3% chance of flooding each year, this can also be expressed as having:

§ a 1 in 75 chance of flooding in that location in any year

§ betting odds of 75 to 1 against a location being flooded in any year

However, this doesn't mean that if a location floods one year, it will definitely not flood for the next 74 years. Nor, if it has not flooded for 74 years, will it necessarily flood this year.

When we describe the chance of flooding, we give it one of three descriptions or put it into one of three categories:

**Significant:** the chance of flooding in any year is greater than 1.3% (1 in 75)

**Moderate:** the chance of flooding in any year is 1.3% (1 in 75) or less, but greater than 0.5% (1 in 200)

**Low:** the chance of flooding in any year is 0.5% (1 in 200) or less

The **lower the percentage** then the **less chance** there is of flooding in any one year; the **higher the percentage** then the **more chance** there is of flooding in any one year.

#### **An example of chance is:**

A horse running in the Grand National with odds of 200 to 1 (or 1 chance in 200) has less chance of winning than one running at 75 to 1 (or 1 chance in 75). Similarly if the **chance of flooding is 200 to 1 (or 1 chance in 200)** then there is **less chance of flooding** than somewhere believed to have a **chance of flooding of 75 to 1 (or 1 chance in 75)**.



**29 CHARLES STREET, BARNES**  
**FLOOD RISK ASSESSMENT**

**APPENDIX 6**

Strategic Flood Risk Assessment Extracts

### 6.5.1 Character Area R1 – Barnes (Figure 1)

A large proportion of the character area of Barnes is contained within ZONE 3A HIGH PROBABILITY. The area is subject to both tidal and fluvial flooding from the River Thames. Flood warnings are provided within the Borough, relating to both fluvial (river) and tidal flooding. The Environment Agency strives to provide as much forewarning as possible of a pending flood event. This provides the Council, emergency services, residents & businesses with an opportunity to prepare in an endeavour to minimise property damage and risk to life.

The southern portion of Character Area R1 is also affected by flooding from Beverley Brook. The Beverley Brook catchment is relatively steep and underlain by impermeable soils. As a result, the brook is susceptible to flooding of a 'flashy' nature and in addition to placing properties at risk during prolonged widespread rainfall, Beverley Brook may also affect properties during localised high intensity rain storms.

In addition to the known fluvial/tidal flooding from the River Thames and Beverley Brook, there are sites where local drainage has been identified by the Council as a known source of flood risk, namely:

- Lonsdale Road
- The area adjacent to Rocks Lane
- The Terrace<sup>15</sup>.

These localised problem areas have been highlighted by the Council following observed flooding at these locations. The precise cause of the flooding problem is generally uncertain. Notwithstanding this however, it is important to ensure that any future development does not exacerbate these issues. It is essential to make certain that future development does not increase the rate runoff that drains towards these areas.

### 6.5.2 Character Area R2 –Mortlake (Figure 2)

The area of Mortlake adjoining the River Thames corridor are situated within ZONE 3A HIGH PROBABILITY, subject to both tidal and fluvial flooding from the River Thames. Flood warnings are provided within the Borough, relating to both fluvial (river) and tidal flooding. The Environment Agency strives to provide as much forewarning as possible of a pending flood event. This provides the Council, emergency services, residents & businesses with an opportunity to prepare in an endeavour to minimise property damage and risk to life.

A proportion of Character Area R2 is also affected by flooding from Beverley Brook. The Beverley Brook catchment is relatively steep and underlain by impermeable soils. As a result, the brook is susceptible to flooding of a 'flashy' nature and in addition to placing properties at risk during prolonged widespread rainfall, Beverley Brook may also affect properties during localised high intensity rain storms.

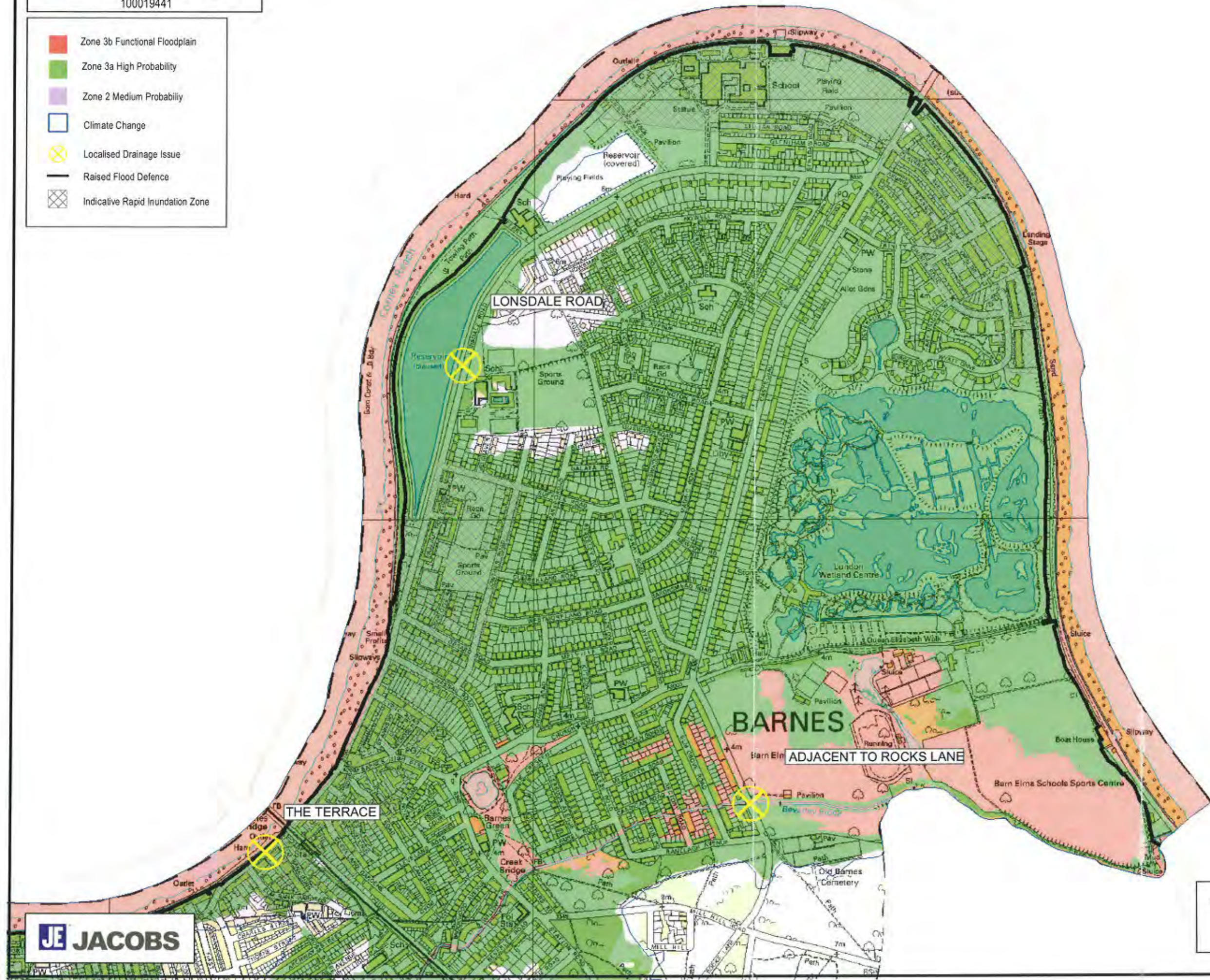
In addition to the known fluvial/tidal flooding from the River Thames and Beverley Brook, there are sites where local drainage has been identified by the Council as a known source of flood risk, namely:

