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Twickenham Riverside

Flood Risk Technical Note

London Borough of Richmond Upon Thames

Document Control

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Contents

Figures

Tables

1 Introduction

1.1 Scope of Report

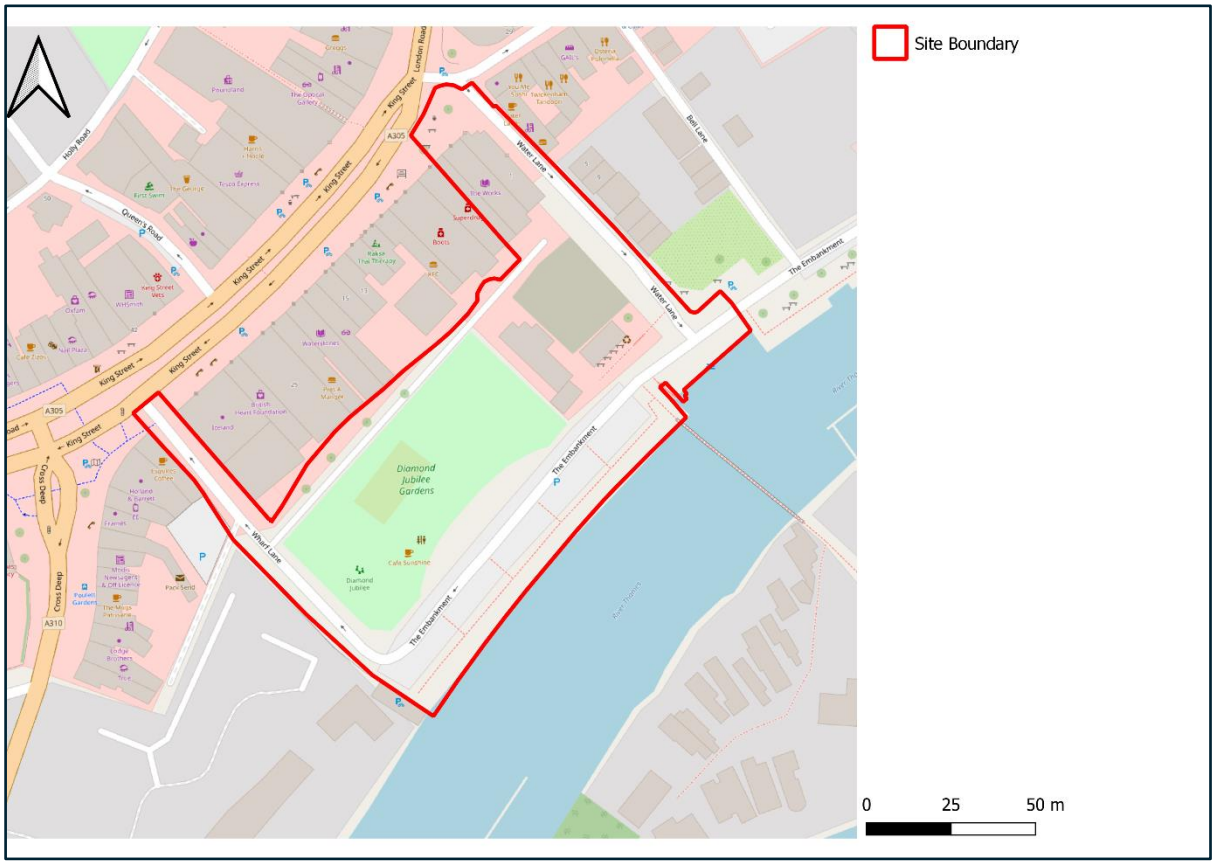
Logika Consultants Ltd were commissioned on behalf of London Borough of Richmond Upon Thames (hereafter referred to as the 'Applicant') to undertake an assessment of flood risk in relation to a proposed development at Twickenham Riverside (hereafter referred to as 'the Site'). This is in addition to the Flood Risk Assessment and Surface Water Drainage Strategy which have previously been submitted in support of the planning application.

1.2 Site Description

The Site is approximately 1.19 hectares (ha) in size and is located on the northern bank of the River Thames at Twickenham, within the London Borough of Richmond Upon Thames. The Site is bordered by the River Thames to the southeast, and by existing development to the northeast, northwest, and southwest (Figure 1-1). Wharf Lane and Water Lane join The Embankment, which passes through the eastern area of the Site.

The existing topographic survey is included in Appendix A1, and the proposed development is included in Appendix A2.

