civils ltd - consulting engineers

FLOOD RISK ASSESSMENT

210 Kingston Road, Teddington, Surrey TW11 9JF

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W6 0ST

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Ref: 4246/2.3F
Date: January 2012

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E Strategic Flood Risk Assessment (SFRA) Extracts

F Micro Drainage Calculation

Issue	Date	Compiled	Checked
First Issue	06 January '12	JP	MR
Second Issue	11 September '12	JP	MR
Third Issue	05 March '13	JP	MR

Report by: **John Pakenham BSc (Hons)**
Checked by: **Martin Roberts I Eng, ACIWEM, MIHT**

1.0 INTRODUCTION

1.1 This report has been prepared for Frontdoor Properties Ltd in relation to the premises at 210 Kingston Road, Teddington, Surrey TW11 9JF and no responsibility is accepted to any third party for all or part of this study in connection with this or any other development.

1.2 GTA Civils Ltd was appointed by the client to provide a Flood Risk Assessment (FRA) to accompany the planning application as requested by the Environment Agency and Richmond Council in order to achieve Planning Approval at said property.

1.3 The FRA has been developed in accordance with the National Planning Policy Framework (27/03/12) and the supporting Technical Guidance document.

2.0 EXISTING SITE & CURRENT FLOOD CONDITIONS

2.1 The site lies within the London Borough of Richmond-Upon-Thames, approximately 750m west of the River Thames. Currently the site consists of a 3 storey retail unit comprising a ground floor shop with residential accommodation above, whose roofed area is approximately 162m^2.

2.2 Existing site location maps and an aerial view of the site are shown in Appendix A.

2.3 A topographical survey of the existing site has been conducted, with levels to Ordnance Datum (Newlyn), and is contained within Appendix B of this report. The lowest threshold level is 7.82m AOD. Levels around the site range between approximately 7.83m and 7.48m AOD.

2.4 The site is bounded by Kingston Road to the northeast, Bushy Park Road to the northwest. Kingston road is characterised by shop units and Bushy Park Road by residential dwellings.

2.5 Drainage from the existing building is assumed to drain via gravity to the existing public storm and foul sewers located in the street.

2.6 The site's geology, according to the BGS's online geological map, is London Clay overlain by Kempton Park Gravel. The former is renowned for its low porosity whilst the latter may demonstrate a good soakage rate. A soil soakage test, to be carried out in accordance with BRE Digest 365, should be undertaken prior to finalising the design.

2.7 There is no historical record of flooding on this site from any source, e.g. groundwater, overland flow or sewerage flooding – see the SFRA map extracts in Appendix E.

3.0 PROPOSED SITE LAYOUT & FLOOD RISK

3.1 The planning application is to demolish the existing building and construct a new 3 storey building comprising a retail unit at ground floor and 7 flats above. See the proposed scheme drawing in Appendix C.

3.2 The proposed roofed area on site is to increase to 544m^2 (ie by approximately 382m^2.)

3.3 The proposed ground floor's FFL shall be set at the existing level. The new hardstanding areas (car parking spaces etc.) will be formed with permeable surfacing, e.g. porous paviors or similar.

3.4 The Environment Agency Flood Map in Appendix D shows that the site lies within the Flood Zone 2 of the Thames. The pale blue shading of the floodplain indicates that the site is in Flood Zone 2.

3.5 Sites within Flood Zone 2 are susceptible to a 1 in 1000 chance (0.1%) of river flooding each year. This section of the Thames is fluvially influenced.

3.6 The EA has modelled the flood level at various locations shown as nodes on the Flood Maps in Appendix D. The nearest node to the site is '16.028', which is away to the west. The highest modelled '1% plus climate change' level for this node is shown as 7.09m AOD. This is 0.74m below the ground floor level. Even if the highest node's level were taken (7.30m) there is 530mm freeboard. This means that the site is clear of flooding from the Thames, according to the EA.

3.7 The 2D model in Appendix D confirms that this site is clear of the 1% and 1% + CC events: only the 0.1% event has been recorded (7.69m AOD.) Means of access to safety is southwest along Bushy Park Road.

3.8 Vulnerability: Table 2 of the NPPF classes shops as 'Less Vulnerable' and residential dwellings as 'More Vulnerable'. The residential units are clear of the ground floor.

3.9 Policy 4A.14 of the London Plan states: "*The use of sustainable urban drainage systems should be promoted for development unless there are practical reasons for not doing so...*" There is little outside space in which to put the measures that make up the SUDS management train.

3.10 SW strategy: it is proposed to discharge the extended roof's surface water either into 2 soakaways under the car park, or into the sewer in Bushy Park Road at an attenuated rate (of 5 l/s, this being the practical limit of such devices), subject to Thames Water's approval. The soakaways or attenuation tank will have been sized to hold the excess volume in the critical '1 in 100 years plus climate change' storm event.

3.11 The choice of disposal method depends on the results of a soil soakage test, to be carried out in accordance with BRE Digest 365. Appendix F shows the calculation of 2 no. PCC ring soakaways assuming an infiltration rate of 10^{-4}m/s (equivalent to 0.36m/hour.) This design must be checked once the actual rate has been determined.

3.12 Other sources: the SFRA maps show that this site is clear of modelled surface water flood routes and away from groundwater flooding incidents. There is no historical record of flooding from any flood sources according to the SFRA or EA. This development will not alter this risk in any case.

4.0 SUMMARY AND CONCLUSIONS

4.1 The proposal is to demolish the existing building and construct a new 3 storey building comprising a retail unit at ground floor and 7 flats above. The roofed area on the site will increase by approximately 382m^2 (from 162m^2 to 544m^2.) The proposed ground FFL will be maintained at 7.83m AOD.

4.2 The EA's Flood Map in Appendix D indicates that the site lies in Flood Zone 2 (Medium Probability Area), but the highest modelled '1 in 100 year + CC' level is 7.09m AOD. There will therefore be a freeboard of 0.74m, 0.3m being the minimum needed.

4.3 According to the EA and SFRA there is no historical record of flooding on this site – whether from the river or other sources such as overland flow or groundwater. This development will not alter this risk profile.

4.4 The new external surfaces will be of porous materials in order to limit the positively drained area to discharge into the sewer (or soakaway.)

4.5 It is proposed to confirm the soil's infiltration rate by carrying out a soakage test in accordance with BRE Digest 365. If soakaways are found to be feasible then 2 no. soakaways shall be formed within the new car park area to the rear of the unit. If not the new roof's surface water shall be discharged at 5l/s (subject to Thames Water's approval) into the sewer in Bushy Park Road. The attenuation tank will be sized to hold the volume of the critical '100 years plus 30% climate change' storm.

