Appendix G-1: Flood Risk Assessment

The Civil Engineering Practice
11 Tungsten Building
George Street
Fishersgate
Sussex
BN41 1RA

T. 01273 424 424
F. 01273 424 425
E. design@civil.co.uk
www.civil.co.uk

Flood Risk Assessment

Proposed development at

Twickenham Railway Station
Twickenham, London

On behalf of

Solum Regeneration

February 2011

CONTENTS

1 Non Technical Summary

1.1 This Flood Risk Assessment has been undertaken in accordance with Planning Policy Statement 25 (PPS25) in respect of the proposed development at Twickenham Railway Station, Twickenham, London on behalf of Solum Regeneration.

1.2 The scheme comprises a new improved transport interchange with a predominantly residential development above, amounting to 115 residential units. In addition, retail or leisure units (Use Class A1, A3 or D2) are proposed fronting London Road and the new station plaza. These uses are envisaged to be ancillary to the station use and residential development above and could include a small supermarket, kiosk, cafes, gym and / or family restaurants.

1.3 Planning Policy Statement 25 (PPS25) 'Development and Flood Risk' requires that the Sequential Test be applied initially to a development application which indicates a possibility of flooding and is followed by the Exception Test if necessary.

1.4 The Sequential Test has been applied to the development and passed. There is no requirement for the Exception Test to be applied in this case.

1.5 The Environment Agency and Thames Water have been consulted in respect of historic flooding in the vicinity of the site, both of whom have confirmed that they hold no records of any incidences of flooding in the area.

1.6 The Environment Agency's current modelled flood map is based on 2008 modelling data and confirms that the site is within Flood Zone 1 with less than a 1:1000 chance of tidal or fluvial flooding in any year even in the event of the total failure of the existing flood defences on the River Crane and the River Thames.

1.7 Flood levels for a range of predicted flood events have been confirmed by the Environment Agency with the present day 1:100 year event predicted to reach a level of 7.308m AOD rising to 7.347m AOD in future years as a result of the predicted effects of climate change.

2 Existing Site

2.1 Site Location

2.1.1 The development site is located at Twickenham Railway Station on the south side of the main railway line that connects London Waterloo to Reading. The site is immediately to the south of the River Crane and approximately 550m to the northwest of the River Thames and located to the east of the A310 London Road at postcode TW1 1BD, Ordnance Survey reference TQ161736.

2.1.2 The site is bounded by residential dwellings to the southeast and the A310 London Road to the south and west.

2.1.3 A copy of the site location plan is located in Appendix 1 at the rear of this report.

2.2 Site Description

2.2.1 The site is approximately 6,540m^2 in area, approximately 5,000m^2 of which is impermeable.

2.2.2 Site levels vary between approximately 8m and 10.5m AOD.

2.2.3 Vehicular and pedestrian access to the site is available from the A310 London Road along the southwest site boundary.

2.2.4 A copy of the existing site layout plan is located in Appendix 2 at the rear of this report.

2.3 Drainage

2.3.1 Initial investigations suggest that surface water from the site is positively drained to the 225mm diameter public sewer in Beauchamp Road to the south east of the site.

2.3.2 Correspondence is attached in Appendix 3 confirming that Thames Water is in agreement in principle to a 'like for like' discharge from the site which based on a 50mm/hour rainfall across the current impermeable area of the site is equivalent to approximately 70l/s.

2.3.3 The actually capacity of the 225mm diameter sewer is likely to be far less than 70l/s and at a self cleansing gradient of approximately 1:200 a maximum discharge of 30l/s is likely.

2.3.4 Foul drainage from the site is discharged to the existing 375mm diameter public foul sewer beneath the A310 London Road at the northwest corner of the site.

3 Flood History and Flooding Potential

3.1 Flood History

3.1.1 The Environment Agency and Thames Water have been consulted in respect of historic flooding. Neither hold any records of flooding at the site.

3.1.2 A copy of the Environment Agency's Flood Maps and correspondence, Thames Water correspondence and extracts of the Strategic Flood Risk Assessment are located in Appendix 3 at the rear of this report.

3.2 Flood Defences

3.2.1 There are flood defences on both sides of the River Crane at the northern site boundary in the form of 1.5m high channel walls providing protection to the wider area against 1:100 year fluvial flood event.

3.2.2 There are flood defences on both sides of the River Thames to the south of the site in the form of man made earth banks and 1.5m high channel walls providing protection to the wider area against 1:50 year fluvial flood event.

3.3 Flood Zone

3.3.1 The Stage 1 Strategic Flood Risk Assessment dated June 2008 prepared by Jacobs for the London Borough of Richmond Upon Thames based on the Environment Agency's mapping data from 2007 suggests that the development site is located within Flood Zone 3a.

3.3.2 The Environment Agency's current modelled flood map is based on 2008 modelling data and confirms that the site is within Flood Zone 1 with less than a 1:1000 chance of tidal or fluvial flooding in any year even in the event of the total failure of the existing flood defences on the River Crane and the River Thames.

3.3.3 Flood levels for a range of predicted flood events have been confirmed by the Environment Agency with the present day 1:100 year event predicted to reach a level of 7.308m AOD rising to 7.347m AOD in future years as a result of the predicted effects of climate change.

3.4 Flooding Potential

3.4.1 The site is located at a level of between approximately 8m and 10.5m AOD approximately 650mm above the estimated level of a predicted future year 1:100 year flood event.

3.4.2 The site is not at risk of flooding from such an event and safe dry access would be available throughout its duration.

4 Proposed Development

4.1 Description

4.1.1 The scheme comprises a new improved transport interchange with a predominantly residential development above, amounting to 115 residential units. In addition, retail or leisure units (Use Class A1, A3 or D2) are proposed fronting London Road and the new station plaza. These uses are envisaged to be ancillary to the station use and residential development above and could include a small supermarket, kiosk, cafes, gym and / or family restaurants

4.1.2 The development proposals are for the construction of four to seven storey buildings with a combined footprint of approximately 3,190m^2 to replace the existing station building.

4.1.3 Undercroft car parking will be provided at existing site ground levels between 8 and 9m AOD. The station facilities and a part of the residential elements will be at a level of approximately 12m AOD which is the approximate level of the A310 London Road with the remaining residential dwellings on the floors above.

4.1.4 The entire impermeable area of the redeveloped site will be approximately 5,900m^2.

4.1.5 Vehicular access to the site will remain as existing with access from the A310 London Road at a level of approximately 10.5m AOD.

4.1.6 A copy of the proposed site layout plan is located in Appendix 4 at the rear of this report.

4.2 Sustainable Drainage Strategy

4.2.1 The surface water from the site will discharge to the 225mm diameter public sewer in Beauchamp Road to the south east of the site using the existing private on site drainage connection.