Figure 1-1 Site Location Map



1.3 Scope of Report

This report considers the impacts of altering existing ground levels within the Site as part of the proposed development, to ascertain the risk of flooding to certain areas of the Site pre and post development. The report focuses on the external areas of the Site and does not consider the built development, which has already been considered as part of the submitted Flood Risk Assessment.

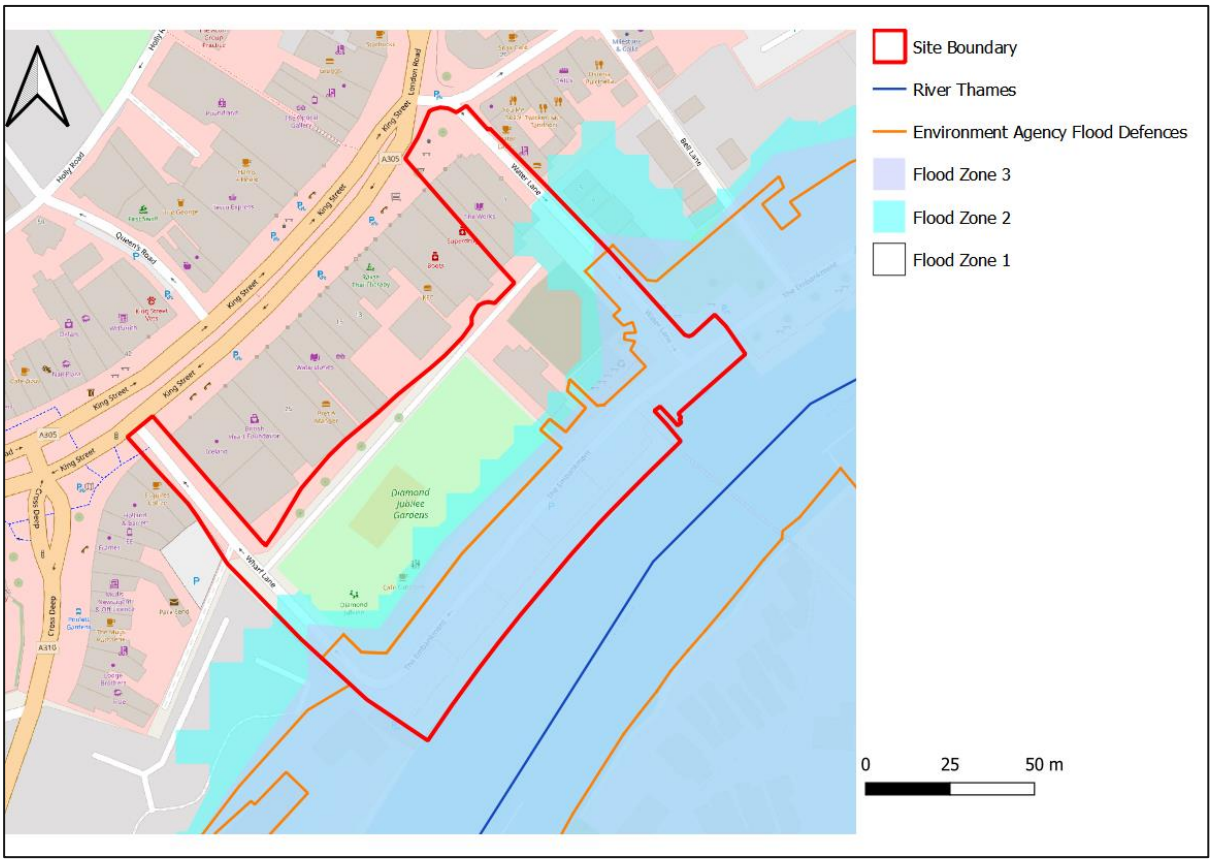
2 Data Analysis

2.1 Flood Map for Planning

The Environment Agency (EA) Flood Map for Planning shows the southern and eastern areas of the Site to be situated within Flood Zones 3 and 2, representing a high and medium probability of flooding from tidal and fluvial sources (Figure 2-1). The central and western areas of the Site are located within Flood Zone 1, indicating a low probability of tidal and fluvial flooding.

An existing flood defence is present through the central area of the Site, providing protection through naturally raised ground levels.

Figure 2-1 Environment Agency Flood Map for Planning



Source: Environment Agency Flood Map for Planning, (available at: https://flood-map-for-planning.service.gov.uk/).