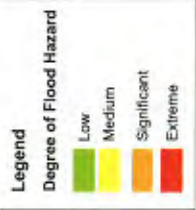
- Shrewsbury Avenue
- Percival Road
- The Terrace
- Groundwater flooding at East Sheen (refer Environment Agency).

These localised problem areas have been highlighted by the Council following observed flooding at these locations. The precise cause of the flooding problem is generally uncertain. Notwithstanding this however, it is important to ensure that any future development does not exacerbate these issues. It is essential to make certain that future development does not increase the rate runoff that drains towards these areas.

<sup>15</sup> Note that the Environment Agency has identified an observed groundwater flooding event at this location

- Zone 3b Functional Floodplain
- Zone 3a High Probability
- Zone 2 Medium Probability
- Climate Change
- Localised Drainage Issue
- Raised Flood Defence
- Indicative Rapid Inundation Zone







**Legend**

- ▲ Groundwater Flooding Incidents
- River Thames Flood Defence Line
- (ABD) Areas Benefitting from Defences

**Legend**

- Impacts of Climate Change on Zone 3a





- EA Flood Zone 3
- Emergency Routes (Currently Above 100 Year Flood Level)
- Proposed Emergency Routes (To be revised above 100 Year Flood Level)
- Proposed Emergency Routes (Insufficient data to confirm level- considered unlikely to be below the 100 Year Flood Level)

**29 CHARLES STREET, BARNES**  
**FLOOD RISK ASSESSMENT**

**APPENDIX 7**

Modelled flood levels for watercourse,  
provided by the Environment Agency



## Angela Barber

---

**From:** KSL Enquiries <KSLE@environment-agency.gov.uk>  
**Sent:** 04 October 2011 12:49  
**To:** Angela Barber  
**Subject:** KSL001725 - DCR - Charles Street Barnes - Data Request

Emailed to Angela Barber

[A.Barber@hannahreed.co.uk](mailto:A.Barber@hannahreed.co.uk)

**Our ref:** KSL/2011/001725

**Your ref:**

**Date:** 4 October 2011

Dear Angela

**Information request: Charles Street Barnes - Data Request**

Thank you for your email of 29 September 2011.

Please find below the information you requested.

Our Thames Barrier Tidal Mapping and Data team have checked the data you sent to us and can confirm that the information supplied previously is still up to date.

The information is provided subject to the enclosed notices.

I hope the enclosed information is sufficient. If you require any further help please contact me.

We would be really grateful if you could spare five minutes to help us improve our service. Please click on the link below and fill in our survey – we use every piece of feedback we receive.

<https://web.questback.com/isa/qbv.dll/SQ?q=8w2Qkfx%2BivseokDpT0B63zPEtigrVPtzrntO%2BbBapSm00Q%3D%3D>