4.2.2 In order to retain the current rate of discharge to the existing surface water drainage system during normal storm events, whilst providing additional protection to the site for more intense storms and a benefit to the wider area it is proposed that the surface water discharge from the site will be restricted to the existing maximum of 30l/s and on site storage provided to accommodate the volume of water experienced on storms of

up to a 1:100 year intensity including a 30% increase to account for the predicted effects of future climate change.

4.2.3 Preliminary calculations are located in Appendix 5 at the rear of this assessment and confirm a maximum volume of storage of approximately 94m^3 will be required to accommodate the additional water generated by a present day 1:100 year pluvial event, 123m^3 including an additional 30% to account for the anticipated future effects of climate change.

4.2.4 The exact nature of the on site SUDS storage facilities will be confirmed during detailed design and may include voided sub bases to external works, oversized pipes, below ground storage tanks or a combination thereof.

4.2.5 A new foul drainage connection will be required to the public foul sewer beneath the A310 London Road at the west of the site.

4.2.6 Solum Regeneration commissioned a capacity check of the existing sewers in 2010 and Thames Water confirmed that there was sufficient capacity within the network to accommodate the existing surface water flow and the foul water flows from the proposed development.

4.2.7 The results and confirmation from Thames Water are located in Appendix 3 at the rear of this report.

5 The Sequential and Exception Tests

5.1 Introduction

5.1.1 The Sequential Approach is a risk based approach outlined within Planning Policy Statement 25 – Development and Flood Risk to be adopted at all levels of planning.

5.2 Application

5.2.1 Work on the Local Development Framework for The London Borough of Richmond Upon Thames is underway but at present the Site Allocations DPD has not been started. Currently the first submission is planned for November 2011 with adoption anticipated in July 2012.

5.2.2 The Unitary Development Plan first adopted in March 2005 is still in use. The Saved Policy Areas are included on the London Borough of Richmond Upon Thames' current on line proposals map.

5.2.3 The development site is listed as Saved Policy Area T17 Twickenham Railway Station.

5.2.4 Saved Policy T17 is ***"to improve interchange facilities and provide a mix of town centre uses to take advantage of the high level of public transport accessibility and to maximise benefits to the town centre."***

5.2.5 The Policy confirms that the site has been considered sequentially noting that ***"the site has potential for a mix of town centre uses including business, leisure and residential."***

5.2.6 PPS25 identifies the nature of the development proposals as more vulnerable and as appropriate in Flood Zones 1 and 2 without application of the Exception Test.

6 Safe Development

6.1 Safe Access

6.1.1 The site is located outside the predicted extent of a future year 1:100 year fluvial event affecting the River Crane and the River Thames at a level of 7.347m AOD with a minimum freeboard of approximately 650mm at the lowest part of the site and over 3m at the vehicular access to the A310 London Road.

6.1.2 Safe dry access to and from the site would remain available to pedestrians and vehicles throughout the duration of such an event.

7 Conclusions

7.1 Neither the Environment Agency nor Thames Water hold any record of flooding in the area.

7.2 The site is located within Flood Zone 1 a minimum of approximately 650mm above the level of a 1 in 100 year return period fluvial flood event including the predicted effects of climate change.

7.3 The Sequential Test has been applied to the development site by the London Borough of Richmond Upon Thames. The development proposals accord with Saved Policy T17 of the Council's Unitary Development Plan and the Sequential Test has been passed.

7.4 The Environment Agency's Modelled Flood Extent Map confirms that safe dry access will be available throughout the duration of a 1:1000 return period fluvial event.

7.5 The proposed new onsite surface water drainage system will be designed to restrict flows to the current 30l/s maximum and the volume of water generated by a 1:100 year duration pluvial event across the increased impermeable area of the site, including an allowance for future climate change, will be stored on site providing a benefit to the wider community over the existing situation.

7.6 Foul drainage will be discharged to the existing public foul sewer beneath the A310 London Road at the west of the site

7.7 The proposed residential uses are classified by Planning Policy Statement 25 as more vulnerable and deemed acceptable in Flood Zones 1 and 2 subject to passing the Sequential Test and in Flood Zone 3a subject to passing the Exception Test. The retail use is classified as less vulnerable and deemed acceptable in Flood Zones 1, 2 and 3a subject to passing the Sequential Test only.

8 List of Appendices

Appendix 1	Site Location Plan
Appendix 2	Existing Site Layout Plan
Appendix 3	Correspondence from the Environment Agency, Thames Water and extracts from the Strategic Flood Risk Assessment
Appendix 4	Proposed Site Layout Plan
Appendix 5	Preliminary Drainage Calculations

Appendix 1
Site Location Plan

TITLE: Site Location Plan

SCALE: 1:12,500

DRG No: 1

Appendix 2
Existing Site Layout Plan

the civil engineering practice

N

MARCH ROAD

A310 LONDON ROAD

B361 WHITTON ROAD

COLE PARK ROAD

RIVER CRANE

A310 LONDON ROAD

TWICKENHAM RAILWAY STATION

STATION YARD

-10m 0 10m 20m 30m 40m

Scale 1:1000

TITLE

Existing Site Layout Plan

SCALE 1:1000

DRG No 2

Appendix 3

Correspondence from the Environment Agency, Thames Water and extracts from the Strategic Flood Risk Assessment

Environment Agency

Paul Reynolds
The Civil Engineering Practice
By email
paul@civil.co.uk

Our ref: NE22334/AS

Date: 5 January 2010

Dear Mr Reynolds

Provision of Product name 4 for FRA at site in Twickenham, postcode TW1 3QB (NGR TQ 1610073500)

Thank you for your request of 2 December 2009 to use Environment Agency data, Product 4, in the development of the FRA at Twickenham, postcode TW1 3QB. The information is attached.

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
We have not provided TUFLOW level maps as they are not relevant to the site