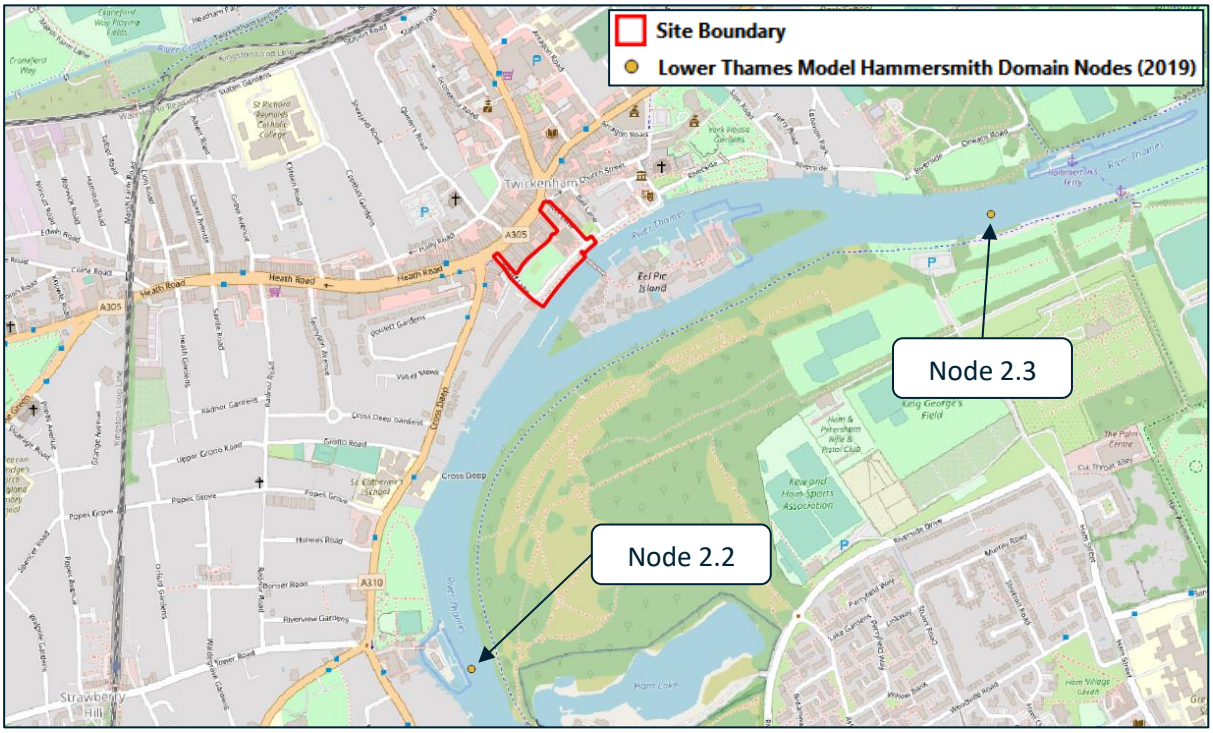
2.2 Environment Agency Hydraulic Model

2.2.1 Fluvial Modelling

EA modelled data was obtained from the Lower Thames Model (Hammersmith Domain, 2019), which covers the River Thames from West Molesey to Putney Bridge. The Site is located between model nodes 2.2 and 2.3, which are situated approximately 740m upstream and 725m downstream of the Site respectively. These were used as indicators of in-channel water levels at the Site for varying

probabilities. The node locations can be seen in Figure 2-2, and the respective modelled water levels are included in Table 2-1.

Figure 2-2 Lower Thames Model Hammersmith Domain (2019) Nodal Data Points



Source: Lower Thames Model (Hammersmith Domain) (2019)

Table 2-1 Lower Thames Hammersmith Domain Fluvial Nodal Levels

Node	1:5 year	1:10 year	1:20 year	1:50 year	1:75 year	1:100 year	1:100 year plus 25% CC	1:1000 year
2.2	5.11	5.23	5.33	5.68	5.80	5.90	6.35	7.24
2.3	5.00	5.11	5.20	5.50	5.61	5.71	6.26	6.90
Interpolated	**5.06**	**5.17**	**5.27**	**5.59**	**5.71**	**5.81**	**6.31**	**7.07**

Source: Lower Thames Model (Hammersmith Domain) (2019)

Whilst this is a fluvial model, the downstream boundary within the Hammersmith Domain model comprises a water level / time relationship extracted from the EA's 1D tidal model of the River Thames at Putney Bridge (model node 2.23). The EA 1D tidal River Thames model included simulation of the Thames Barrier operating at a frequency more consistent with a typical flood response.