Yours sincerely

David Rich

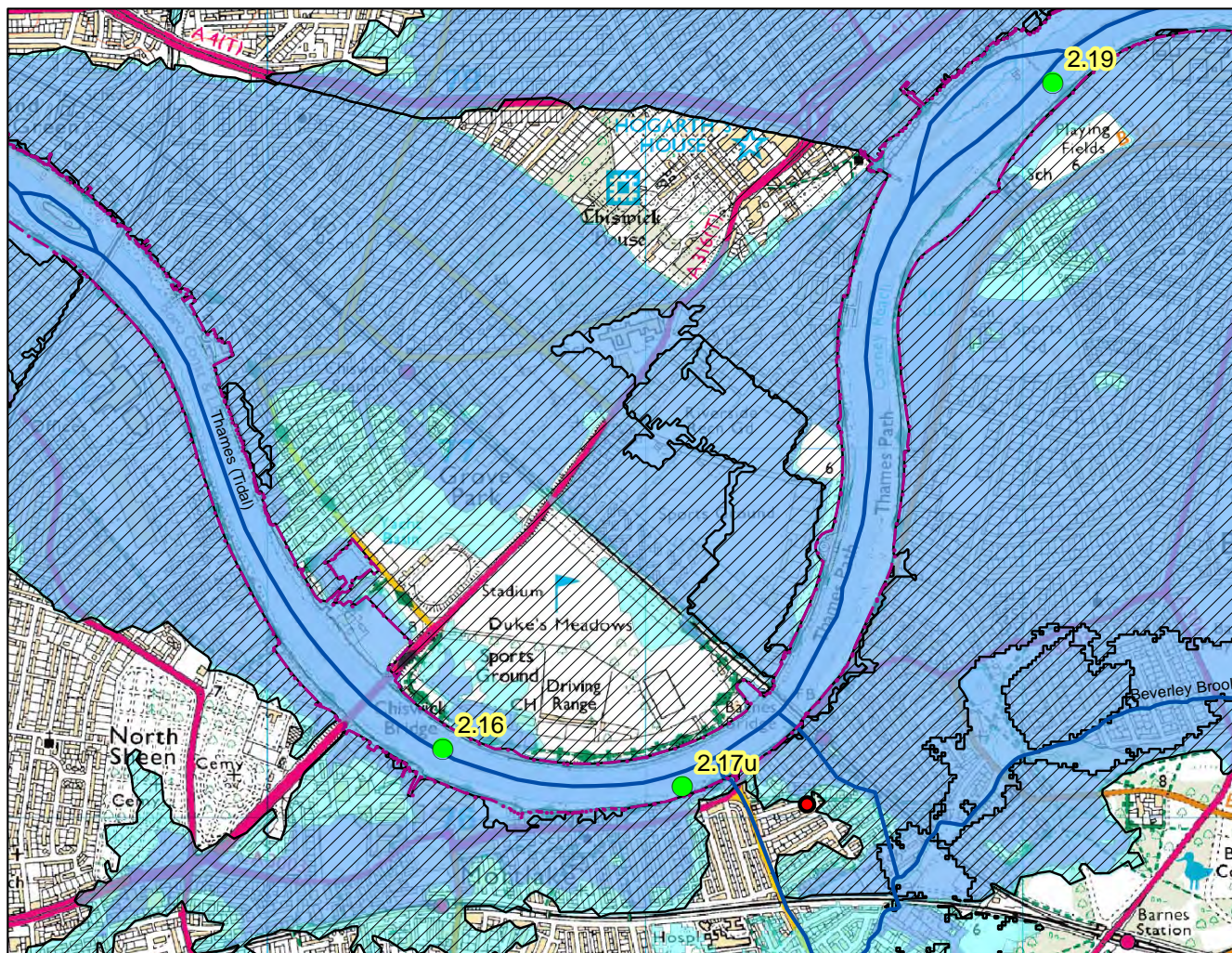
**External Relations Officer**

Phone 01732 223202

Fax 01732 875057

E-mail [KSLEnquiries@environment-agency.gov.uk](mailto:KSLEnquiries@environment-agency.gov.uk)

# Detailed FRA/FCA [Charles Street, Barnes] - created 9th of February 2010 [Ref: SE18376]



Scale 1:25,000



### Legend

- Site Location
- Model Nodes
- Flood Map - Defences
- Main Rivers
- Areas Benefiting from Flood Defences
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2

### Flood Map Areas (assuming no defences)

**Flood Zone 3** shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of occurring each year
- or from a river with a 1 in 100 or greater chance of occurring each year.

**Flood Zone 2** shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

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**Contact Us:** National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

## Product 4 (Detailed Flood Risk) for Charles Street, Barnes

Our ref: **SE18376**

### Product 4 is designed for developers where Flood Risk Standing Advice FRA (Flood Risk Assessment) Guidance Note 3

- i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq meters; and all domestic extensions", and
- ii) "all applications with a site area greater than 1 ha" in Flood Zone 2.

### Product 4 includes the following information:

Ordnance Survey 1:25k colour raster base mapping;  
Flood Zone 2 and Flood Zone 3;  
Relevant model node locations and unique identifiers (for cross referencing to the water levels, depths and flows table);  
Model(s) extents;  
FRA site boundary (where a suitable GIS layer is supplied);  
Flood defence locations (where available/relevant) and unique identifiers; (supplied separately)  
Flood Map areas benefiting from defences (where available/relevant);  
Flood Map flood storage areas (where available/relevant);  
Historic flood events outlines (where available/relevant, not the Historic Flood Map) and unique identifiers;  
Statutory (Sealed) Main River (where available within map extents);

A table showing:

- i) model node X/Y coordinate locations, unique identifiers, levels, flows and JFLOW depths;
- ii) Flood defence locations unique identifiers and attributes; (supplied separately)
- iii) Historic flood events outlines unique identifiers and attributes; and
- iv) local flood history data (where available/relevant).

### Please note:

If you will be carrying out computer modelling as part of your Flood Risk Assessment, please read the enclosed guidance which sets out our requirements and best practice for computer river modelling.

This information is based on that currently 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 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.

This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance

<http://www.environment-agency.gov.uk/research/planning/82584.aspx>

If you would like advice from us regarding your development proposals you can complete our pre application enquiry form which can be found at

<http://www.environment-agency.gov.uk/research/planning/33580.aspx>

## Modelled in-channel levels

SE18376

The modelled flood levels for the closest most appropriate model node points for your site that are within the river channel are provided below:

<b>Modelled Tidal Levels (mAODN)</b>
<b>Node 2.16</b>
<b>Grid ref: TQ 20463 76185</b>

Year	Return Period						
	10	20	50	100	200	500	1000
2005	5.09	5.14	5.19	5.22	5.25	5.27	5.28
2055	5.16	5.18	5.20	5.21	5.22	5.23	5.24
2107	5.15	5.16	5.16	5.16	5.17	5.17	5.18

<b>Modelled Tidal Levels (mAODN)</b>
<b>Node 2.17</b>
<b>Grid ref: TQ 21100 76081</b>

Year	Return Period						
	10	20	50	100	200	500	1000
2005	5.05	5.11	5.16	5.19	5.21	5.23	5.24
2055	5.13	5.15	5.16	5.17	5.18	5.19	5.19
2107	5.12	5.12	5.13	5.13	5.13	5.14	5.14

<b>Modelled Tidal Levels (mAODN)</b>
<b>Node 2.19</b>
<b>Grid ref: TQ 22080 77993</b>

Year	Return Period						
	10	20	50	100	200	500	1000
2005	5.02	5.06	5.11	5.14	5.16	5.18	5.19
2055	5.07	5.09	5.10	5.11	5.12	5.13	5.14
2107	5.08	5.09	5.09	5.09	5.10	5.10	5.11

## Model disclaimer

SE18376

Model: **Tidal Thames Extreme Water Levels 2008**

Disclaimer:

Our water levels are created from a 2-D joint-probability computer hydraulic model. As this is a joint-probability model the confluence of different factors such as astronomical tides, tide surge and river flows have been taken into account. In summary, the calculation of extreme water levels involves two main stages:

1) Estimating a matrix of water levels at various locations (or model nodes) along the estuary 2) Calculating the statistical frequency (return period) with which a particular water level might be expected to occur at each of the model nodes.

This study modelled water levels to various return periods (1 to 10, 20, 50, 100, 200, 500 and 1000) Each of these return periods have been modelled for present day (2005) and future years (2055 and 2107) taking into account DEFRA's climate change allowances as set out in the Planning Policy Statement 25 (PPS25)

Description:

Some of the levels are lower for greater return periods when including climate change because the hydraulic model used to produce these levels takes into account the Thames Barrier closure rule (circumstances/conditions of closure) and assumes that it remains unchanged up to 2107. Increased sea levels and fresh water flows mean that the Thames Barrier closure rule will be met more often. This means that a smaller number of tides will be allowed to flow up into central London each year. The highest tides experienced upstream of the Thames Barrier occur when the circumstances are within a fine margin of meeting the closure rule, and the decision is taken not to close (a near closure event). As there will be fewer tides per year upstream of the Barrier, and the ratio of near closure levels to regular tidal levels within this smaller number of tides remains constant, the number of near closure events will decrease, and therefore so do the modelled levels.