4.6 It is therefore contended that this proposal complies with the 2012 NPPF.

- End of Report -

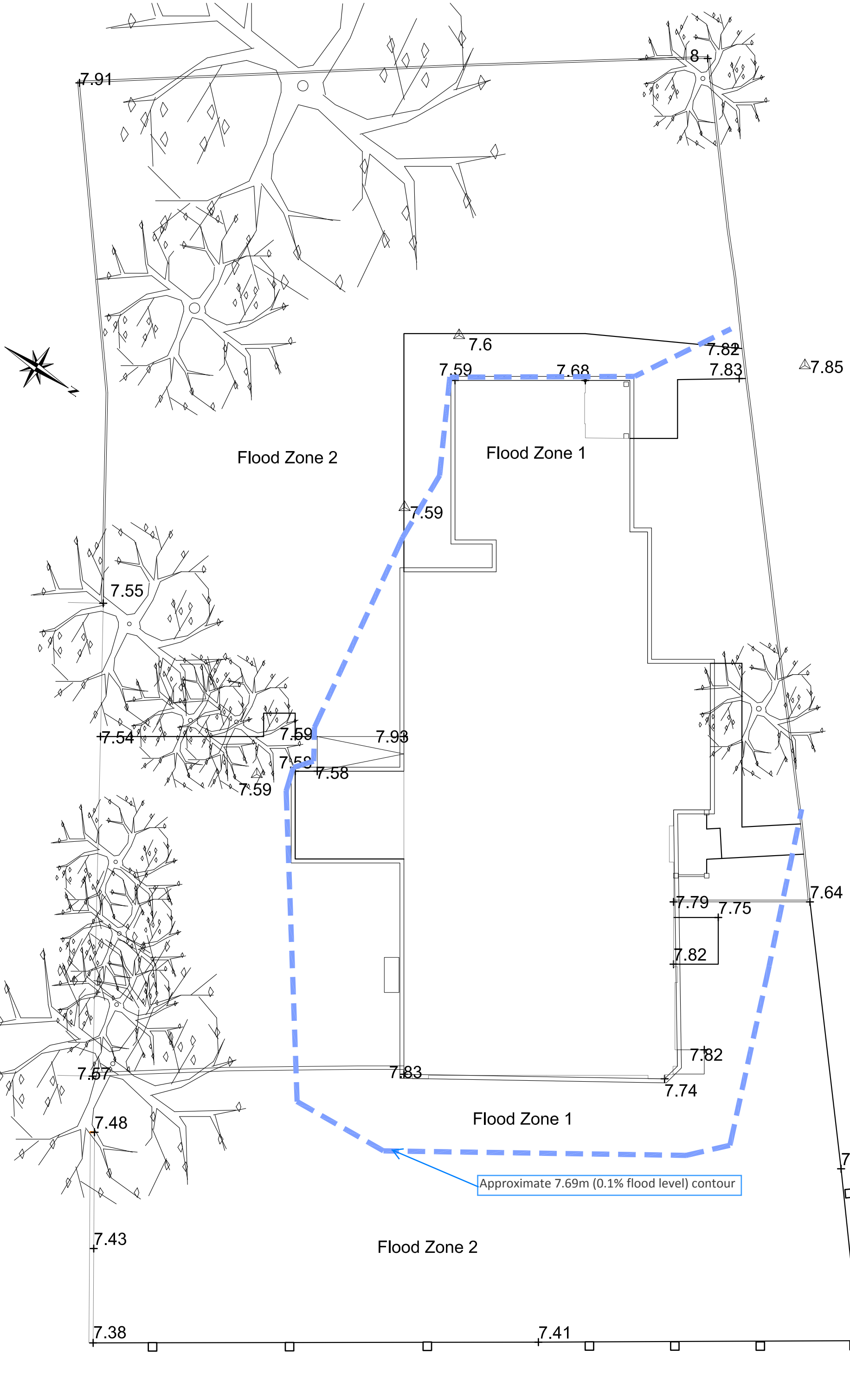
APPENDIX A

Site Location Map & Aerial Photo


SITE
LOCATION
A

APPENDIX B

Topographical Survey

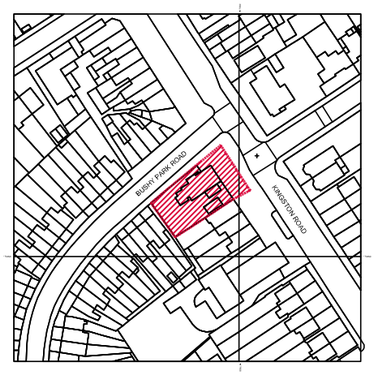

7.91
8
7.6
7.82
7.59
7.68
7.83
7.85
Flood Zone 2
Flood Zone 1
7.59
7.55
7.54
7.59
7.93
7.58
7.59
7.64
7.79
7.75
7.82
7.82
7.67
7.83
7.74
7.48
Flood Zone 1
Approximate 7.69m (0.1% flood level) contour
7.55
7.43
Flood Zone 2
7.38
7.41
7.46
7.42

APPENDIX C

Proposed Scheme Drawings

DO NOT SCALE FROM THIS DRAWING - STATED DIMENSIONS REFER
CONTRACTORS SHALL BE RESPONSIBLE FOR THE CHECKING OF ALL
STATED DIMENSIONS, WITH ANY ANOMALIES BEING IDENTIFIED TO
THE ORIGINATOR PRIOR TO ANY CONSTRUCTION OR FABRICATION
WORKS COMMENCING.

N



LOCATION PLAN
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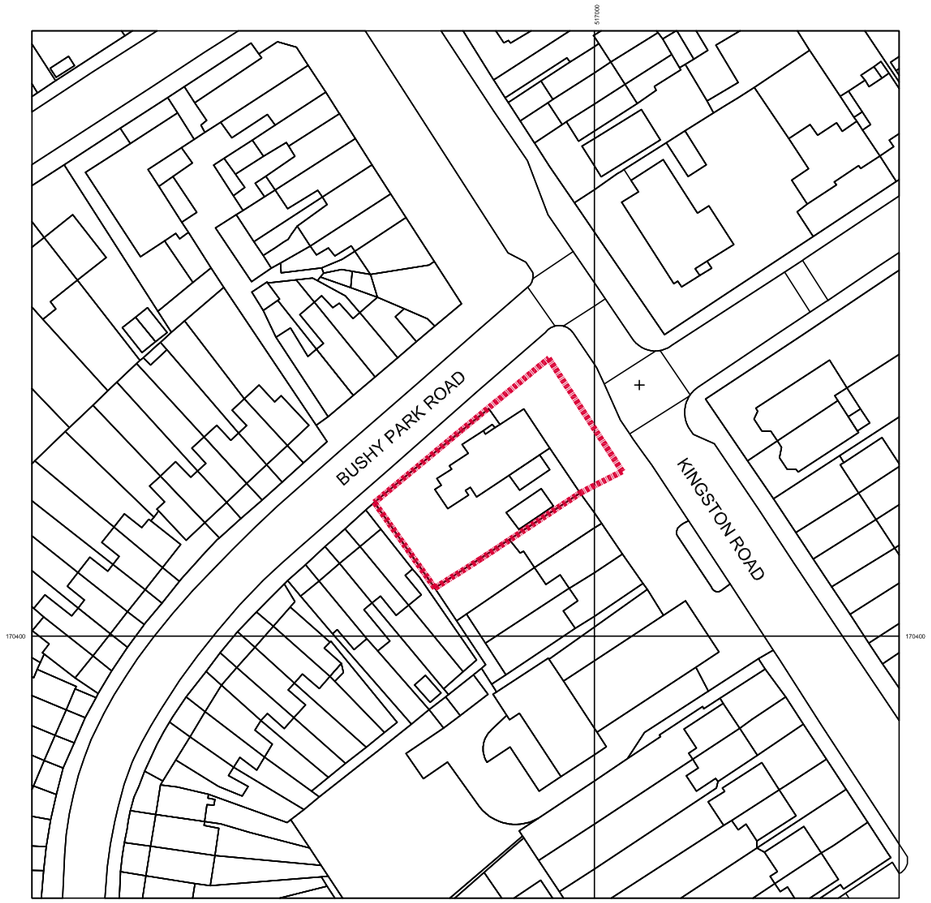

BLOCK PLAN
scale- 1:500

0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1250

0 10 20 30 40 50m
SCALE 1:500

–	21-12-11	First Issue
Revision	Date	Description

architects
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cost consultants
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london
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jla