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

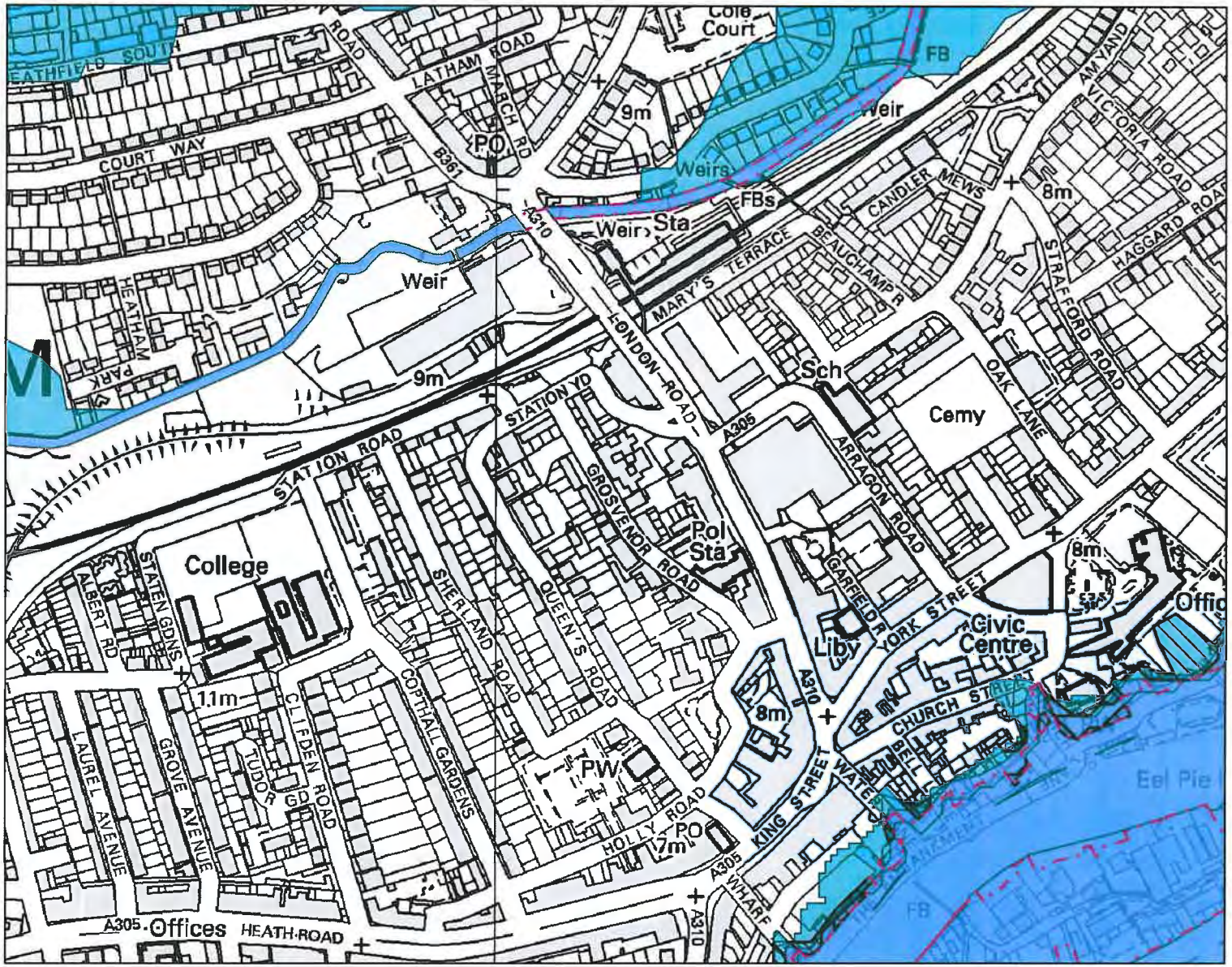
If you have any queries or would like to discuss the content of this letter further please contact me.

Yours faithfully

Annette Smith
External Relations Officer
Direct dial 01707 632301
Direct fax 01707 632 610
Direct email thnortheast@environment-agency.gov.uk

Enc. Flood Map / Detailed FRA/FCA Map / Standard Notice (Commercial)

Flood map centred on postcode TW1 3QB - created on 5 January 2010 NE22334/AS



Environment Agency

Scale 1:4,917

N W E S

- Flood Map - Defences
- Areas Benefiting from Flood Defences
- Flood Map - Flood Storage Areas
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2

Flood Likelihood
(taking into account defences)

Low: The chance of flooding each year is 0.5% (1 in 200) or less.

Moderate: The chance of flooding each year is 1.3% (1 in 75) or less, but greater than 0.5% (1 in 200).

Significant: The chance of flooding each year is greater than 1.3% (1 in 75).

Outside Blue Areas: Generally this means that the chance of flooding each year from rivers or the sea is less that 0.1% (1 in 1000).

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 happening each year
- or from a river with a 1 in 100 or greater chance of happening 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.

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

Environment Agency ref: NE22334AS

The following information on defences has been extracted from the National Flood and Coastal Defence Database (NFCDD)

Map ID	Asset Reference	Asset Type	Asset Protection	Asset Comment	Asset Description	Asset Location	Data Owner	Design Standard of protection (years)	Grid Reference
1	0623636CR0104R02	maintained channel	fluvial	Cast insitu concrete lined channel with 1.5m high walls and lined channel bed.	Lined channel.	Twickenham	Environment Agency	50	TQ1602473713
2	0623636CR0104L02	maintained channel	fluvial	Cast insitu concrete lined channel with 1.5m high walls and lined channel bed.	Lined channel.	Twickenham	Environment Agency	50	TQ1601573725
3	0623636CR0103R02	raised defence (man-made)	fluvial	Channel is lined with a concrete wall. 1.5m high from top to base, raised 0.3m above surrounding ground level. Levels taken from a survey by Halcrow Geomatics in March 2006. Ref: HG5252. Part River Crane F.A.S.	Cole Park RB Channel	D/S of London Roa	Environment Agency	100	TQ1634374439
4	0623636CR0103L02	raised defence (man-made)	fluvial	Channel lined with concrete wall. 1.5m high top to base, raised 0.3m above ground level D/S from Moor Mead Ground. Steel access ladders and chains attached. Levels taken from a survey by Halcrow Geomatics in 2006. Ref: HG5252. River Crane F.A.S.	Cole Park LB channel	D/S of London Roa	Environment Agency	100	TQ1633174437

Environment Agency ref: NE22334AS

The following information has been extracted from the River Crane Mapping Study (Halcrow 2008)

Caution:
The modelled flood levels and extents are appropriate for catchment wide strategic flood risk mapping. However, for more detailed flood risk assessment it is recommended that each of the underlying flood mapping, hydraulic modelling and hydrological assumptions are re-evaluated to determine the appropriateness in a more detailed analysis.

All flood levels are given in metres Above Ordnance Datum (mAOD)
All flows are given in cubic metres per second (cumecs)

MODELLED FLOOD LEVEL

			Return Period					
Node Label	Easting	Northing	5 yr	20 yr	50 yr	100 yr	100yr + 20%	1000yr
C523	515862	173672	7.604	7.679	7.704	7.728	7.763	7.957
C522	515936	173692	7.449	7.531	7.559	7.584	7.623	7.843
C522d	515936	173692	7.449	7.531	7.559	7.584	7.623	7.843
C521	516025	173713	7.558	7.648	7.678	7.706	7.748	7.977
C520	516045	173724	7.546	7.635	7.665	7.693	7.735	7.957
C519u	516053	173724	7.399	7.484	7.513	7.539	7.579	7.779
C519d	516053	173724	7.291	7.374	7.401	7.427	7.466	7.651
C518u	516144	173731	7.166	7.252	7.281	7.308	7.347	7.529
C518d	516144	173731	7.053	7.137	7.165	7.191	7.23	7.394
C517	516197	173751	7.111	7.199	7.229	7.257	7.298	7.487
C517d	516197	173751	7.111	7.199	7.229	7.257	7.298	7.482
C516u	516237	173773	7.005	7.09	7.119	7.145	7.184	7.364
C516d	516237	173773	6.909	6.991	7.018	7.044	7.082	7.25