## Historic flood data

**SE18376**

Our records show that the area of your site had not been affected by tidal flooding.  
Information on the floods that have affected the area is provided in the table below:

Historic Flood Events Unique ID	Flood Event Code	Flood Event Name	Start Date	End Date	Source of Flooding	Cause of Flooding

**Extra historic flood information:**

Please note the Environment Agency maps show flooding to land not individual properties. Floodplain extents are an indication of the geographical extent of a historic flood. They do not provide information regarding levels of individual properties, nor do they imply that a property has flooded internally.

## Flood Defences

SE18376

### General description:

The defences along the tidal Thames in this area are all raised, man-made and privately owned. We regularly inspect them twice a year to ensure that they remain fit for purpose. They must be maintained by their owners to a crest level of 5.94 m AODN (the Flood Defence Level in this reach of the Thames). The overall condition grade for defences in the area is 3(Fair), on a scale of 1 (very good) to 5 (very poor).

### Standard of protection provided by the tidal defences

The river Thames is defended along this section to a standard of 1:1000. The defences protect against a tidal flooding event that has a 0.1% annual probability of occurring up to the year 2070. After 2070 the standard of protection will decrease over time. However we have a project (Thames Estuary 2100) that is studying options to manage flood risk in the Thames estuary up to 2100. Public consultation of this study has finished, but you can access all the information here: <http://www.environment-agency.gov.uk/research/library/consultations/106100.aspx>

Ms. Angela Barber  
Hannah Reed and Associates Ltd  
Telford House  
Fulbourne  
Cambridge  
CB21 5HB

Our ref: SE18376  
Your ref: AJS/SCD/C-210023

Date: Thursday 11 February 2010

Dear Angela,

**Re: Charles Street Barnes London**

Provision of Product 4 for FRA/FCA for the above site.

Thank you for your request of 28 January 2010 to use Environment Agency data, Product 4, in the development of the FRA/FCA. The information is attached.

This information has been supplied in the form of a PDF file and e-mailed to the following address:

[ABarber@hannahreed.co.uk](mailto:ABarber@hannahreed.co.uk)

If you have requested this information to help inform a development proposal, then you should note the detail in the attached advisory text on the use of Environment Agency Information for Flood Risk Assessments / Flood Consequence Assessments.

**Supporting Information**

**Strategic Flood Risk Assessment**

The site falls within the London Borough of Richmond upon Thames. The Council prepared a Level 1 Strategic Flood Risk Assessment (SFRA) in June 2008 and the completed final document and Map Figures can be found on their website using the following link:

[http://www.richmond.gov.uk/home/environment/planning/planning\\_guidance\\_and\\_policies/local\\_development\\_framework/local\\_development\\_framework\\_research/flood\\_risk\\_assessment.htm](http://www.richmond.gov.uk/home/environment/planning/planning_guidance_and_policies/local_development_framework/local_development_framework_research/flood_risk_assessment.htm)

As a Statutory Consultee on Strategic Flood Risk Assessments we have been in close liaison with the council throughout the production of their SFRA. If you have any queries about the SFRA document please contact the council directly. Their contact details are as follows:

Address: Local Development Framework Team, London Borough of Richmond upon Thames, Civic Centre, 44 York Street, Twickenham, TW1 3BZ



Email: [ldf@richmond.gov.uk](mailto:ldf@richmond.gov.uk)

Telephone: 0208 891 7322

### Groundwater

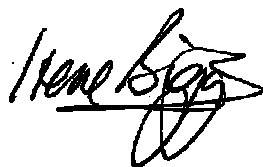
We have no record of potential groundwater flooding for this location, nor within a radius of 500m.

We have no groundwater level data for this location. However, a site investigation undertaken approximately 150m to the west reported groundwater at 5.1m to 5.4m below ground level in October 2004.

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

If you have any queries or would like to discuss the content of this letter further please contact Irene Biggs at the Environment Agency.

Yours faithfully

A handwritten signature in black ink, appearing to read 'Irene Biggs', with a stylized flourish at the end.

**Irene Biggs**

**External Relations Officer**

Direct dial 01276 454345

Direct fax 01276 454301

Direct e-mail [irene.biggs@environment-agency.gov.uk](mailto:irene.biggs@environment-agency.gov.uk)

Enc. Detailed FRA/FCA Map – Product 4

Standard Notice (Commercial)