Status
PRELIMINARY ISSUE

Client
FRONTDOOR PROPERTIES LIMITED

Project Title
RETAIL & RESIDENTIAL
210 KINGSTON ROAD
TEDDINGTON
TW11 9JF

Drawing Title
LOCATION PLAN

Project Number	Drawing Number	Revision
13-744	P13-744-01	-

Drawn	Checked	Scale	Date
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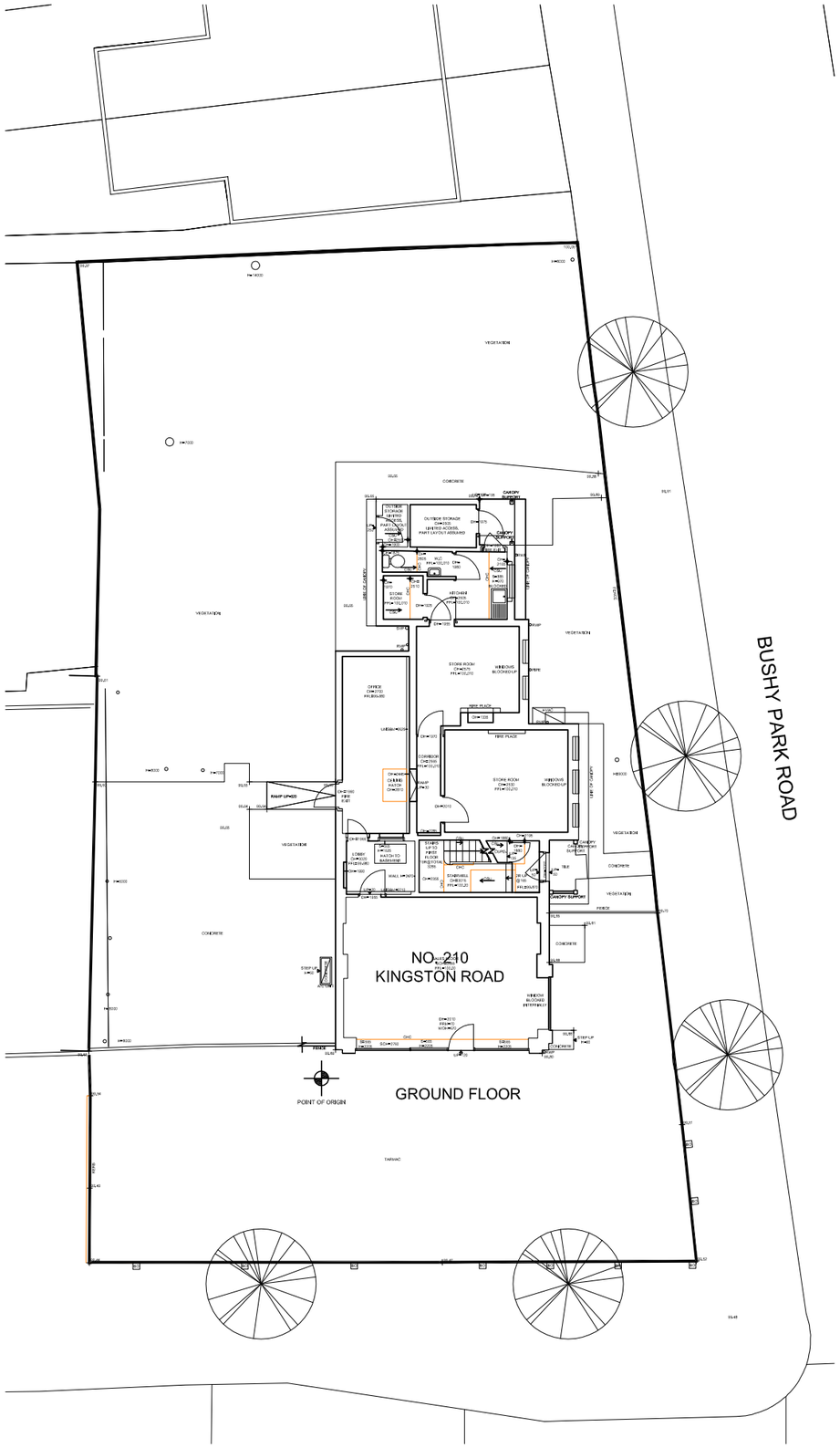
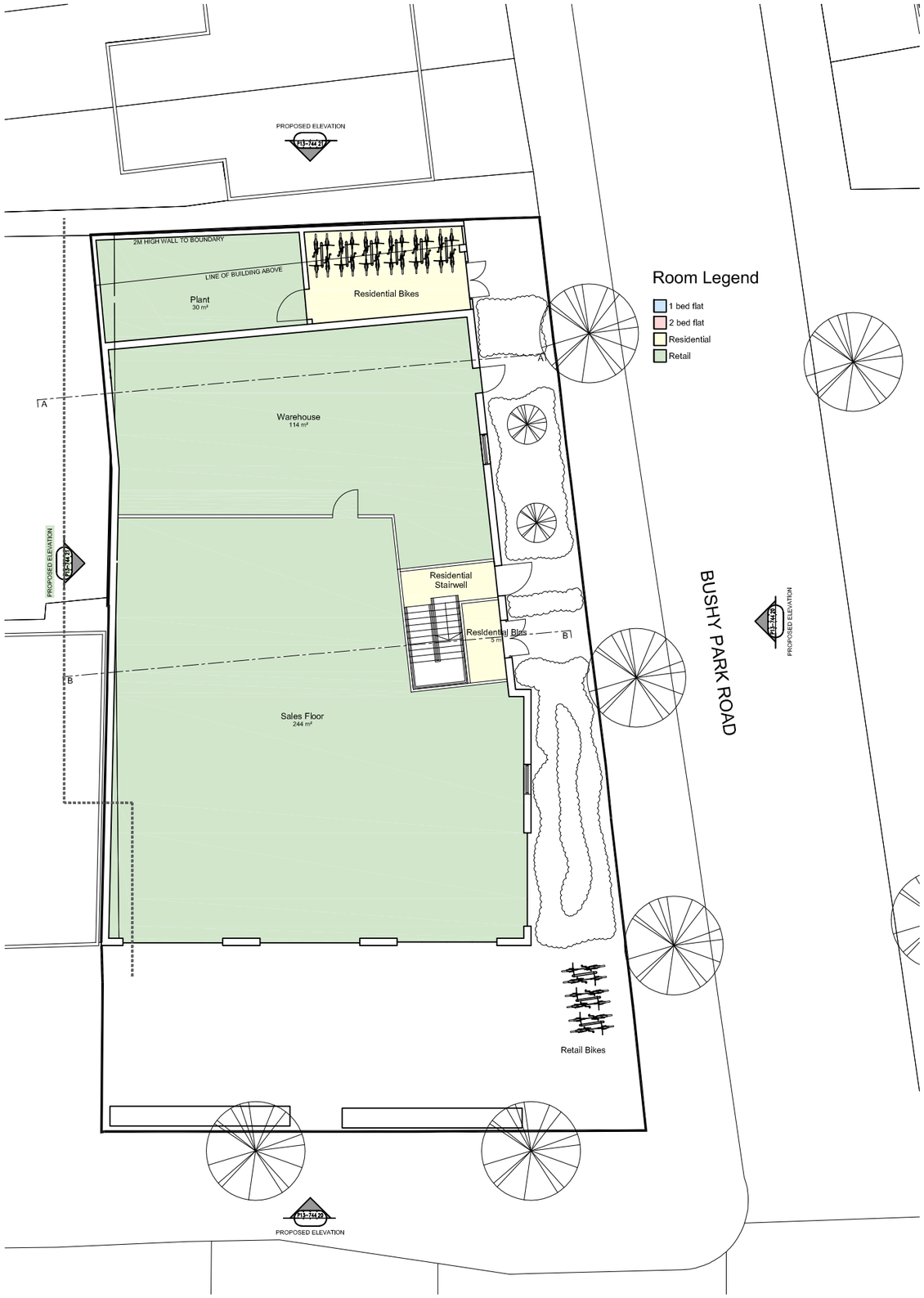


EXISTING GROUND FLOOR PLAN
scale- 1:100



PROPOSED GROUND FLOOR PLAN
scale 1:100

Room Legend

- 1 bed flat
- 2 bed flat
- Residential
- Retail

0 1 2 3 4 5 6 7 8 9 10m

SCALE 1:100

Revision	Date	Description
D	27-02-13	Planners comments
C	15-02-13	Planners comments
B	04-02-13	Planners comments
A	17-01-13	For comment
–	11-01-13	First Issue

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Client
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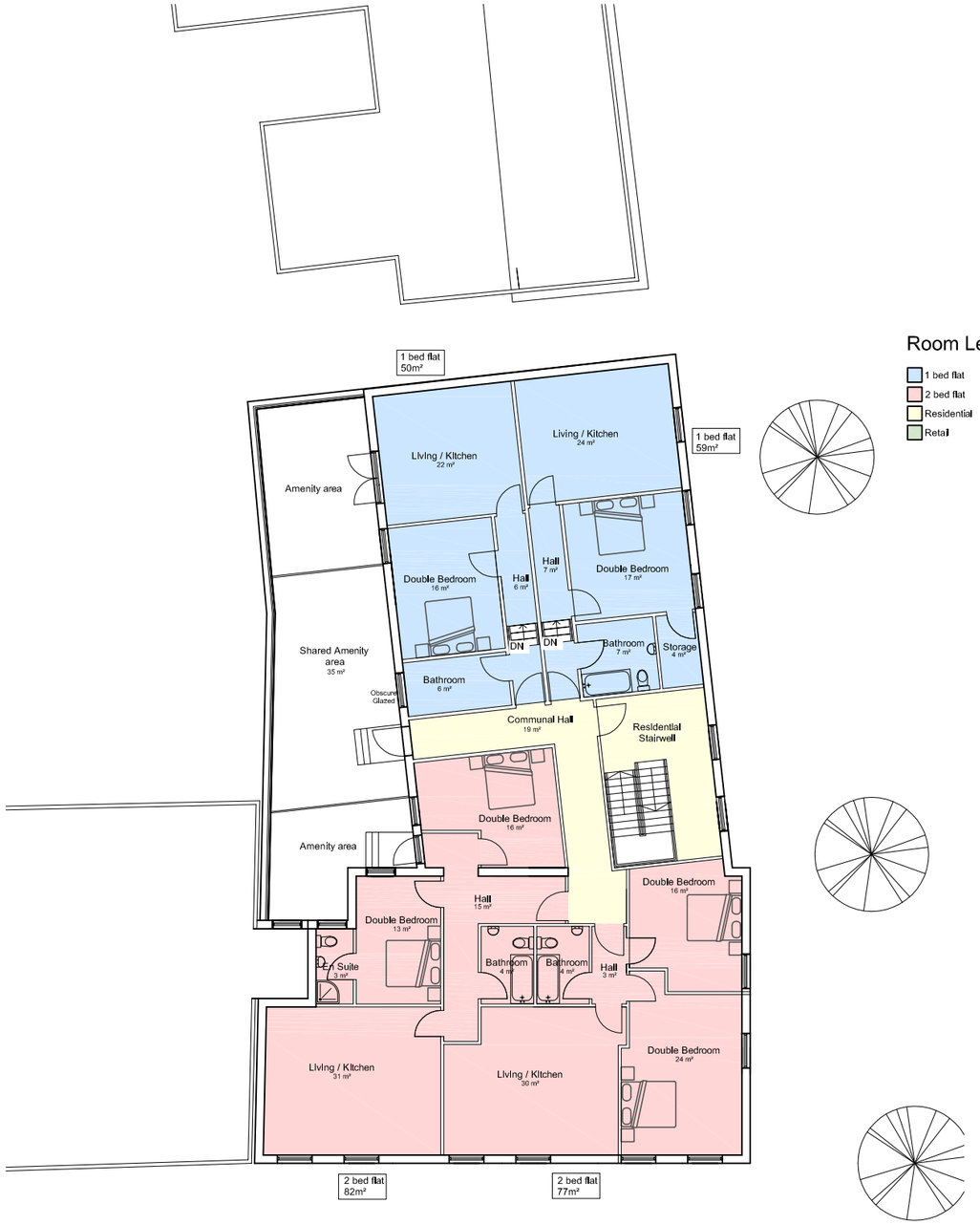
Drawing Title
EXISTING & PROPOSED
GROUND FLOOR PLAN