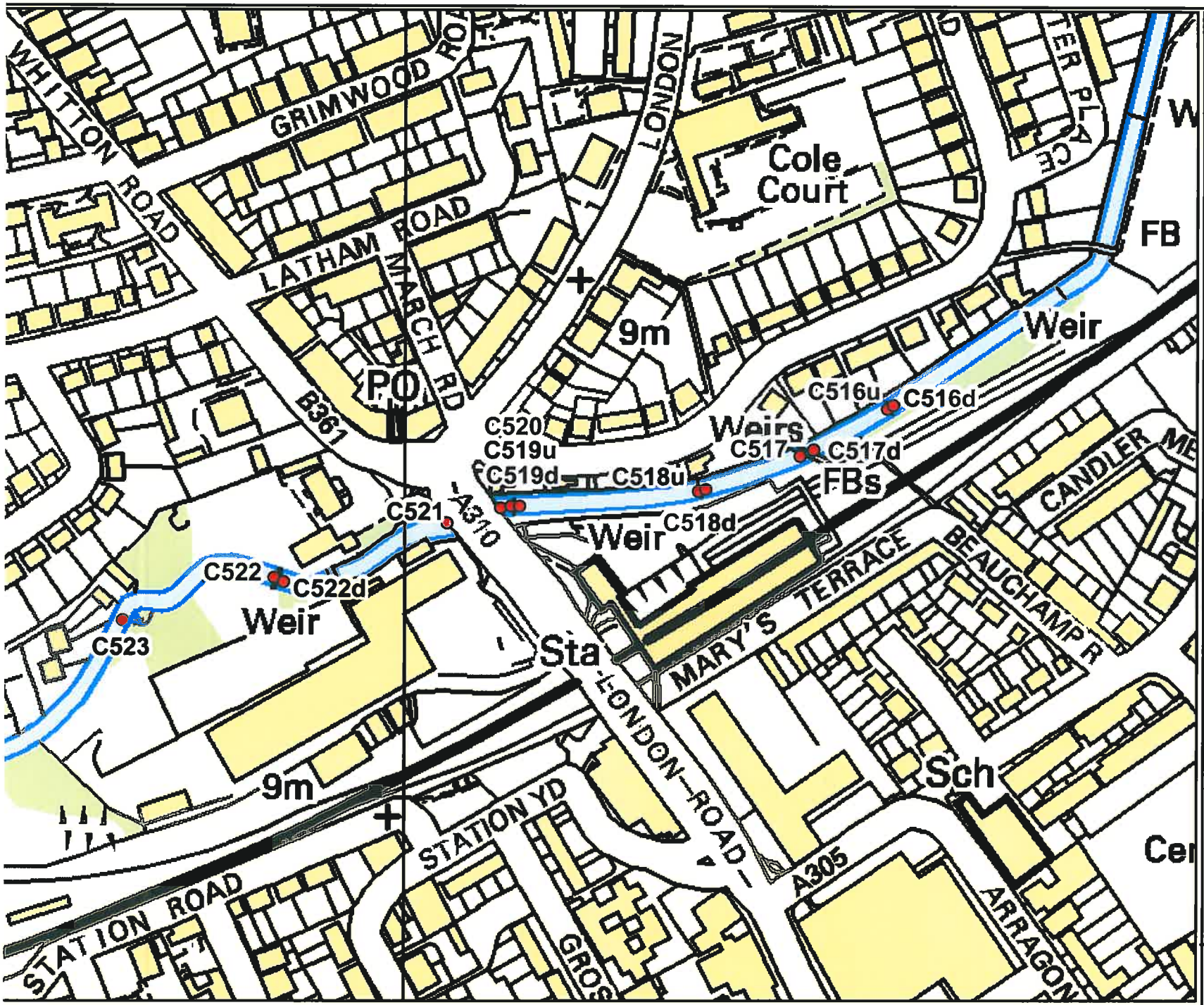
MODELLED FLOWS

			Return Period					
Node Label	Easting	Northing	5 yr	20 yr	50 yr	100 yr	100yr + 20%	1000yr
C523	515862	173672	24.113	26.035	26.677	27.273	28.149	32.456
C522	515936	173692	24.113	26.036	26.677	27.273	28.149	32.459
C522d	515936	173692	24.113	26.036	26.677	27.273	28.149	32.459
C521	516025	173713	24.113	26.036	26.678	27.273	28.15	32.472
C520	516045	173724	24.159	26.053	26.693	27.291	28.193	34.138
C519u	516053	173724	24.159	26.053	26.693	27.291	28.193	34.123
C519d	516053	173724	24.159	26.053	26.693	27.291	28.193	34.123
C518u	516144	173731	24.159	26.053	26.693	27.291	28.193	34.072
C518d	516144	173731	24.159	26.053	26.693	27.291	28.193	34.072
C517	516197	173751	24.159	26.053	26.693	27.29	28.193	34.077
C517d	516197	173751	24.159	26.053	26.693	27.29	28.193	34.077
C516u	516237	173773	24.159	26.053	26.693	27.29	28.193	33.432
C516d	516237	173773	24.159	26.053	26.693	27.29	28.193	33.432

FLOOD HISTORY

No History of Flooding

FRA/FCA Map centred on 70 London Road, Twickenham, London, TW1 3QB, TQ 161 735, created 17th December 2009, NE22334AS



Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

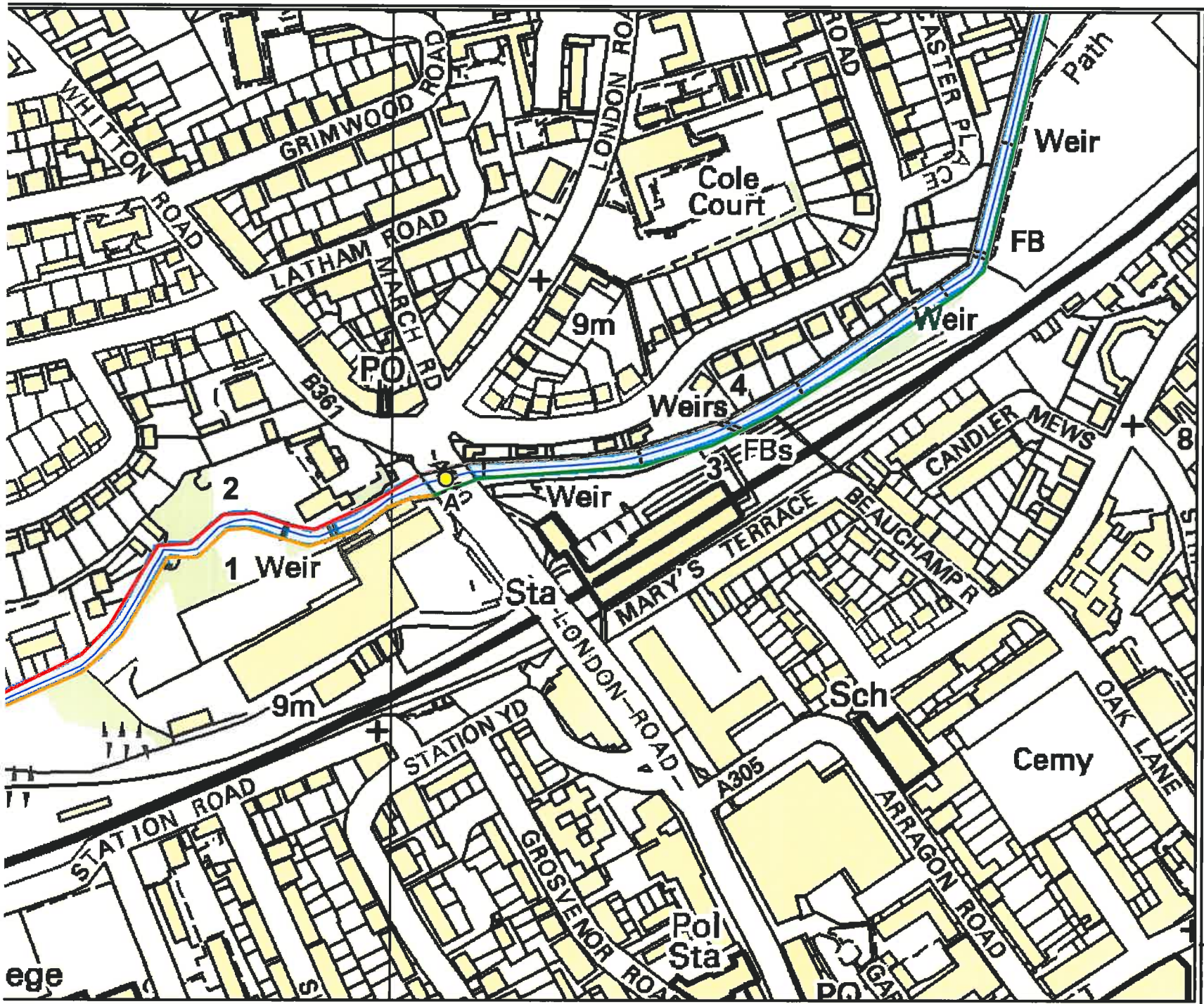
0 25 50 100
Metres

Legend

- NE22334_1D_Levels

Produced by:
Flood Risk Mapping & Data Management
Thames Region (North East Area)

FRA/FCA Map centred on 70 London Road, Twickenham, London, TW1 3QB, TQ 161 735, created 17th December 2009, NE22334AS



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Environment Agency

Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

0 25 50 100
Metres

Legend

- Main River
- NFCDD Structures

NFCDD Defences

- 1
- 2
- 3
- 4

Produced by:
Flood Risk Mapping & Data Management
Thames Region (North East Area)

The Civil Engineering Practice

Paul Reynolds
11 Tungsten Building
George Street
Fishersgate
West Sussex
BN41 1RA

Thames Water Utilities Ltd

Your ref No Ref
Our ref MW
Name Matthew Wood

Date 11/12/09

Development at Twickenham, TW1 3QB

Dear Sir or Madam

I refer to your letter, requesting information in relation to sewer flooding for the above premises. The records held by Thames Water indicate there have been no incidents of flooding as a result of surcharging of public sewers in the vicinity of the above.

Although Thames Water does not have records of public sewer flooding within the vicinity, please be aware that property owners are not legally obliged to report this flooding to Thames Water. In addition flooding from private sewers, watercourses and highways drains are not the responsibility of Thames Water, and such incidents may not be noted in our records. We therefore strongly advise you to contact the current owners and occupiers of the premises and inquire about sewer flooding.

You should also note that sewer surcharging is directly affected by duration and intensity of rainfall. Future changes in rainfall patterns might therefore lead to increased surcharging of sewers, which might not be reflected in our records of previous sewer flooding events.

Yours faithfully

Matthew Wood
Technical Information

Thames Water Utilities Ltd
Reading Mailroom
Reading Bridge House
Reading Bridge
Reading
RG1 8PR

Asset Location Search

Paul Reynolds
The Civil Engineering Practice
11 Tungsten Building
George Street
FISHERSGATE
BN41 1RA

Search address supplied 70
London Road
Twickenham
TW1 3QB

Your reference N/A

Our reference ALS/ALS Standard/2010_1685062

Search date 7 January 2010

Credit card payments are available. Please phone 01189 251509

Thames Water Utilities Ltd

Property Insight
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.twpropertyinsight.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Search address supplied: 70, London Road, Twickenham, TW1 3QB

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

This search provides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0118 925 1504, or use the address below:

Thames Water Utilities Ltd
Property Insight
PO Box 3189
Slough
SL1 4WW

Tel: 0118 925 1504
Fax: 0118 923 6657

Email: searches@thameswater.co.uk
Web: www.twpropertyinsight.co.uk

Thames Water Utilities Ltd

Property Insight
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.twpropertyinsight.co.uk

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Sewers indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended that these details are checked with the developer.

Thames Water Utilities Ltd

Property Insight
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.twpropertyinsight.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0845 920 0800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

An invoice is enclosed. Please send remittance to Thames Water Utilities Ltd., PO Box 223, Swindon, SN38 2TW.

Thames Water Utilities Ltd

Property Insight
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.twpropertyinsight.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clear Water Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Fax: 0118 923 6613
Email: developer.services@thameswater.co.uk

Should you require any further information regarding budget estimates, diversions or stopping up notices then please contact:

DevCon Team
Asset Investment
Thames Water
Maple Lodge STW
Denham Way
Rickmansworth
Hertfordshire
WD3 9SQ

Tel: 01923 898 072
Fax: 01923 898 106
Email: devcon.team@thameswater.co.uk

Thames Water Utilities Ltd

Property Insight
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.twpropertyinsight.co.uk

Asset Location Search

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact our Kew Service Desk by writing to:

Clean Water Design
Thames Water Utilities
1 Kew Bridge Road
Brentford
Middlesex
TW8 0EF

Tel: 0845 850 2777
Fax: 0208 213 8833
Email: developer.services@thameswater.co.uk