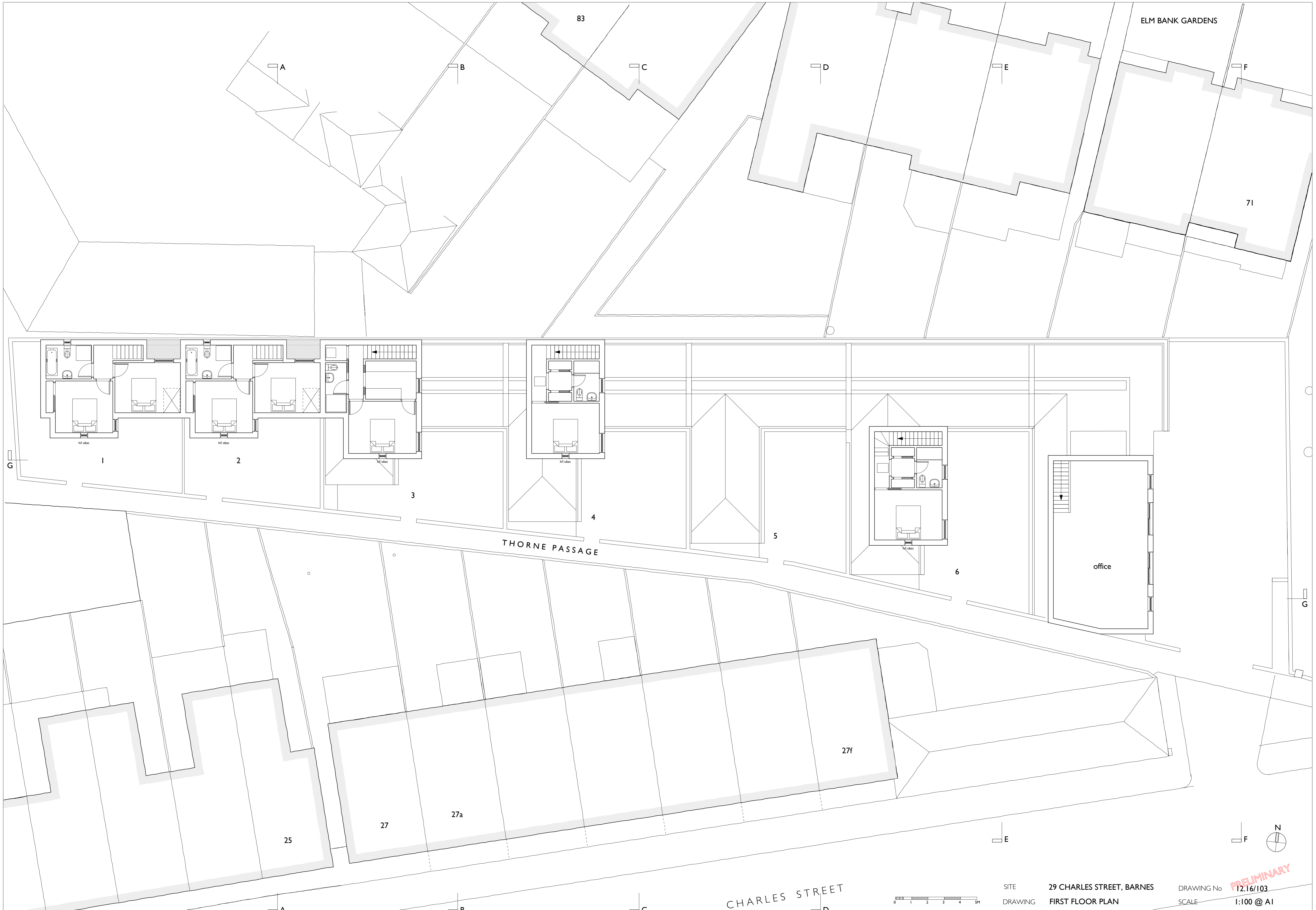
Appendix A

Developers Guidance

**29 CHARLES STREET, BARNES**  
**FLOOD RISK ASSESSMENT**

**APPENDIX 8**

Proposed development plans



ELM BANK GARDENS

83

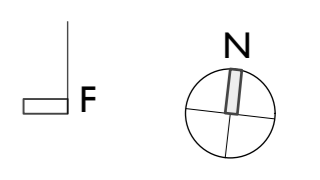
71

THORNE PASSAGE

CHARLES STREET

SITE 29 CHARLES STREET, BARNES  
DRAWING FIRST FLOOR PLAN

DRAWING No 12.16/103  
SCALE 1:100 @ A1



**PRELIMINARY**





PRELIMINARY

**29 CHARLES STREET, BARNES**  
**FLOOD RISK ASSESSMENT**

**APPENDIX 9**

Site sewer record drawing

**Residential CON29DW Drainage & Water Search Sewer Map-DWS/DWS  
Standard/2009 1650645**



The width of the displayed area is 200m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationary Office, License no. WU298557 Crown Copyright Reserved.



# Residential Drainage & Water Search Sewer Key

## Public Sewer Pipes (Operated & Maintained by Thames Water)

	<b>Foul Sewer:</b> A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	<b>Surface Water Sewer:</b> A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers, watercourses or a treatment works.
	<b>Combined Sewer:</b> A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	<b>Trunk Sewer:</b> A strategic sewer which collects either foul or surface water flow from a number of subsidiary catchments and transfers this flow to a pumping station, river outfall or treatment works.
	<b>Storm Overflow Sewer:</b> A sewer designed to convey excess rainfall to rivers or watercourses so that the flow does not exceed the capacity of normal sewers (which could cause flooding).
	<b>Biosolids:</b> A sewer designed to convey sludge from one treatment works to another.
	<b>Vent Pipe:</b> A section of sewer pipe connected between the top of a sewer and vent column, used to prevent the accumulation of gas in a sewer and thus allowing the system to operate properly.
	<b>Rising Main:</b> A pipe carrying pumped flow under pressure from a low point to a high point on the sewerage network. Line style / colour and direction of fleck indicate sewer purpose and direction of flow within the pipe.
	<b>Vacuum:</b> A foul sewer designed to remove foul sewerage under pressure (vacuum sewers cannot accept direct new connections).
	<b>Proposed Foul Sewer</b>
	<b>Proposed Surface Water Sewer</b>

## Other Sewer Types (Not Operated or Maintained by Thames Water)

	<b>Foul Sewer:</b> Any foul sewer that is not owned by Thames Water.
	<b>Surface Water Sewer:</b> Any surface water sewer that is not owned by Thames Water.
	<b>Combined Sewer:</b> Any combined sewer that is not owned by Thames Water.
	<b>Gully:</b> A sewer designed to convey surface water from large roads, motorways, etc. to watercourses or to public surface water sewers. These sewers are generally maintained by the relevant highway authority.
	<b>Culverted Watercourse:</b> A watercourse running through a culvert or pipe which is the responsibility of the property owner or the Environment Agency.
	<b>Abandoned Sewer:</b> A disused sewer. Usually filled with cement mixture or removed from the ground.