Project Number	Drawing Number	Revision
13-744	P13-744-10	D

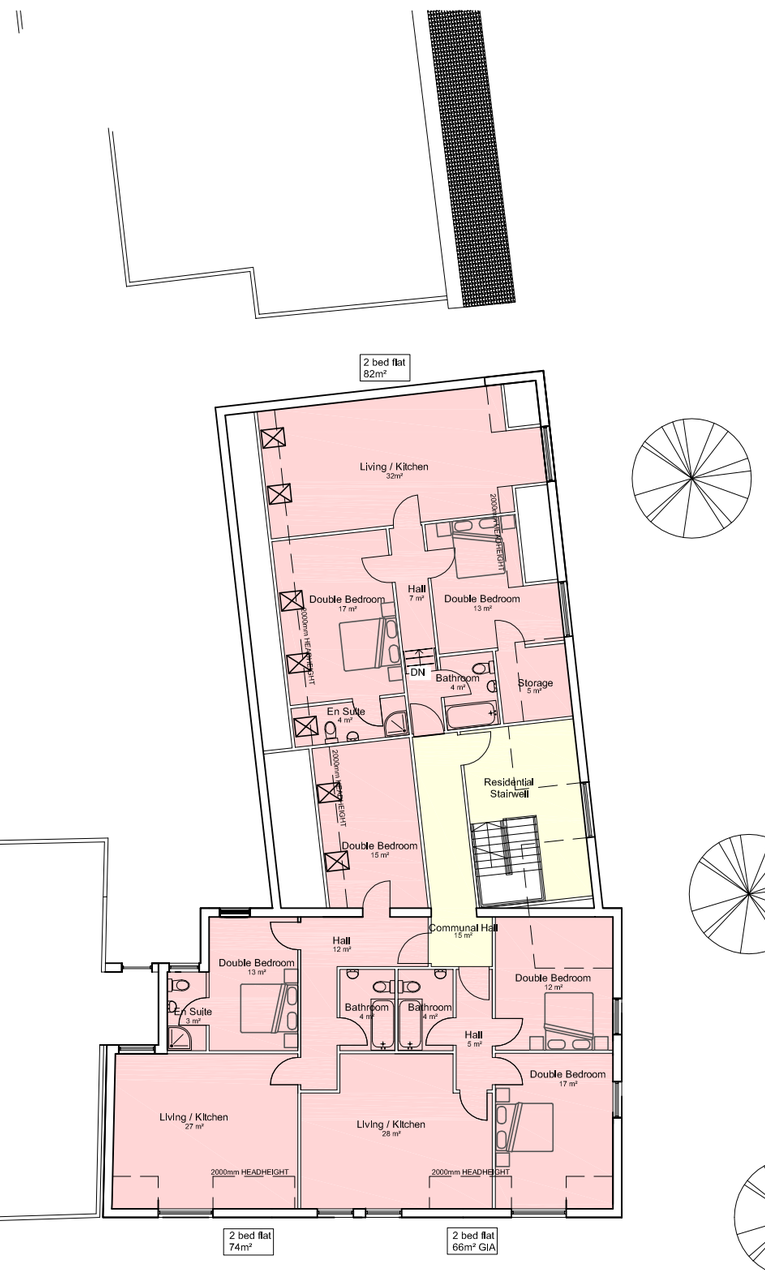
Drawn	Checked	Scale	Date
VA		1:100@A1	11-01-13

DO NOT SCALE FROM THIS DRAWING - STATED DIMENSIONS REFER. CONTRACTORS SHALL BE RESPONSIBLE FOR THE CHECKING OF ALL STATED DIMENSIONS, WITH ANY ANOMALIES BEING IDENTIFIED TO THE ORIGINATOR PRIOR TO ANY CONSTRUCTION OR FABRICATION WORKS COMMENCING.



Room Legend

- 1 bed flat
- 2 bed flat
- Residential
- Retail



PROPOSED FIRST FLOOR PLAN

PROPOSED SECOND FLOOR PLAN

0 1 2 3 4 5 6 7 8 9 10m

SCALE 1:100

Revision	Date	Description
G	04-03-13	Planners comments
F	01-03-13	Planners comments
E	28-02-13	Planners comments
D	27-02-13	Planners comments
C	15-02-13	Planners comments
B	04-02-13	Planners comments
A	17-01-13	For comment
–	11-01-13	First issue

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TW11 9JF

Drawing Title

PROPOSED
FIRST & SECOND FLOOR

Project Number	Drawing Number	Revision
13-744	P13-744-11	G

Drawn	Checked	Scale	Date
VA		1:100@A1	11-01-13

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WORKS COMMENCING.

PROPOSED BUSHY PARK ROAD ELEVATION

PROPOSED KINGSTON ROAD ELEVATION

0 1m 2m 3m 4m 5m

SCALE 1:50

C	27-02-13	Planners comments
B	15-02-13	Planners comments
A	05-02-13	Planners comments
--	17-01-13	First issue

Revision Date Description

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PRELIMINARY ISSUE

Client

FRONTDOOR PROPERTIES LIMITED

Project Title

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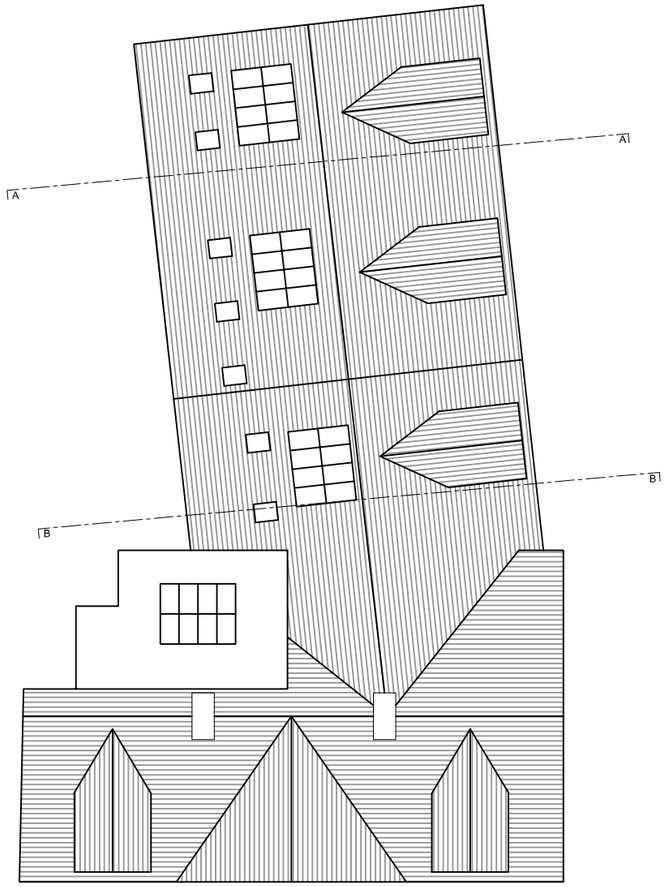
TW11 9JF