Based on the interpolated flood levels set out in Table 2-1, the probability of the existing and proposed Site levels being flooded is set out in Table 2-2. This is based on the specific return periods as modelled by the EA, rather than interpolation between the respective return periods.

Embankment square would be flooded in a 1 in 5 annual probability event. The lower grass terrace would be affected between a 1 in 10 and 1 in 50 year annual probability event. The middle terrace would only be affected between a 1 in 100 year plus 25% climate change and 1 in 1000 year event. Data shows that the upper grass terrace would remain protected.

The existing and proposed Site locations referenced in Table 2-2 below are identified by the respective location letters (i.e. A, B, C etc) shown within Figure 2-3 and 2-4 respectively.

Table 2-2 Fluvial Probability of Site Flooding

Existing Site Use	Proposed Site Use	Ground Level (m AOD)	Return Period Exceeded (annual probability)
Location A Existing: Embankment walkway	Location A Proposed: Start of embankment square (designated open space)	4.75	1 in 5
Location B Existing: North west edge of car parking / bottom of access steps to raised seating area	Location B Proposed: Top of the embankment square	5.00	1 in 5
Location C Existing: Bottom of vehicle ramp	Location C Proposed: Start of the lower grass terrace	5.15	1 in 10
Location D Existing: The Lanes	Location D Proposed: Top of the lower grass terrace	5.45	1 in 50
Location E Existing: The Lanes	Location E Proposed: Start of the middle grass terrace	6.15	1 in 100 plus 25% climate change
Location F Existing: The Lanes	Location F Proposed: Top of the middle grass terrace	6.45	1 in 1000
Location G Existing: Main entrance to Diamond Jubilee Gardens	Location G Proposed: Start of the upper grass terrace	7.20	-