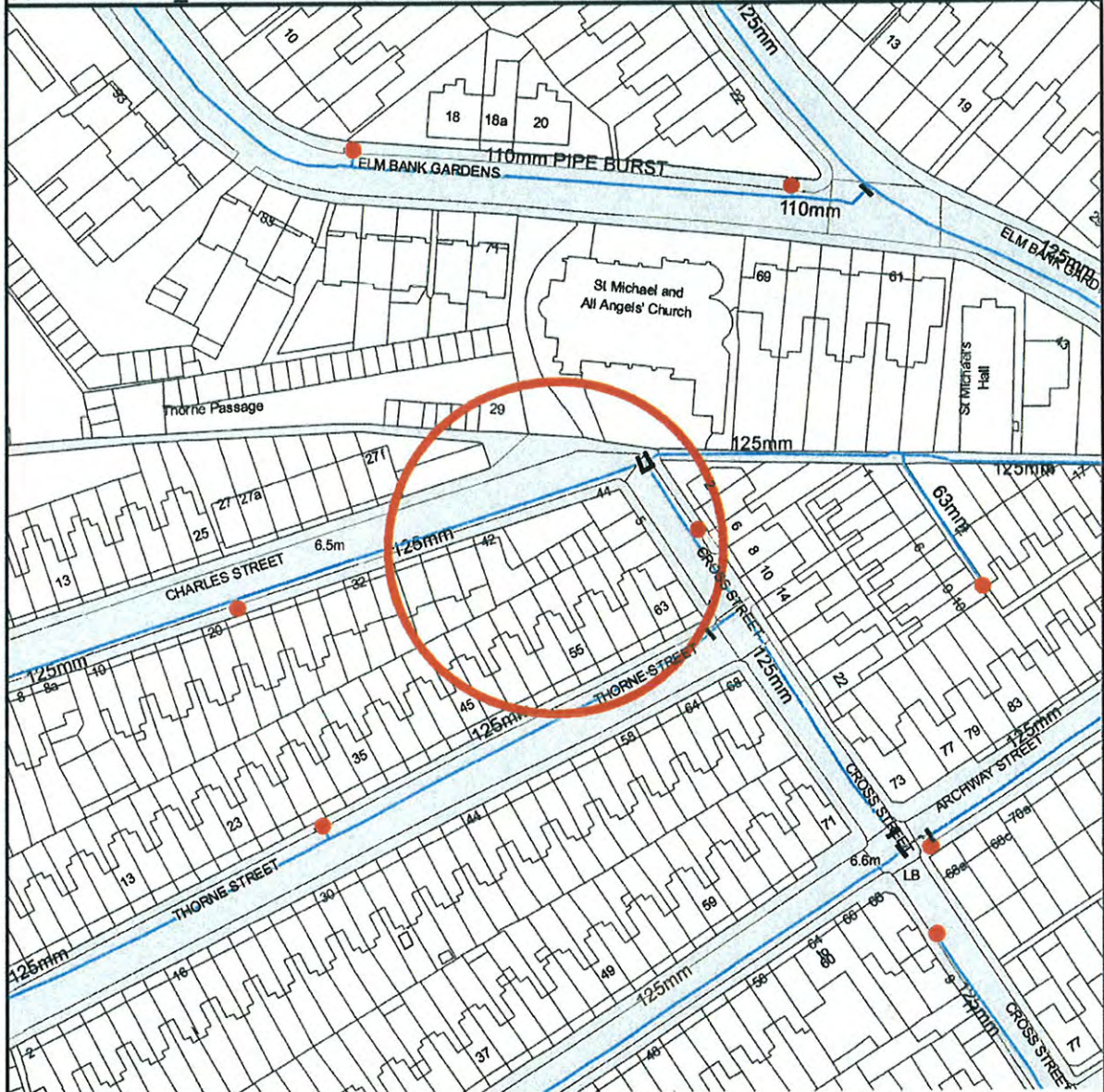
## Other Symbols

	<b>Undefined Ends:</b> These symbols represent the point at which a pipe continues but no records of its position are currently held by Thames Water. These symbols are rare but may be found on any of the public sewer types.
	<b>Public/Private Pumping Station:</b> Foul or Surface water pumping station.

### Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
- 5) 'na' or '0' on a manhole level indicates that data is unavailable.
- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0118 925 1504.

**Residential CON29DW Drainage & Water Search Water Map-DWS/DWS  
Standard/2009 1650645**



The width of the displayed area is 200m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.








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# Residential Drainage & Water Search Water Key





## Public Water Pipes (Operated & Maintained by Thames Water)

- 4"  **Distribution Main:** The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.
- 16"  **Trunk Main:** A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.
- 3" SUPPLY  **Supply Main:** A supply main indicates that the water main is used as a supply for a single property or group of properties.
- 3" FIRE  **Fire Main:** Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.
- 3" METERED  **Metered Pipe:** A metered pipe indicates that the pipe in question supplies water for a single property or group of properties and that the quantity of water passing through the pipe is metered even though there may be no meter symbol shown.
-  **Transmission Tunnel:** A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.
-  **Proposed Main:** A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.



## Depth of Water Pipes (Normal Cover)

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

## Pipe fittings and controls (Operated & Maintained by Thames Water)

-  **Hydrant:** A point on a water main which is used by the fire services or for operational purposes by Thames Water.
-  **Meter:** Used to measure water flowing through a water main for domestic metering or operational purposes by Thames Water.
-  **General Purpose Valve:** Valves allowing control of water flow or pressure within the system.
-  **Air Valve:** A valve which allows the release of trapped air within a water pipe.

## Other Water Pipes (Not Operated or Maintained by Thames Water)

-  **Private Main:** Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and ownership of the pipe.
-  **Other Water Company or Unknown Main:** Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

**Note:**  
Most private pipe work and assets i.e. stopcocks, are not shown on our plans (in the past this information had not been recorded).

**29 CHARLES STREET, BARNES**  
**FLOOD RISK ASSESSMENT**

**APPENDIX 10**

Runoff Calculations

## **Runoff Calculations using the Modified Rational Method**

### **Methodology**

Formula:  $Q_p = 2.78 C_i A$

$Q_p$  = Peak Discharge (l/s)

$C = C_r C_v$  ( $C_r$  - routing coefficient,  $C_v$  - volumetric coefficient)

$i$  = Average Rainfall Intensity (mm/hr)

$A$  = Area (ha)

### **Existing Site Runoff**

#### **Variables**

$C = 1.17$  ( $C_r = 1.3$  and  $C_v = 0.9$ )

$i = 50$  mm/hr

Area = 0.028ha

### **Runoff Calculation**

Area =  $2.78 * 1.17 * 50 * 0.11 = 17.89$  l/s

### **Proposed Site Runoff**

#### **Variables**

$C = 1.17$  ( $C_r = 1.3$  and  $C_v = 0.9$ )

$i = 50$  mm/hr

Area = 0.0786ha

### **Runoff Calculation**

Area =  $2.78 * 1.17 * 50 * 0.079 = 12.78$  l/s

**29 CHARLES STREET, BARNES**  
**FLOOD RISK ASSESSMENT**

**APPENDIX 11**

Glossary of Terms  
NPPF  
FCDPAG Indicative Standards of Protection

## GLOSSARY OF TERMS AND ABBREVIATIONS

Attenuation	Slowing down the rate of flow to prevent flooding and erosion, with a consequent increase in the duration of the flow.
Balancing pond	A pond designed to attenuate flows by storing runoff during peak periods and releasing the water after the flood peak has passed. The pond always contains water. Storage periods may not be long enough to improve water quality.
Catchment	A river catchment is the whole area which drains either naturally or with artificial assistance to a river. It includes the drainage channels, tributaries, floodplains and washlands associated with a river and an estuary where one is present.
Climate Change	Flood risk may increase due to environmental changes, and one of the key uncertainties in assessing flood risk at present is the extent to which climate is changing and may change in the future. NPPF Table 5 advocates a precautionary approach to deal with the uncertainties of how climate change may affect sea levels, river flows and flood risk. Current best practice recommends allowing for a 10% increase in peak rainfall intensity and a 20% increase in peak river flow to 2055. Recommended allowances for net sea level rise in the East of England are 4mm/yr to 2025 and then 8.5mm/yr onwards to 2055.
Critical ordinary watercourse	Ordinary watercourses which the Environment Agency and other operating authorities agree are critical because they have the potential to put large numbers of people and property at risk from flooding.
Design flood level	The flood level to which defences or mitigation measures are designed. This is typically the 1% (1 in 100 year) flood level. More extensive flooding and higher levels due to more extreme conditions than the design event or as a result of obstructions of the watercourse may occur at any time.
Development	In accordance with the definitions given in Section 55 of the Town and Country Planning Act 1990, with certain exceptions development means the carrying out of building, engineering, mining or other operations, in on over or under land or the making of any material change in use of any buildings or other land.
Drainage (land drainage)	The Water Resources Act 1991 (as amended by the Environment Act 1995) defines drainage as including:  a) defence against water, including sea water; b) irrigation other than spray irrigation; c) warping; and d) the carrying on, for any purpose, of any other practice which involves management of the level of water in a watercourse.
Exception Test	If, following application of the Sequential Test (see below), it is not possible for proposed development to be located in zones of lower probability of flooding, the Exception Test can be applied as detailed in the NPPF. For the Exception Test to be passed the Flood Risk Assessment must demonstrate the proposed development provides wider sustainability benefits to the community that outweigh the estimated flood risk.
Flood defence	Flood defence means the drainage of land (as defined above), and the provision of flood warning systems.