Drawing Title

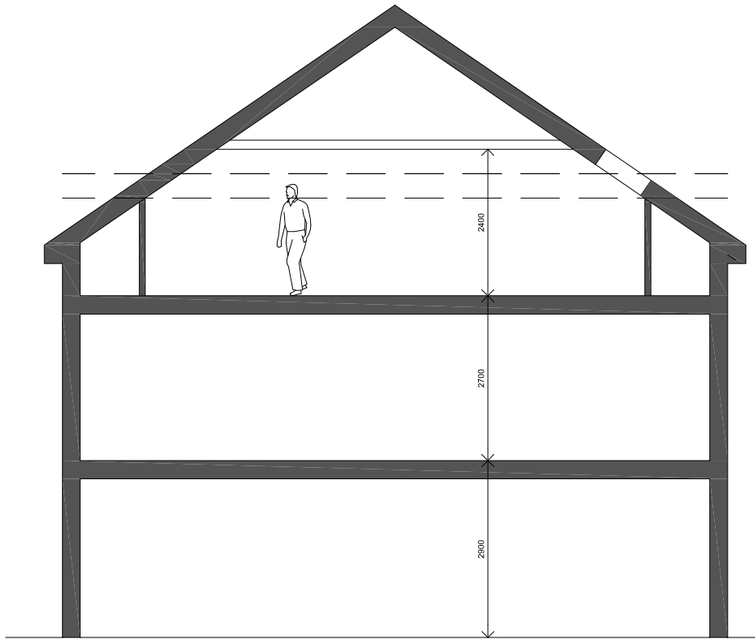
PROPOSED FRONT & SIDE ELEVATION

Project Number	Drawing Number	Revision
13-744	P13-744-20	C

Drawn	Checked	Scale	Date
NE		1:50@A1	17-01-13



PROPOSED ROOF PLAN @1:100



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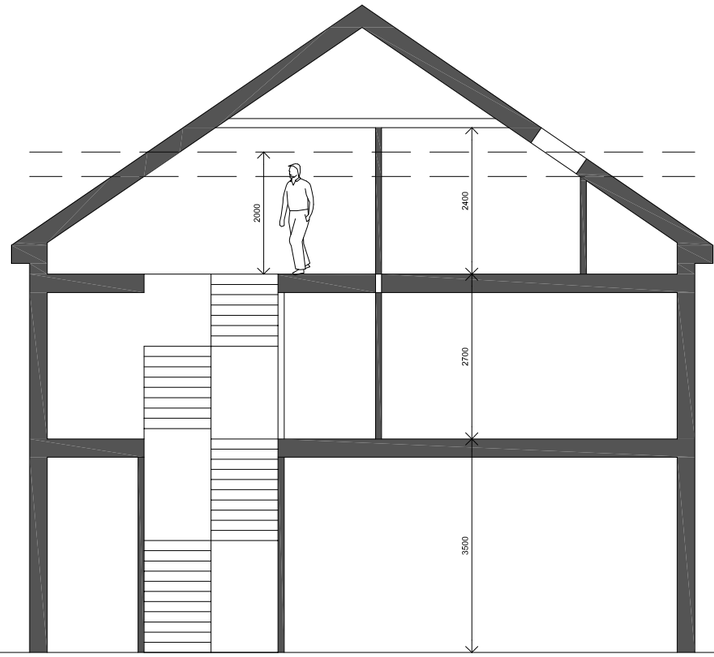

PROPOSED SECTION BB @1:50

SCALE 1:100

SCALE 1:50

Revision	Date	Description
–	27-02-13	First Issue

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fax:020 7440 8641

Status
PRELIMINARY ISSUE

Client
FRONTDOOR PROPERTIES LIMITED

Project Title
RETAIL & RESIDENTIAL
210 KINGSTON ROAD
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TW11 9JF

Drawing Title
PROPOSED SECTIONS AND
ROOF PLAN

Project Number	Drawing Number	Revision
13-744-22	P13-744-22	-

Drawn	Checked	Scale	Date
NE		1:100/1:50@A1	27-02-13

APPENDIX D

Environment Agency Flood Data

Product 4 (Detailed Flood Risk) for 210 Kingston Road, Teddington, TW11 9JF
Our Ref: WT003263

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

i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq meters; and all domestic extensions",

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 extents showing *defended* scenarios;

FRA site boundary (where a suitable GIS layer is supplied);

Flood defence locations (where available/relevant) and unique identifiers; (supplied seperately)

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, and levels and flows for *defended* scenarios.

ii) Flood defence locations unique identifiers and attributes; (supplied

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

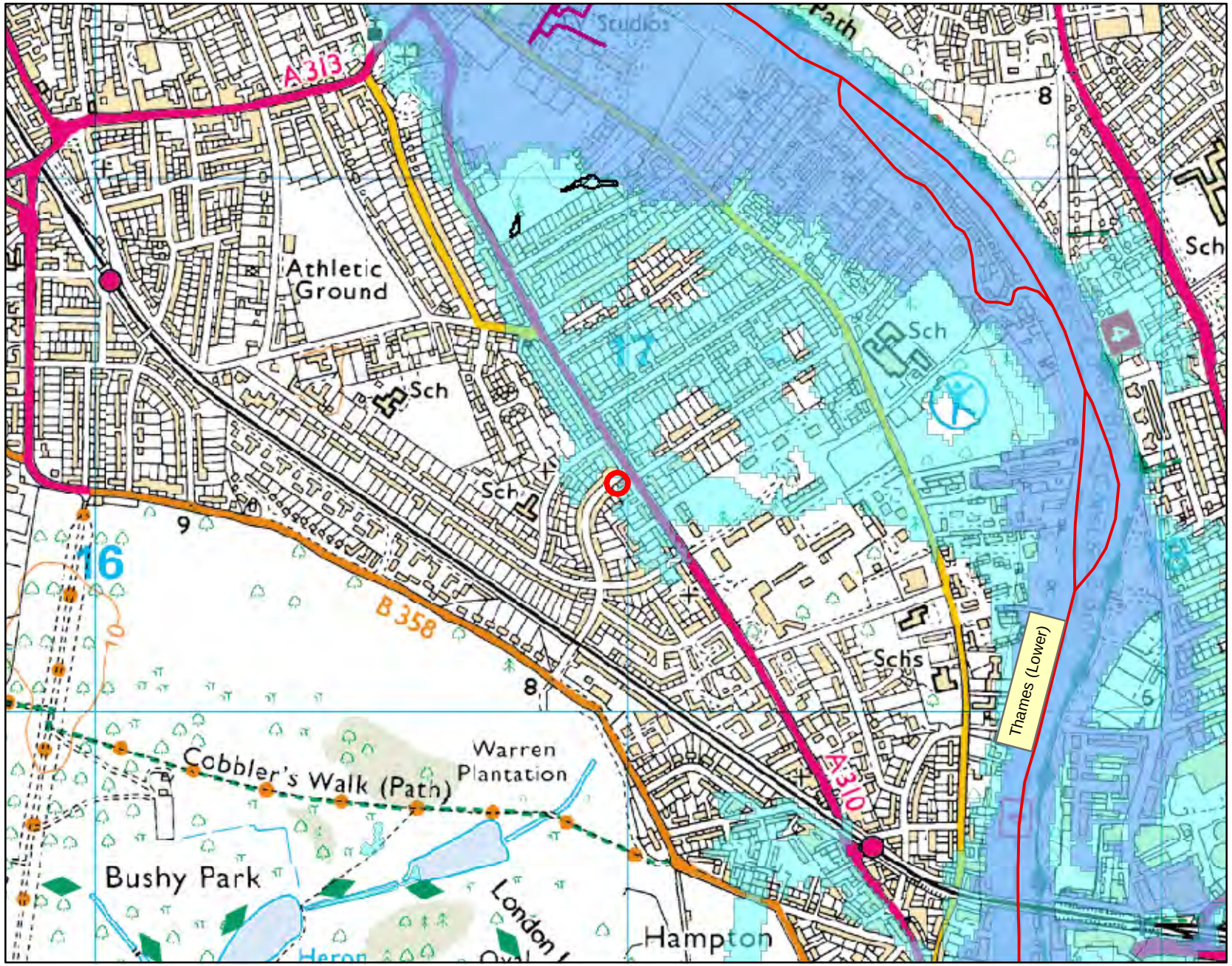
http://www.environment-agency.gov.uk/research/planning/82584.aspx