Thames Water Utilities Ltd

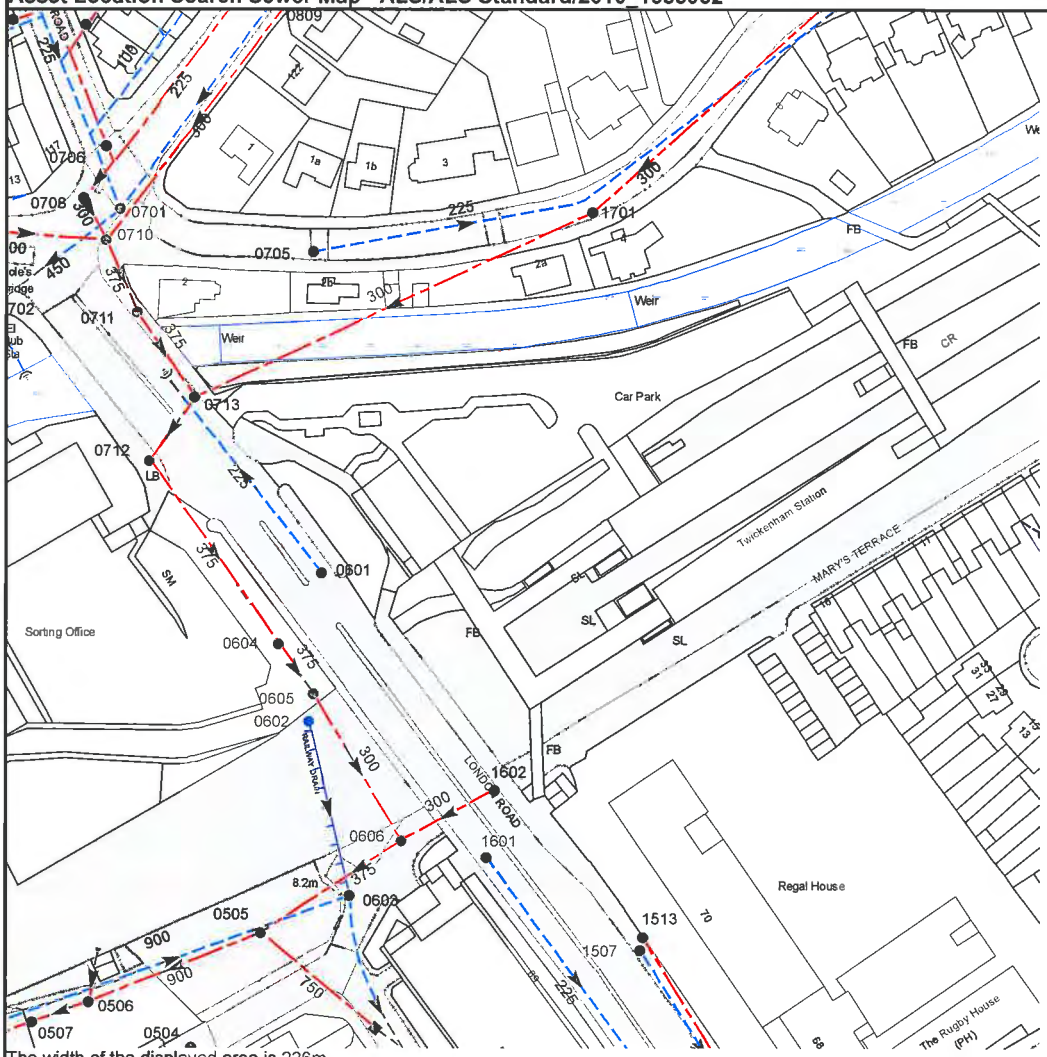
Property Insight
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.twpropertyinsight.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search Sewer Map - ALS/ALS Standard/2010_1685062



The width of the displayed area is 226m

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. Stationery Office, License no. WU298557 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0507	8.2	.66
07ZY	n/a	n/a
0602	7.53	5.85
0605	7.82	3.36
0604	8.42	3.44
0601	12.12	9.55
0705	7.9	6.41
1507	10.87	7.37
1513	10.99	7.13
1701	7.3	4.13
0505	8.11	.73
0603	8.09	5.76
0712	10.76	3.72
0713	10.2	3.85
0711	9.39	4
0708	8.37	4.22
07ZP	n/a	n/a
0506	7.95	5.58
0706	8.22	4.85
0710	8.67	4.17
0701	8.35	5.82
1601	9.65	7.13
1602	8.34	3.69
-	-	-
0606	8.15	3.14

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

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

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

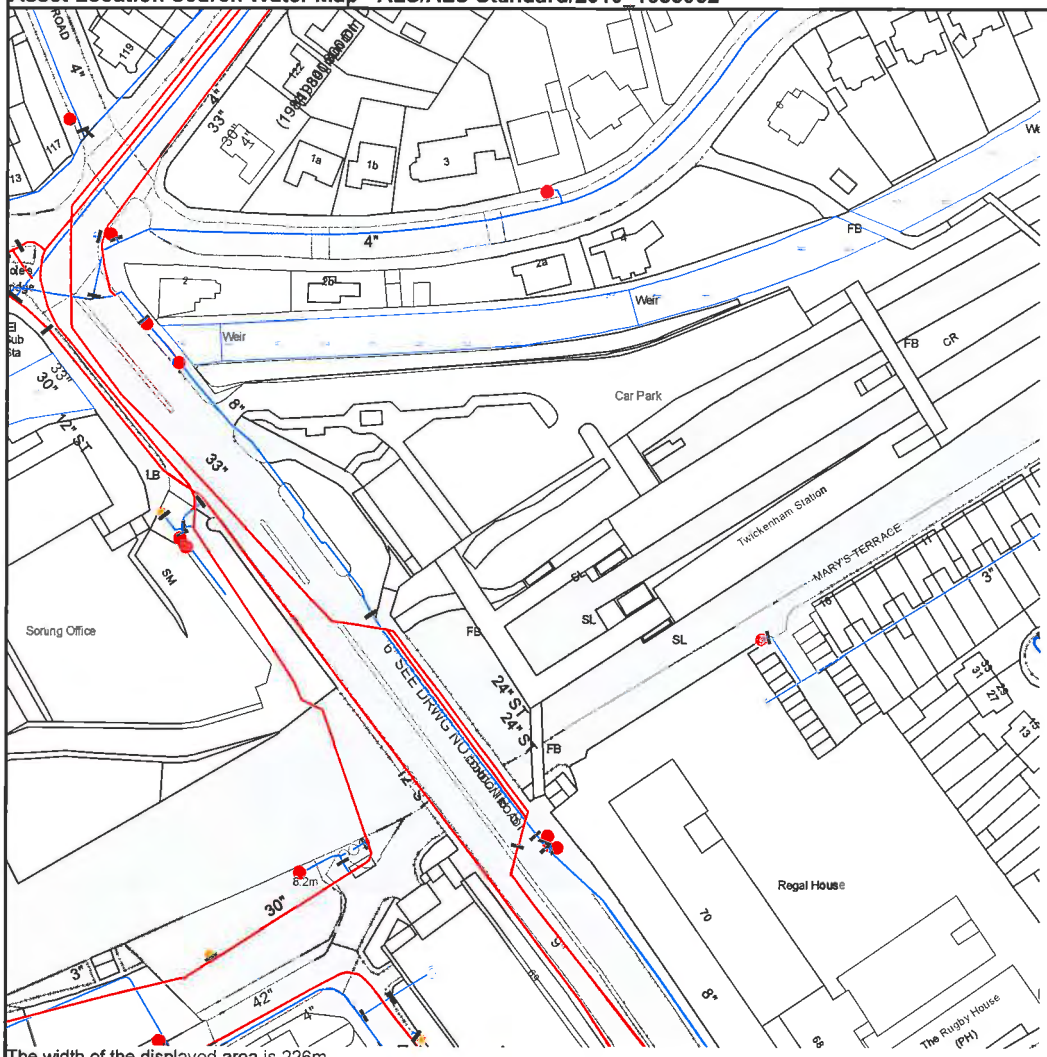
Proposed

Abandoned Sewer

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 milimetres. 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.