Flood Estimation Handbook (FEH)	The primary national guide to flood probability estimation in the UK, developed by CEH Wallingford. The use of the FEH ensures national consistency in estimating the probability of flooding, although users must be aware of the need to exercise good judgment and recognise the uncertainty inherent in flood estimation. Prediction of flood flows is not an exact science and therefore the results of estimation cannot be guaranteed and the user makes use of them at his own risk.
Flood return period/risk	The risk of flooding to floodplain areas and property is often described in terms of a return period. Statistical return periods relate to the long term average time interval between events of a particular magnitude. The 1 in 100 year return period flood has a one percent chance of occurring in any one year, i.e. the odds of it happening are one hundred to one. It does <u>not</u> mean that flooding of this magnitude will only occur once every 100 years.
Flood Zone Maps	These were produced by the Environment Agency after the 1998 and 2000 floods to improve public awareness of flood risk and updated in 2004 alongside the release of the new FRA guidance. The floodplain envelopes indicate where flooding from rivers, streams, watercourses or the sea is possible or has occurred, but ignore the presence of all flood defences such as embankments, pumping stations and walls, although the locations of flood defence structures are indicated. The maps therefore only give a general indication of potential areas at risk of flooding, generally based on either 1% probability assessments or historic flood levels. ( <a href="http://www.environment-agency.gov.uk/subjects/flood/?lang=e">www.environment-agency.gov.uk/subjects/flood/?lang=e</a> )
Flooding	Inundation by river or sea water whether caused by inadequate or slow drainage, or by breaches or overtopping of banks or defences.
Floodplain	All land adjacent to a watercourse over which water flows in times of flood.
Greenfield	Land which has not been developed.
Greenfield rate of runoff	Rate of water flow which would occur over the ground surface of undeveloped land to the drainage system.
Hydrology	The study of water resources
Main River	Watercourses shown as such on the statutory main river maps held by the Department for Environment, Food and Rural Affairs. Main rivers are maintained by the Environment Agency and are generally larger arterial watercourses.
NPPF	National Planning Policy Framework and Technical Guidance published by Communities and Local Government in March 2012. Technical Guidance explains how flood risk should be considered at all stages of the planning and development process in order to reduce future damage to property and loss of life.
Ordinary Watercourses	Any watercourse that does not form part of Main River. Internal Drainage Boards maintain certain designated common watercourses within Internal Drainage Districts. Local Authorities maintain certain 'awarded' common watercourses and highway ditches outside Internal Drainage Districts. Generally, other common watercourses are the responsibility of riparian owners.
PAGN/FCDPAG	The DEFRA Flood and Coastal Defence Project Appraisal Guidance (FCDPAG) documents provide advice on best practice for the appraisal of flood and coastal defence projects. A brief summary of these documents and the applicable standards (tables 6.1 & 6.2) are appended to this glossary.

Riparian	Relating to, or situated on the banks of a river or watercourse.
Runoff	Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable or if permeable ground is saturated.
Sequential test	NPPF advocates that planners use a sequential test when considering land allocations for development to avoid flood risk where possible. Details of this test are summarised in the NPPF.
Soakaway	A subsurface structure into which surface water is conveyed, designed to promote infiltration.
Source Control	The control of runoff at or near its source.
Storage Compensation	Due to the cumulative impacts of developments on the extent and function of the floodplain, the EA may require compensation storage to be provided at a site where a loss of storage in the floodplain occurs, irrespective of the negligible impacts of individual developments. In other words, an area of ground above the floodplain level must be found that can be excavated to compensate for the floodplain storage volume lost by developing the building area. In addition, the EA may insist that compensation is provided on a 'level-for-level' basis, i.e. providing compensation areas at the same level as where storage has been lost, so that there is a minimal impact on the flood patterns in the area.
SuDS	Sustainable Drainage Systems: A strategy, supported by a range of techniques, for dealing with surface water drainage that seeks to promote sustainable and environmentally beneficial or least damaging solutions. Developing a 'greenfield' site can significantly alter the way rainfall runs off the site. Impermeable areas such as tarmac mean that rainwater cannot infiltrate into the ground, and is instead channelled directly into rivers via drains and sewers. Flood risk may therefore be increased by the rapid flow of surface water run-off from developed areas into the watercourse. SuDS were developed initially with urban drainage in mind but the approach has broad application over all development drainage. SuDS techniques include Source Control.
Swale	A grass-lined channel designed to drain water from a site as well as controlling the flow and quality of the surface water.
Watercourse	Any natural or artificial channel which conveys surface water.
Wetland	A pond that has a high proportion of emergent vegetation in relation to open water that provides a variety of habitats.

# NPPF Technical Guidance - The Sequential and Exception Tests

3. As set out in the National Planning Policy Framework, the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. The flood zones (see table 1) are the starting point for this sequential approach. Zones 2 and 3 are shown on the flood map<sup>1</sup> with Flood Zone 1 being all the land falling outside Zones 2 and 3. These flood zones refer to the probability of sea and river flooding only, ignoring the presence of existing defences.
4. Strategic Flood Risk Assessments (see paragraphs 7-8) refine information on the probability of flooding, taking other sources of flooding and the impacts of climate change (see paragraphs 11-15) into account. They provide the basis for applying the Sequential Test, on the basis of the flood zones in table 1. Where table 1 indicates the need to apply the Exception Test (as set out in the National Planning Policy Framework), the scope of a Strategic Flood Risk Assessment will be widened to consider the impact of the flood risk management infrastructure on the frequency, impact, speed of onset, depth and velocity of flooding within the flood zones considering a range of flood risk management maintenance scenarios. Where a Strategic Flood Risk Assessment is not available, the Sequential Test will be based on the Environment Agency flood zones.
5. The overall aim should be to steer new development to Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, local planning authorities allocating land in local plans or determining planning applications for development at any particular location should take into account the flood risk vulnerability of land uses (see table 2) and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required (see table 3). Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

<sup>1</sup> To access the flood map, see the Environment Agency's website at:  
<http://www.environment-agency.gov.uk/homeandleisure/floods/default.aspx>



## Table 1: Flood zones

(Note: These flood zones refer to the probability of river and sea flooding, ignoring the presence of defences)

### Zone 1 - low probability

#### Definition

This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).