Figure 2-3 Existing Site Layout and Level Locations

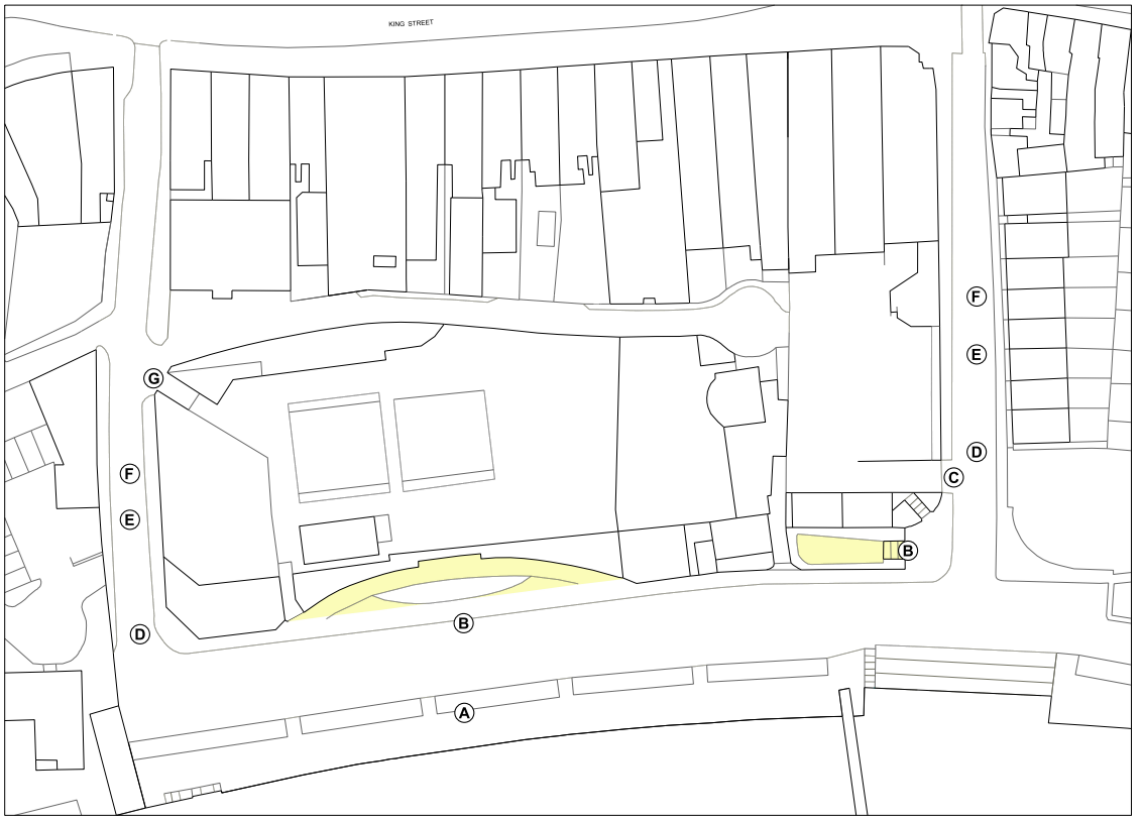
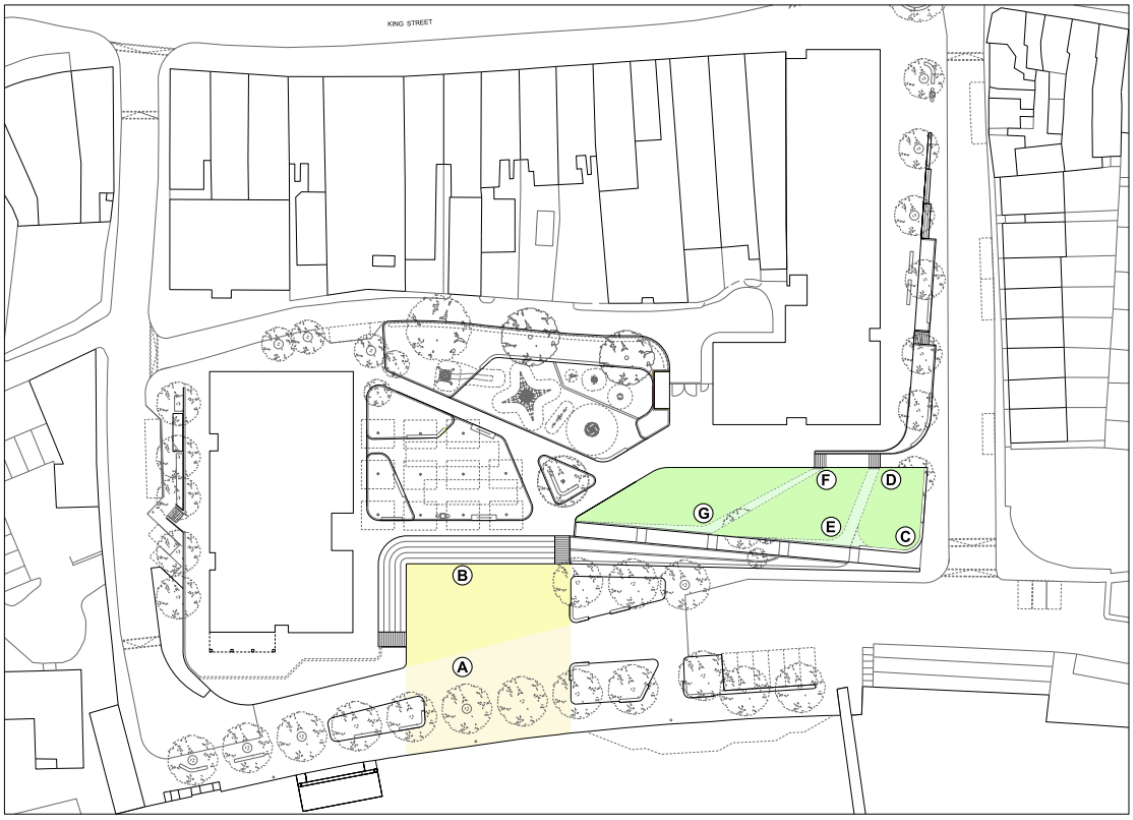


Figure 2-4 Proposed Site Layout and Level Locations



2.2.2 Tidal Modelling

Tidal flood levels were obtained from the EA's TE2100 hydraulic model, which quantifies the potential tidal flood risk based on extreme events. Data was provided at nodes 2.2 and 2.3, which are in similar locations to those shown in Figure 2-2. The on Site breach flood levels were also interrogated based on the Tidal Upriver Breach Inundation Modelling Study undertaken in 2017.

The flood levels upstream of the Thames Barrier are the highest levels permitted through operation of the Thames Barrier, and no return periods are provided. The associated flood levels are shown in Table 2-3.