Asset Location Search Water Map - ALS/ALS Standard/2010_1685062



The width of the displayed area is 226m

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.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

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.

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that 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.

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')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

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

Other Water Company 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.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (TW.cashoperations@npower.com).

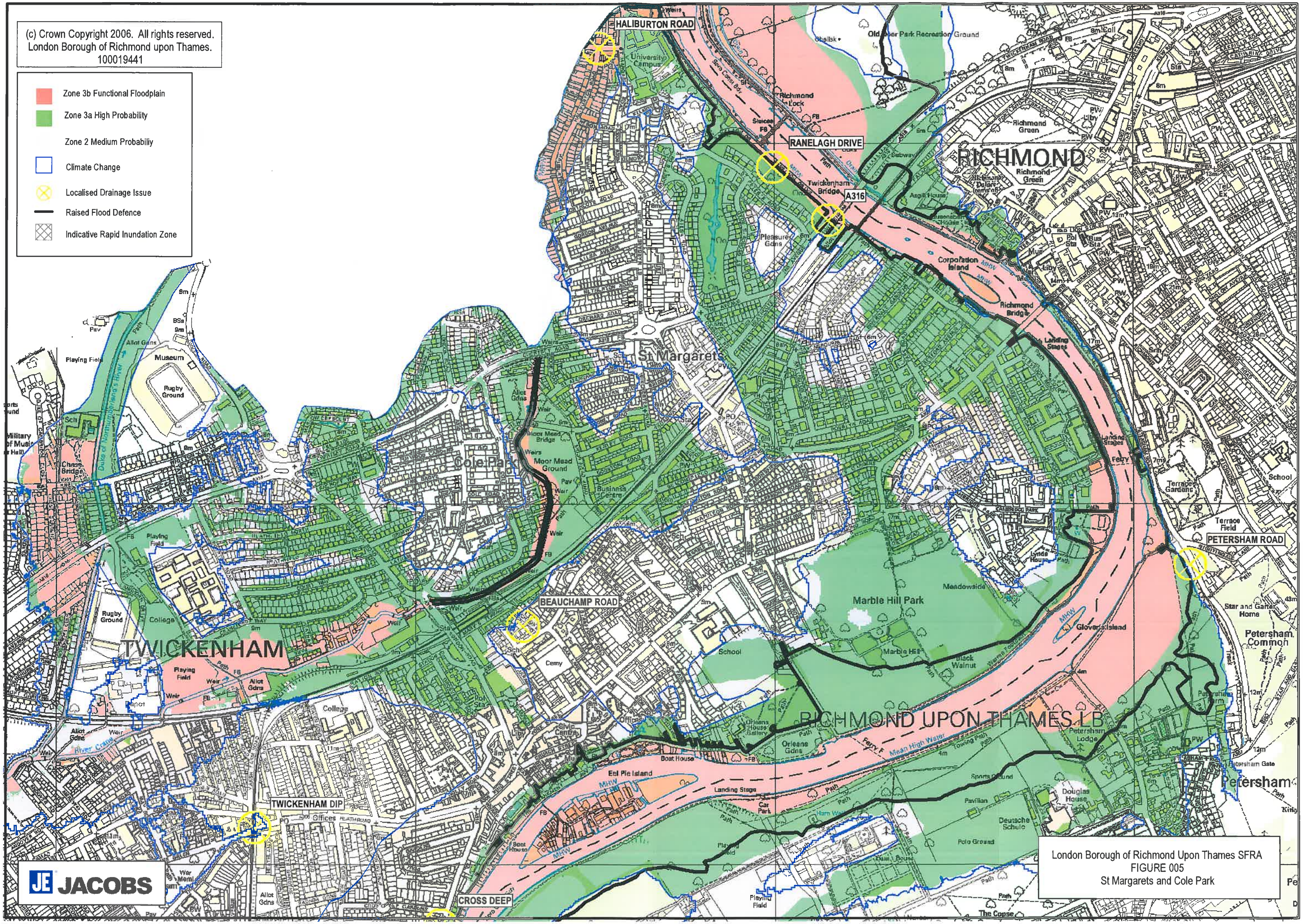
We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0845 9200 800.

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to him at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to WaterVoice Thames on 0845 758 1658 (it will cost you the same as a local call) or write to them at 4th Floor (South), High Holborn House, 52-54 High Holborn, London WC1V 6RL.

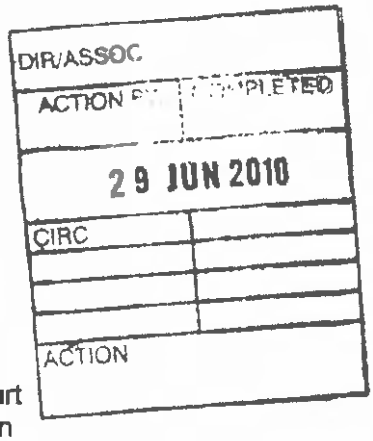
Ways to pay your bill

By Post – Cheque only, made payable to 'Thames Water Utilities Ltd' writing your Thames Water account number on the back. Please fill in the payment slip below and send it with your cheque to Thames Water Utilities Ltd., PO Box 223, Swindon SN38 2TW	**By BACS Payment** direct to our bank on account number 90478703, sort code 60-00-01 may be made. A remittance advice must be sent to Thames Water Utilities Ltd., PO Box 223, Swindon SN38 2TW. Or fax to 01793 424599 or email: cashoperations@thameswater.co.uk	**Telephone Banking** By calling your bank and quoting your invoice number and the Thames Water's bank account number 90478703 and sort code 60-00-01	**By Swift Transfer** You may make your payment via SWIFT by quoting **NWBKGB2L** together with our bank account number 90478703, sort code 60-00-01 and invoice number



London Borough of Richmond Upon Thames SFRA
FIGURE 005
St Margarets and Cole Park

Ref 01



Waterman

Versailles Court
3 Paris Garden
London
SE1 8ND

Thames Water UK
Developer Services

Your ref	16683/letters/RP/PS
Our ref	680690
Name	Tim Dale
Phone	0118 373 8782
Fax	0118 373 8150
E-Mail	developer.services@thameswater.co.uk

Attention:-Richard Papworth

28 June 2010

Site: **Twickenham Station Twickenham – Foul Water Impact Study**

WHEN CONTACTING US PLEASE QUOTE THE REFERENCE 680690

Dear Richard,

I refer to your letter dated 8th June concerning the Foul Water Impact for the above site.