#### Appropriate uses

All uses of land are appropriate in this zone.

#### Flood risk assessment requirements

For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention.

#### Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems<sup>2</sup>.

<sup>2</sup> Sustainable drainage systems cover the whole range of sustainable approaches to surface drainage management. They are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible.

### Zone 2 - medium probability

#### Definition

This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

#### Appropriate uses

Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are *only* appropriate in this zone if the Exception Test is passed.

#### Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

#### Policy aims

In this zone, developers and local authorities should seek opportunities to reduce

the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.

### **Zone 3a - high probability**

#### **Definition**

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

#### **Appropriate uses**

The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone.

The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

#### **Flood risk assessment requirements**

All development proposals in this zone should be accompanied by a flood risk assessment.

#### **Policy aims**

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

### **Zone 3b - the functional floodplain**

#### **Definition**

This zone comprises land where water *has* to flow or be stored in times of flood.

Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

**Appropriate uses**

Only the water-compatible uses and the essential infrastructure listed in table 2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

**Flood risk assessment requirements**

All development proposals in this zone should be accompanied by a flood risk assessment.

**Policy aims**

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land with a lower probability of flooding.

**Table 2: Flood risk vulnerability classification**

<p><b>Essential infrastructure</b></p> <ul style="list-style-type: none"><li>• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.</li><li>• Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.</li><li>• Wind turbines.</li></ul>
<p><b>Highly vulnerable</b></p> <ul style="list-style-type: none"><li>• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.</li><li>• Emergency dispersal points.</li><li>• Basement dwellings.</li><li>• Caravans, mobile homes and park homes intended for permanent residential use<sup>3</sup>.</li><li>• Installations requiring hazardous substances consent<sup>4</sup>. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”)<sup>5</sup>.</li></ul>
<p><b>More vulnerable</b></p> <ul style="list-style-type: none"><li>• Hospitals.</li><li>• Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels.</li><li>• Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.</li><li>• Non–residential uses for health services, nurseries and educational establishments.</li><li>• Landfill and sites used for waste management facilities for hazardous waste<sup>6</sup>.</li><li>• Sites used for holiday or short-let caravans and camping, <i>subject to a specific warning and evacuation plan.</i><sup>7</sup></li></ul>
<p><b>Less vulnerable</b></p> <ul style="list-style-type: none"><li>• Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding.</li><li>• Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in “more vulnerable”, and assembly and leisure.</li><li>• Land and buildings used for agriculture and forestry.</li><li>• Waste treatment (except landfill and hazardous waste facilities).</li><li>• Minerals working and processing (except for sand and gravel working).</li><li>• Water treatment works which do <i>not</i> need to remain operational during times of flood.</li><li>• Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).</li></ul>

### **Water-compatible development**

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, *subject to a specific warning and evacuation plan.*

<sup>3</sup> For any proposal involving a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site, the Sequential and Exception Tests should be applied.

<sup>4</sup> See Circular 04/00: *Planning controls for hazardous substances* (paragraph 18) at: [www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols](http://www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols)

<sup>5</sup> In considering any development proposal for such an installation, local planning authorities should have regard to planning policy on pollution in the National Planning Policy Framework.

<sup>6</sup> For definition, see *Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10* at

[www.communities.gov.uk/publications/planningandbuilding/planningsustainable](http://www.communities.gov.uk/publications/planningandbuilding/planningsustainable)

<sup>7</sup> See footnote 3.

<sup>8</sup> See website for further details.

[www.defra.gov.uk/science/ProjectData/DocumentLibrary/FD23203364TRP.pdf](http://www.defra.gov.uk/science/ProjectData/DocumentLibrary/FD23203364TRP.pdf)

### **Notes to table 2:**

a. This classification is based partly on Department for Environment, Food and Rural Affairs and Environment Agency research on *Flood Risks to People (FD2321/TR2)*<sup>8</sup> and also on the need of some uses to keep functioning during flooding.

b. Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

c. The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

## FCDPAG INDICATIVE STANDARDS OF PROTECTION

The DEFRA Flood and Coastal Defence Project Appraisal Guidance (FCDPAG) documents provide advice on best practice for the appraisal of flood and coastal defence projects. Volume 3: Economic Appraisal gives indicative standards for flood and coastal defence in England and Wales. The tables below are provided “as an aid to authorities to help in establishing the range of options to be considered, though they should not constrain the need to consider a full range of alternatives. They do not represent any entitlement to protection or minimum level to be achieved”. Please refer to the FCDPAG documents at <http://www.defra.gov.uk/enviro/fcd/pubs/pagn/default.htm> for further information.

**Table 6.1 Indicative standards of protection**

<b>Land use band</b>	<b>Indicative standards of protection</b>			
	<b>Fluvial</b>		<b>Coastal</b>	
	<b>Return period (years)</b>	<b>Annual probability of failure</b>	<b>Return period (years)</b>	<b>Annual probability of failure</b>
A	50-200	0.005-0.02	100-300	0.003-0.01
B	25-100	0.01-0.04	50-200	0.005-0.02
C	5-50	0.02-0.20	10-100	0.01-0.10
D	1.25-10	0.10-0.80	2.5-20	0.05-0.40
E	<2.5	>0.40	<5	>0.20

The standards shown in Table 6.1 are determined by land use bands, as defined in Table 6.2 below.

**Table 6.2 Description of Land Use Bands**

<b>Land use band</b>	<b>Indicative range of housing units (or equivalent) per km of coastline or single river bank</b>	<b>Description</b>
A	>=50	Typically intensively developed urban areas at risk from flooding and/or erosion
B	>=25 to <50	Typically less intensive urban areas with some high-grade agricultural land and/or environmental assets of international importance requiring protection.
C	>=5 to <25	Typically large areas of high-grade agricultural land and/or environmental assets of national significance requiring protection with some properties also at risk, including caravans and temporary structures.
D	>=1.25 to <5	Typically mixed agricultural land with occasional, often agriculturally related, properties at risk. Agricultural land may be prone to flooding, water logging or coastal erosion. May also apply to environmental assets of local significance.
E	>0 to <1.25	Typically low-grade agricultural land, often grass, at risk from flooding, impeded land drainage or coastal erosion, with isolated agricultural or seasonally occupied properties at risk, or environmental assets at little risk from frequent inundation.