Table 2-3 Tidal Flood Levels

Node	Present Day Water Level	Future 2065-2100 Water Level	Future 2100 Water Level
2.2	5.95	6.00	6.45
2.3	5.80	5.97	6.42
Interpolated	**5.87**	**5.98**	**6.43**
Breach Model	5.84	No data provided	6.42

Source: Thames Estuary 2100 Study (2008), and Tidal Upriver Breach Inundation Modelling Study (2017)

Based on the interpolated in channel flood levels set out in Table 2-3, the events at which the existing and proposed Site levels would be flooded is set out in Table 2-4. This is based on the specific events as modelled by the EA, rather than interpolation between the respective events.

Embankment square and the lower grass terrace would be flooded in a present day event, and the middle grass terrace would be flooded in a future 2100 scenario. The top of the middle terrace and upper terrace would remain protected.

Table 2-4 Tidal Events of Site Flooding

Existing Site Use	Proposed Site Use	Ground Level (m AOD)	Return Period Exceeded (annual probability)
Location A Existing: Embankment walkway	Location A Proposed: Start of embankment square (designated open space)	4.75	Present day
Location B Existing: North west edge of car parking / bottom of access steps to raised seating area	Location B Proposed: Top of the embankment square	5.00	Present day

Location C Existing: Bottom of vehicle ramp	Location C Proposed: Start of the lower grass terrace	5.15	Present day
Location D Existing: The Lanes	Location D Proposed: Top of the lower grass terrace	5.45	Present day
Location E Existing: The Lanes	Location E Proposed: Start of the middle grass terrace	6.15	Future 2100 scenario
Location F Existing: The Lanes	Location F Proposed: Top of the middle grass terrace	6.45	-
Location G Existing: Main entrance to Diamond Jubilee Gardens	Location G Proposed: Start of the upper grass terrace	7.20	-

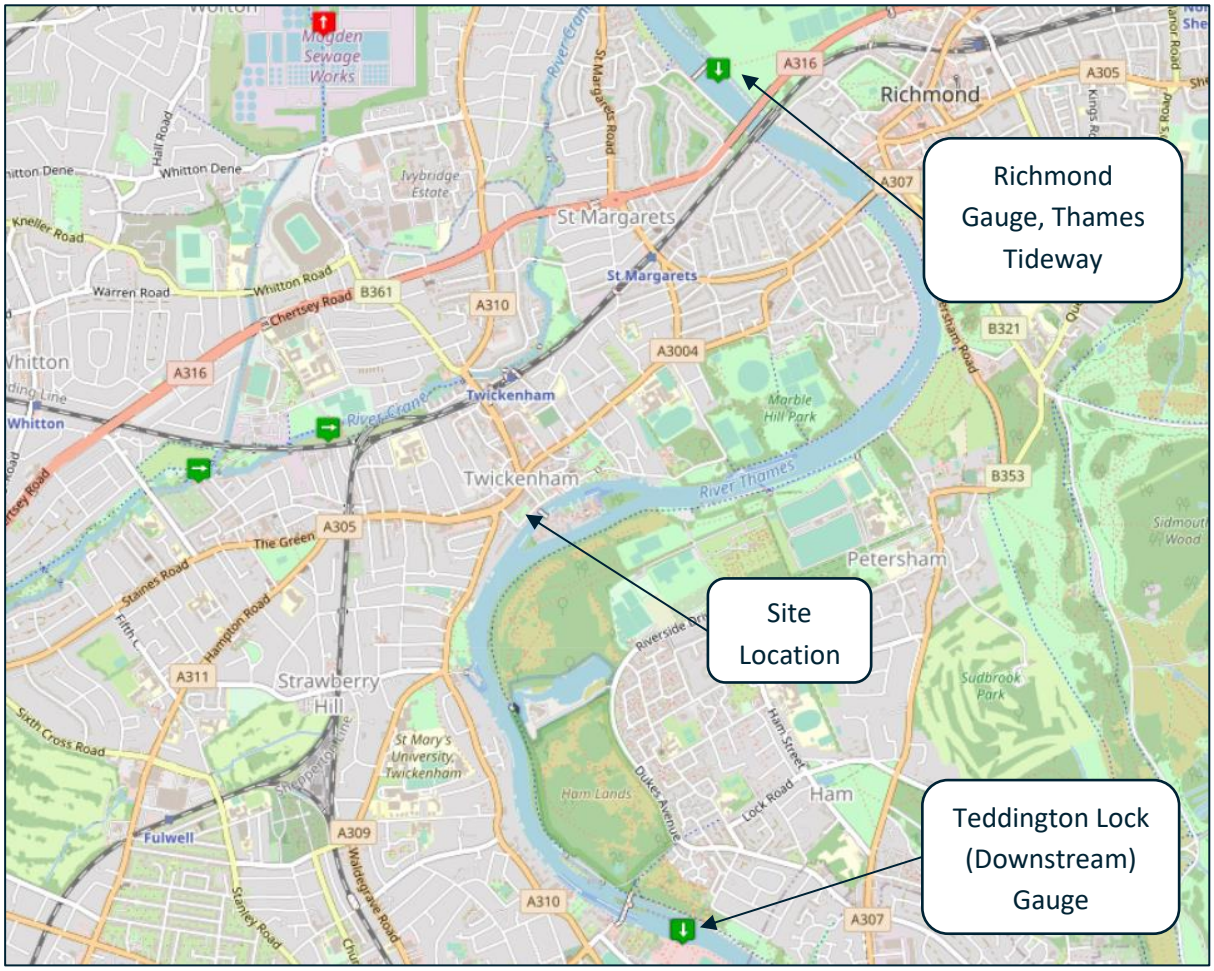
2.3 Environment Agency Historic Gauge Level Data