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

Red Kite House, Howbery Park, Wallingford, Oxon OX10 8BD
Customer services line: 08708 506 506
Email: WTenquiries@environment-agency.gov.uk

Basic/Detailed FRA Map centred on 210 Kingston Road, Teddington, TW11 9JF
Created 20/12/2011 - REF: WT003263



Environment Agency

Kilometres

0 0.125 0.25

N W E S

Legend

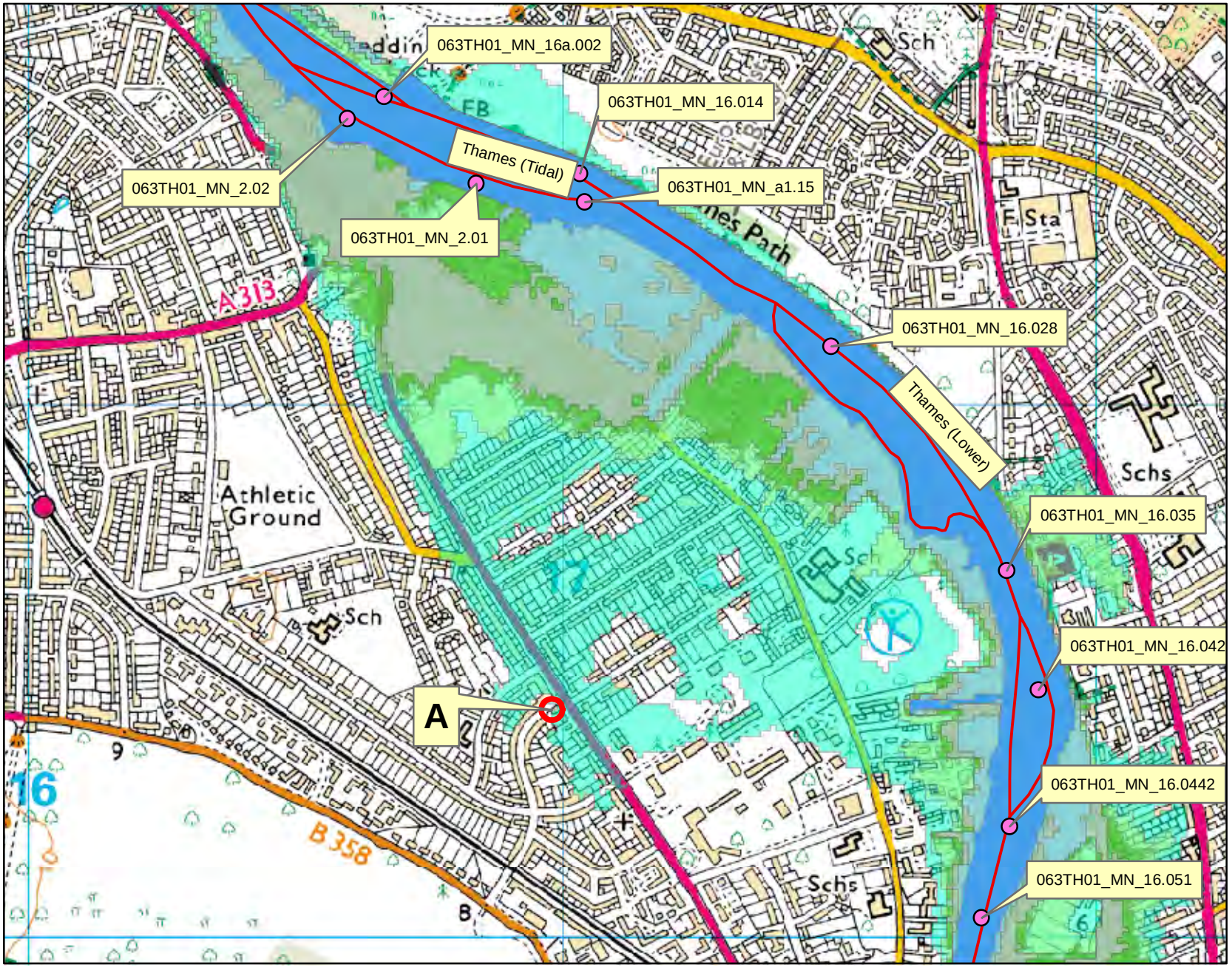
- Main River
- Enquiry
- Flood defences
- Areas benefiting from flood defences
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- Flood Map - flood storage areas

Flooding from rivers or sea without 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.

The Extent of an extreme flood (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

Basic/Detailed FRA Map centred on 210 Kingston Road, Teddington, TW11 9JF
Created 20/12/2011 - REF: WT003263



Environment Agency

Kilometres

0 0.125 0.25

N W E S

Legend

- Nodes
- Main River
- Enquiry
- 20% AEP flood extent
- 5% AEP flood extent
- 2% AEP flood extent
- 1% AEP flood extent
- 1%CC AEP flood extent
- 0.1% AEP flood extent

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occuring in any given year

1%CC = 1% Climate Change extent
This is the 1% AEP event with an allowance for climate change (+20% on river flows)

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

Modelled in-channel flood flows and levels

WT003263

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

				Flood Levels (mAOD)				
Node label	Model	Easting	Northing	20% AEP	5% AEP	1% AEP	1% AEP with climate change allowance (+20% on river flows)	0.1% AEP
063TH01_MN_16.051	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517788	170035	5.16	5.93	6.75	7.30	7.90
063TH01_MN_16.0442	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517841	170207	5.15	5.94	6.77	7.34	7.96
063TH01_MN_16.042	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517895	170463	5.10	5.87	6.68	7.22	7.84
063TH01_MN_16.035	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517835	170687	5.01	5.77	6.57	7.10	7.70
063TH01_MN_16.028	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517506	171108	4.95	5.73	6.55	7.09	7.69
063TH01_MN_a1.15	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517044	171379	4.86	5.64	6.49	7.07	7.72
063TH01_MN_16.014	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517035	171432	4.86	5.64	6.49	7.07	7.72
063TH01_MN_16a.002	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	516667	171576	4.85	5.58	6.40	6.99	7.64
063TH01_MN_2.01	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	516840	171413	4.73	5.55	6.38	6.97	7.63
063TH01_MN_2.02	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	516599	171535	4.50	5.30	6.08	6.63	7.24

				Flood Flows (m3/s)				
Node label	Model	Easting	Northing	20% AEP	5% AEP	1% AEP	1% AEP with climate change allowance (+20% on river flows)	0.1% AEP
063TH01_MN_16.051	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517788	170035	429.182	587.368	780.236	944.196	1168.120
063TH01_MN_16.0442	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517841	170207	430.655	588.950	775.933	924.532	1125.730
063TH01_MN_16.042	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517895	170463	430.416	588.640	783.119	931.697	1107.970
063TH01_MN_16.035	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517835	170687	428.906	589.244	783.349	937.480	1115.000
063TH01_MN_16.028	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517506	171108	429.788	589.053	784.681	938.609	1152.700
063TH01_MN_a1.15	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517044	171379	430.719	582.792	732.244	824.114	930.064
063TH01_MN_16.014	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	517035	171432	45.319	126.242	197.824	226.201	263.934
063TH01_MN_16a.002	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	516667	171576	1.309	13.862	35.817	55.340	79.981
063TH01_MN_2.01	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	516840	171413	429.756	568.268	688.856	760.477	840.953
063TH01_MN_2.02	Lower Thames Reach 4 - ISIS-TUFLOW Model 20	516599	171535	429.309	571.869	734.141	854.319	997.468

Modelled floodplain flood levels

WT003263

The modelled flood levels for the closest most appropriate model grid cells for your site are provided below:

				flood levels (mAOD)				
2D grid cell reference	Model	Easting	Northing	5% AEP	2% AEP	1% AEP	1% AEP with climate change allowance (+20% on river flows)	0.1% AEP
A	Thames Reach 4 2010	516984	170421					7.66