I have now received from the Modelling Group an assessment of the impact of the proposed development on the waste water network.

We already have in place a hydraulic model for the catchment which includes the sewer into which the development is likely to discharge.

The model does not indicate any hydraulic incapacity issues at the site or downstream during storm conditions and the local operations office does not report any significant hydraulic problems local to the development.

Therefore based on the available information the Modelling Group have advised that the proposed peak increase in flow from the development can be accepted in the public foul water system and no further investigation is required.

Please note that capacity cannot be reserved and should changes be made to the development proposal or the discharge rate then the potential impact will need to be reassessed.

Yours sincerely,

Tim Dale
Development Engineer

Thames Water Utilities Limited

Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading RG1 8DB

T 0845 850 2777
F 020 7713 3886
I www.thames-water.com

Registered in England and Wales No. 2366661, Registered office Clearwater Court Vastern Road Reading, RG1 8DB

Appendix 4
Proposed Site Layout Plan

the civil engineering practice

N

MARCH ROAD

A310 LONDON ROAD

B361 WHITTON ROAD

COLE PARK ROAD

RIVER CRANE

ACCESS

115 NEW RESIDENTIAL DWELLINGS, RETAIL UNITS, BASEMENT PARKING

Block C

Block A

Block B

TWICKENHAM RAILWAY STATION

A310 LONDON ROAD

STATION YARD

-10m 0 10m 20m 30m 40m

Scale 1:1000

TITLE

Proposed Site Layout Plan

SCALE

1:1000 @ A3

DRG. No.

3

Appendix 5
Preliminary Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - England & Wales

Return Period (years)	2	Volumetric Runoff Coeff.	0.75
M5-60 (mm)	20	Infiltration %	0
Ratio R	0.35	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Depth from Soffit to G.L. (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	500

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	50.00	0.117	426.5	0.327	5.00	0	0.600	o	300
1.001	50.00	0.104	480.8	0.327	0.00	0	0.600	o	375
1.002	10.00	0.021	480.8	0.000	0.00	0	0.600	o	375

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	50.0	6.1	6.600	0.327	0	0	0	0.76	53	44
1.001	50.0	7.1	6.408	0.654	0	0	0	0.82	91	89
1.002	50.0	7.3	6.304	0.654	0	0	0	0.82	91	89

11 Tungsten Building
George Street
Fishersgate, BN41 1RA

Solum Regeneration
Twickenham
Storage Estimate

Date May-10
File 30 yr 15 min.SIM
Elstree Computing Ltd

Designed By SRD
Checked By
Simulation W.7.5 (c)1982-2001 Micro Drainage

Summary of Results

Return Period (years)	30	Analysis Time Step (seconds)	15
Storm Duration (mins)	15	DVD Status	ON
Margin for Flood Risk warning (mm)	300	Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	7.676	0.776	0.000	1.83	0	96	SURCH'ED
1.001	7.275	0.492	0.000	2.09	0	184	SURCH'ED
1.002	6.842	0.163	0.000	2.26	0	183	SURCH'ED

Global Variables

Region	England & Wales	Foul Sewage/Hectare (l/s)	0.00
Return Period (yrs)	30	Additional Flow % of Total Flow	0
M5-60 (mm)	20.00	Number of Input Hydrographs	0
Ratio R	0.35	Number of Time/Area Diagrams	0
Volumetric Runoff Cocf	0.75	Number of Bifurcations	0
Areal Reduction Factor	1.00	Number of Overflows	0
Storm Duration (mins)	15	Number of Off-Line Controls	0
Manhole Headloss Coefficient	0.15	Number of Tank Sewers	2
MADD Factor * 10m3/ha Storage	1.00		

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.002	4	7.000	6.283	0	0

Summary of Results

Return Period (years)	30	Analysis Time Step (seconds)	15
Storm Duration (mins)	30	DVD Status	ON
Margin for Flood Risk warning (mm)	300	Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	7.537	0.637	0.000	1.70	0	89	SURCH'ED
1.001	7.199	0.416	0.000	1.94	0	171	SURCH'ED
1.002	6.820	0.141	0.000	2.10	0	170	SURCH'ED

Global Variables

Region	England & Wales	Foul Sewage/Hectare (l/s)	0.00
Return Period (yrs)	30	Additional Flow % of Total Flow	0
M5-60 (mm)	20.00	Number of Input Hydrographs	0
Ratio R	0.35	Number of Time/Area Diagrams	0
Volumetric Runoff Coef	0.75	Number of Bifurcations	0
Areal Reduction Factor	1.00	Number of Overflows	0
Storm Duration (mins)	30	Number of Off-Line Controls	0
Manhole Headloss Coefficient	0.15	Number of Tank Sewers	2
MADD Factor * 10m3/ha Storage	1.00		

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.002	4	7.000	6.283	0	0

Summary of Results

Return Period (years)	100	Analysis Time Step (seconds)	15
Storm Duration (mins)	15	DVD Status	ON
Margin for Flood Risk warning (mm)	300	Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	8.117	1.217	16.986	2.43	0	127	FLOOD
1.001	8.101	1.318	1.012	2.21	0	195	FLOOD
1.002	7.951	1.272	0.000	2.26	0	183	FLD RISK

Global Variables

Region	England & Wales	Foul Sewage/Hectare (l/s)	0.00
Return Period (yrs)	100	Additional Flow % of Total Flow	0
M5-60 (mm)	20.00	Number of Input Hydrographs	0
Ratio R	0.35	Number of Time/Area Diagrams	0
Volumetric Runoff Coef	0.75	Number of Bifurcations	0
Areal Reduction Factor	1.00	Number of Overflows	0
Storm Duration (mins)	15	Number of Off-Line Controls	0
Manhole Headloss Coefficient	0.15	Number of Tank Sewers	2
MADD Factor * 10m3/ha Storage	1.00		

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.002	4	7.000	6.283	0	0

Summary of Results

Return Period (years)	100	Analysis Time Step (seconds)	15
Storm Duration (mins)	30	DVD Status	ON
Margin for Flood Risk warning (mm)	300	Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	8.114	1.214	14.514	2.21	0	116	FLOOD
1.001	8.101	1.318	0.600	2.05	0	182	FLOOD
1.002	7.784	1.105	0.000	2.26	0	183	SURCH'ED

Global Variables

Region	England & Wales	Foul Sewage/Hectare (l/s)	0.00
Return Period (yrs)	100	Additional Flow % of Total Flow	0
M5-60 (mm)	20.00	Number of Input Hydrographs	0
Ratio R	0.35	Number of Time/Area Diagrams	0
Volumetric Runoff Coef	0.75	Number of Bifurcations	0
Areal Reduction Factor	1.00	Number of Overflows	0
Storm Duration (mins)	30	Number of Off-Line Controls	0
Manhole Headloss Coefficient	0.15	Number of Tank Sewers	2
MADD Factor * 10m3/ha Storage	1.00		

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.002	4	7.000	6.283	0	0