Historic River Thames level gauge data was also reviewed as part of this assessment, taken from the local EA gauging stations. The locations reviewed include a gauge at the downstream side of Teddington Lock, approximately 2.2km upstream of the Site, and at Richmond (Thames Tideway), approximately 3.5km downstream of the Site (Figure 2-5).

Gauge data obtained from EA online sources includes daily maximum, mean, and minimum water levels, but does not include levels of individual tides. The available records for the Richmond gauge covers the period from 26/11/2012, although this gauge appears to be set at a different datum until 05/10/2014, and therefore the first two years of data are not comparable. The records available for the gauge at the downstream side of Teddington Lock start in 17/12/2014. All data was taken until 15/03/2023.

As the Site lies in between these two gauging stations, water levels were also interpolated between the two gauges, when corresponding data was available at Teddington and Richmond (covering the period between 17/12/2014 and 15/03/2023). This interpolation assumed that on each particular day the change in tidal level between the two gauges would be constant with the distance between the gauges.

Figure 2-5 Environment Agency Gauge Location Map



The total number of days on which the Site levels were/would be overtopped based on an approximate 8 year period (i.e. end of 2014 to beginning of 2023) is detailed in Table 2-5.

It is worth noting that peak water levels at Teddington Lock and Richmond gauges do not always occur on the same day. The interpolated water levels assume a constant gradient between the two respective gauges. Therefore when Site levels could theoretically be exceeded at each respective gauge, it does not necessarily mean that the interpolated water levels are correspondingly high (i.e. the second gauge shows a lower water level). The gauge level locations and high level details are provided in Appendix A3.

Table 2-5 Comparison of Site Levels and Potential Historic Exceedance

Existing Site Use	Proposed Site Use	Ground Level (m AOD)	No. of times level exceeded at Teddington Lock	No. of times level exceeded at Site (interpolated)	No. of times level exceeded at Richmond
Location A Existing: Embankment walkway	Location A Proposed: Start of embankment square (designated open space)	4.75	189	**144**	102
Location B Existing: North west edge of car parking / bottom of access steps to raised seating area	Location B Proposed: Top of the embankment square	5.00	39	**19**	5
Location C Existing: Bottom of vehicle ramp	Location C Proposed: Start of the lower grass terrace	5.15	6	**0**	5
Location D Existing: The Lanes	Location D Proposed: Top of the lower grass terrace	5.45	0	**0**	0
Location E Existing: The Lanes	Location E Proposed: Start of the middle grass terrace	6.15	0	**0**	0
Location F Existing: The Lanes	Location F Proposed: Top of the middle grass terrace	6.45	0	**0**	0
Location G Existing: Main entrance to Diamond Jubilee Gardens	Location G Proposed: Start of the upper grass terrace	7.20	0	**0**	0

The total number of days that the Site levels have been exceeded historically needs to be put in context to the number of days the gauged data has been collected. Teddington Lock includes 2976 days, Richmond includes 3076 dates, and the interpolated data includes 2974 days.

Based on the Interpolated data, Table 2-6 sets out the number of times the Site levels have been exceeded in comparison to the total number of days.

Table 2-6 Historic Likelihood of Site Level Exceedance

Level (m AOD)	Number of days gauged data available	No. of times level exceeded at Site (interpolated)	% Site Level Exceeded
4.75	2974	144	4.8%
5.00	2974	19	0.6%

Over the study period neither gauge indicated that water levels have historically been higher than the proposed top level of the lower grass terrace (5.45m AOD). Accordingly, this area of the Site would not be overtopped under equivalent conditions.