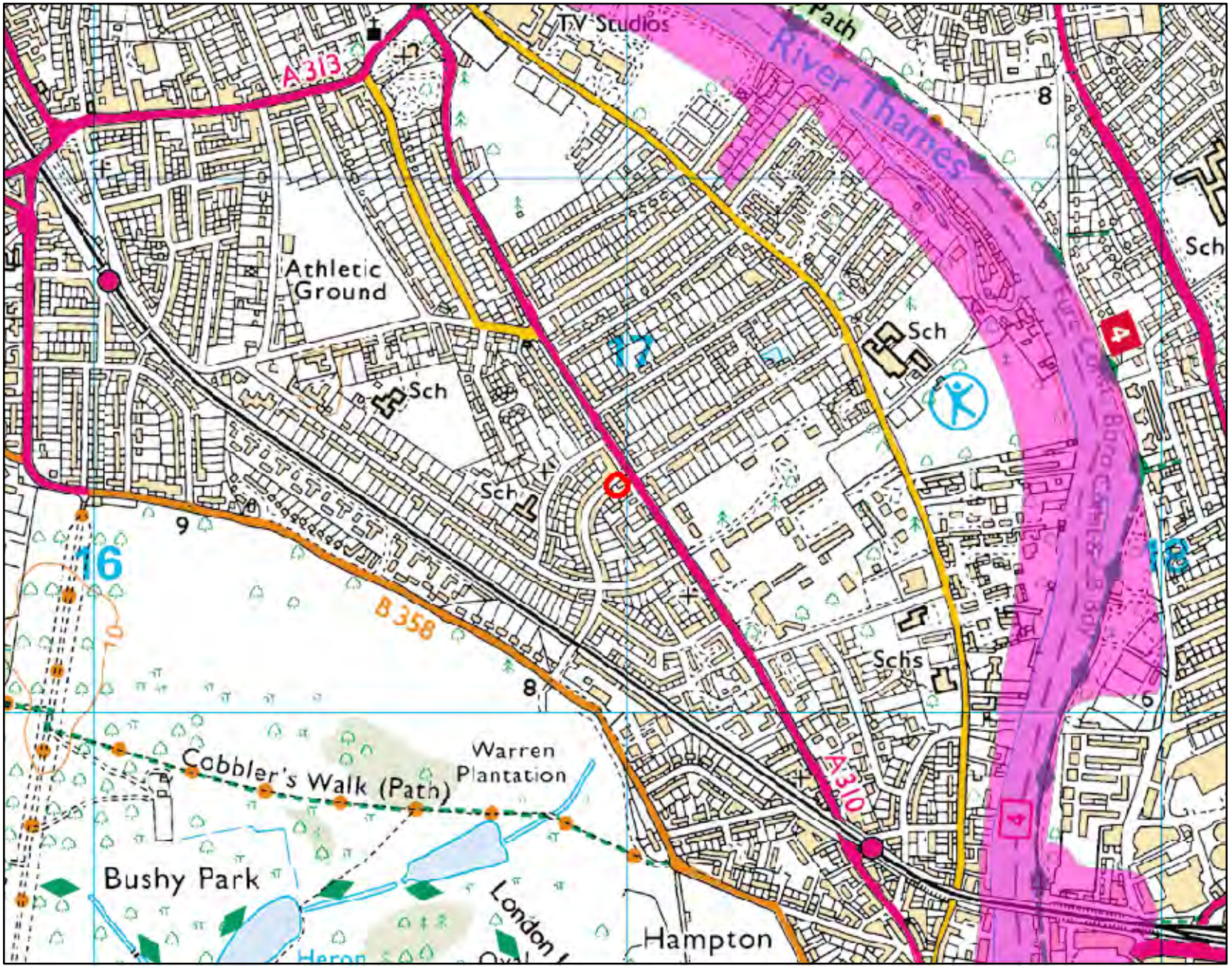
This flood model has represented the floodplain as a grid.
The flood water levels have been calculated for each grid cell.

Model information

WT003263

Model:	Thames Reach 4 2010
Description:	Reach 4 (Sunbury Court Island to Teddington): The information provided is taken from the Lower Thames Reach 4 2D Modelling Study which was completed in December 2010. It was modelled usinga linked ISIS- TUFLOW model. Accuracy of the final model: +/- 200mm of gauged data at the head and tail water levels at the main locks on the River Thames for the calibration event. Model design runs: 1 in 5 / 20%; 1 in 20 / 5%; 1 in 50 / 2%; 1 in 100 / 1%; 1 in 1000 (0.1%) and 1 in 100+20% / climate change Mapped outputs: 1 in 5 / 20%; 1 in 20 / 5%; 1 in 50 / 2%; 1 in 100 / 1%; 1 in 1000 (0.1%) and 1 in 100+20% / climate change

Basic/Detailed FRA Map centred on 210 Kingston Road, Teddington, TW11 9JF
Created 20/12/2011 - REF: WT003263



Environment Agency

Kilometres

0 0.125 0.25

N W E S

Legend

1947 Flood Event Outline

Enquiry

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

Historic flood data

WT003263

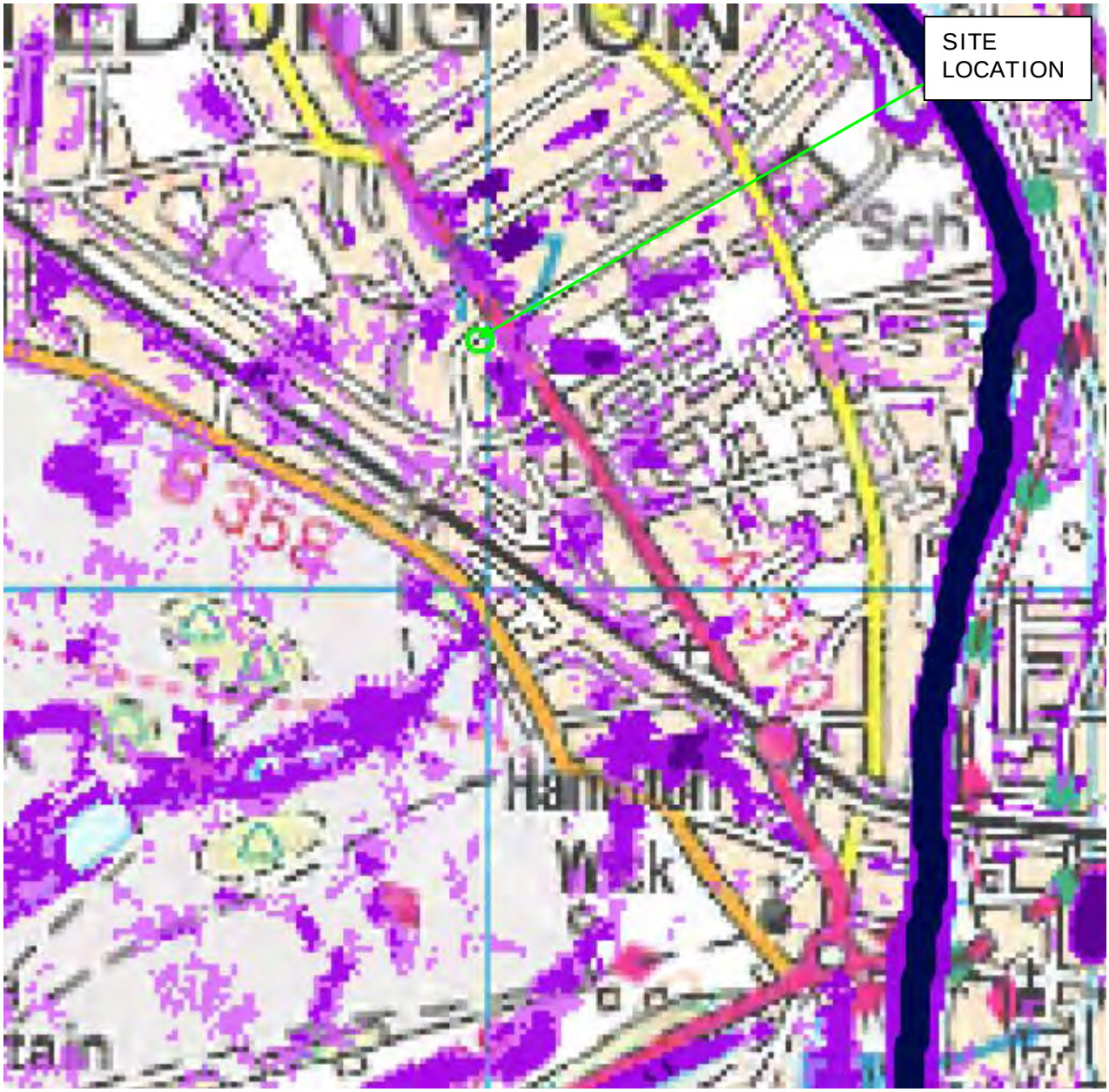
Our records show that the area of your site has been affected by flooding.
Information on the floods that have affected your site is provided in the table below:

Flood Event Code	Flood Event Name	Start Date	End Date	Source of Flooding	Cause of Flooding
EA0619470300171b	06MarchSpring1947	01/01/1947	12/12/1947	main river	channel capacity exceeded (no raised defences)
EA0619470300171a	06MarchSpring1947	01/01/1947	12/12/1947	main river	channel capacity exceeded (no raised defences)

Please note the Environment Agency maps 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.

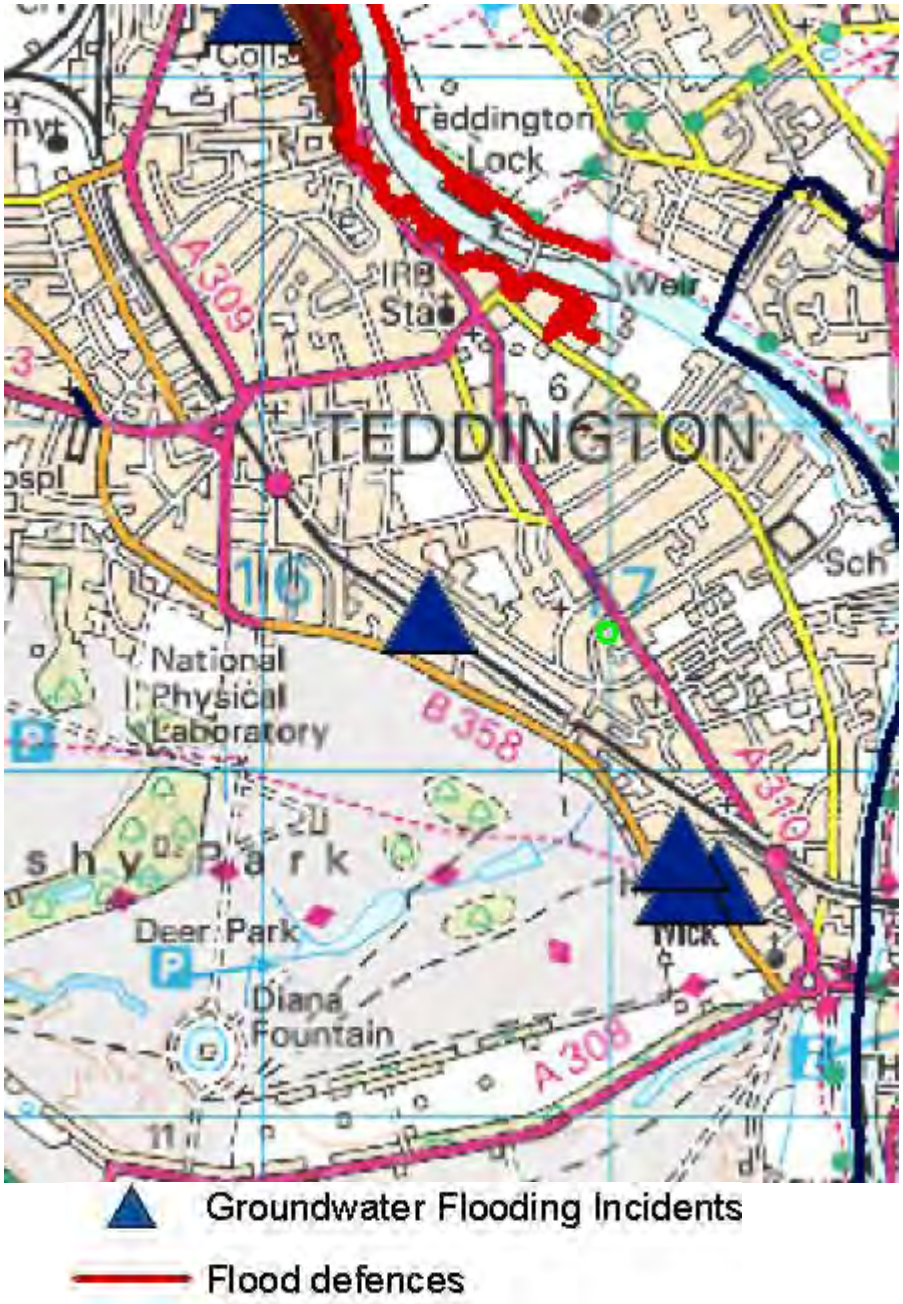
APPENDIX E

Strategic Flood Risk Assessment (SFRA) Extracts



Enlarged Excerpt from 'Figure G - Areas Susceptible to Surface Water Flooding'

(This shows the site being clear of surface water flooding risk)



Enlarged Excerpt from 'Figure D – Groundwater Flooding Incidents'

(This shows the site being removed from such incidents.)

APPENDIX F

Micro Drainage Calculation

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 50 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	6.732	1.332	2.5	10.5	O K
30 min Summer	7.034	1.634	2.9	12.9	O K
60 min Summer	7.202	1.802	3.1	14.2	O K
120 min Summer	7.224	1.824	3.1	14.4	O K
180 min Summer	7.134	1.734	3.0	13.7	O K
240 min Summer	7.027	1.627	2.9	12.8	O K
360 min Summer	6.845	1.445	2.6	11.4	O K
480 min Summer	6.690	1.290	2.4	10.2	O K
600 min Summer	6.556	1.156	2.3	9.1	O K
720 min Summer	6.441	1.041	2.1	8.2	O K
960 min Summer	6.252	0.852	1.9	6.7	O K
1440 min Summer	5.981	0.581	1.6	4.6	O K
2160 min Summer	5.727	0.327	1.3	2.6	O K
2880 min Summer	5.572	0.172	1.1	1.4	O K
4320 min Summer	5.447	0.047	0.9	0.4	O K
5760 min Summer	5.437	0.037	0.7	0.3	O K
7200 min Summer	5.431	0.031	0.6	0.2	O K
8640 min Summer	5.427	0.027	0.5	0.2	O K
10080 min Summer	5.424	0.024	0.5	0.2	O K
15 min Winter	6.906	1.506	2.7	11.9	O K
30 min Winter	7.262	1.862	3.1	14.7	O K
60 min Winter	7.450	2.050	3.4	16.1	Flood Risk
120 min Winter	7.446	2.046	3.4	16.1	Flood Risk

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	122.433	17
30 min Summer	82.239	30
60 min Summer	52.662	48
120 min Summer	32.503	82
180 min Summer	24.118	116
240 min Summer	19.386	150
360 min Summer	14.268	216
480 min Summer	11.460	282
600 min Summer	9.659	344
720 min Summer	8.396	406
960 min Summer	6.724	530
1440 min Summer	4.907	778
2160 min Summer	3.573	1144
2880 min Summer	2.849	1496
4320 min Summer	2.067	2172
5760 min Summer	1.644	2880
7200 min Summer	1.377	3648
8640 min Summer	1.193	4368
10080 min Summer	1.056	5048
15 min Winter	122.433	17
30 min Winter	82.239	30
60 min Winter	52.662	50
120 min Winter	32.503	88

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	7.305	1.905	3.2	15.0	Flood Risk
240 min Winter	7.144	1.744	3.0	13.7	O K
360 min Winter	6.878	1.478	2.7	11.6	O K
480 min Winter	6.663	1.263	2.4	9.9	O K
600 min Winter	6.486	1.086	2.2	8.5	O K
720 min Winter	6.338	0.938	2.0	7.4	O K
960 min Winter	6.106	0.706	1.7	5.6	O K
1440 min Winter	5.800	0.400	1.4	3.1	O K
2160 min Winter	5.538	0.138	1.1	1.1	O K
2880 min Winter	5.447	0.047	0.9	0.4	O K
4320 min Winter	5.434	0.034	0.6	0.3	O K
5760 min Winter	5.427	0.027	0.5	0.2	O K
7200 min Winter	5.423	0.023	0.4	0.2	O K
8640 min Winter	5.420	0.020	0.4	0.2	O K
10080 min Winter	5.417	0.017	0.3	0.1	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
180 min Winter	24.118	124
240 min Winter	19.386	160
360 min Winter	14.268	230
480 min Winter	11.460	296
600 min Winter	9.659	362
720 min Winter	8.396	426
960 min Winter	6.724	550
1440 min Winter	4.907	794
2160 min Winter	3.573	1148
2880 min Winter	2.849	1436
4320 min Winter	2.067	2152
5760 min Winter	1.644	2896
7200 min Winter	1.377	3640
8640 min Winter	1.193	4320
10080 min Winter	1.056	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.053

Time (mins)	Area (ha)
0-4	0.053

Model Details

Storage is Online Cover Level (m) 7.600

Lined Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.36000
Infiltration Coefficient Side (m/hr)	0.36000
Safety Factor	2.0
Porosity	0.30
Invert Level (m)	5.400
Ring Diameter (m)	1.50
Pit Multiplier	2.0
Number Required	2
Cap Volume Depth (m)	0.000
Cap Infiltration Depth (m)	0.000