The proposed level at the start (4.75m AOD) and top (5.00m AOD) of the embankment square were calculated as being overtopped on 144 and 19 occasions respectively, during the study period. No other proposed level on Site was calculated to have been overtopped over this time period.

2.3.1 Seasonality of Exceedance Events

The seasonality of the data has also been considered, to understand whether exceedance events are more likely to occur during certain months of the year.

The interpolated historic water levels included in Table 2-7 show that the start of embankment square (set at 4.75m AOD) would have been exceeded 144 times over the past 8 years. Interrogation of the data shows that these events mainly occurred between October and April, with February having the most instances. Only a few occurrences have been recorded between May and September, with no exceedances recorded in July.

The top of embankment square (set at 5.00m AOD) would have been exceeded 19 times over the past 8 years. Interrogation of the data similarly shows that the majority of these events occurred in February, with no events during June to September.

The data shows that the number of exceedance events is seasonally effected, with the majority of events occurring in winter/early spring, and very few events occurring during summer months.

Table 2-7 Seasonality of Exceedance Events

Month	Number of occurrences (>4.75m AOD)	Number of occurrences (>5.00m AOD)
January	23	2
February	25	7
March	23	2
April	19	4
May	5	1
June	2	
July		
August	1	
September	5	
October	11	1
November	11	2
December	19	2
Total	144	19

Taking a precautionary approach, whilst the interpolated data shows that 5.15m AOD (i.e. the start of the lower grass terrace) would not have been exceeded at the Site, for this event the seasonality of data at both the Teddington Lock and Richmond gauges has also been considered in terms of seasonality.

As seen in Table 2-8 this similarly shows a seasonal trend, with exceedance events not having occurred during summer months. 5.15m AOD was only exceeded at Teddington Lock in March, April, and December. Levels at Richmond gauge were only exceeded in May, October, and December.

Table 2-8 Teddington and Richmond Locks, Seasonality of Exceedance Events

Month	Teddington Lock Lower Number of occurrences (>5.15m AOD)	Richmond Lock Number of occurrences (>5.15m AOD)
January		
February		
March	1	
April	3	
May		1
June		
July		
August		
September		
October		3
November		
December	2	1
Total	6	5

3 Conclusion

The EA Flood Map for Planning shows that the south eastern area of the Site is located within Flood Zones 3 and 2, indicating a high to medium risk of flooding from tidal and fluvial sources. The central and north western areas of the Site are located within Flood Zone 1, and are therefore at a low risk of tidal and fluvial flooding.

To assess the risk to the existing and proposed external areas of the Site, flood data has been reviewed based on the EA's fluvial hydraulic model for varying return periods (1 in 5 year to 1 in 1000 year event). The EA's TE2100 tidal model has also been considered, which takes into account extreme tidal events.

In the proposed situation, embankment square would be flooded in a 1 in 5 annual probability event. The lower grass terrace would be affected between a 1 in 10 and 1 in 50 year annual probability event. The middle terrace would only be affected between a 1 in 100 year plus 25% climate change and 1 in 1000 year event. Data shows that the upper grass terrace would remain protected.

The extreme tidal flood levels have the potential to affect embankment square and the lower grass terrace in a present day event, and the middle grass terrace in a future 2100 scenario. The top of the middle terrace and upper terrace would remain protected.

Historic data from the nearest level gauges (at the downstream side of Teddington Lock and at Richmond) have also been compared and daily maximum water levels for the Site were interpolated.

The proposed level at the start (4.75m AOD) and top (5.00m AOD) of the embankment square were calculated as being overtopped on 144 (4.8%) and 19 (0.6%) occasions respectively, during the study period of approximately 8 years. Interrogation of the data shows that the majority of events occurred in winter/early sprint, with very few events occurring during summer months.

No other proposed level on Site was calculated to have been overtopped over this time period. Over the study period neither gauge indicated that water levels have historically been higher than the proposed top level of the proposed lower grass terrace (5.45m AOD).

4 Appendices

A1 Site Topographic Survey

TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AH	Arch Head Height	FH	Fire Hydrant	RSJ	Rolled Steel Joist
AR	Assumed Route	FBD	Floor Board Direction	SI	Sign Post
AV	Air Valve	FR	Flex Hydrant	SP	Arch Spring Point Height
BB	Belisha Beacon	FL	Floor Level	SV	Stop Valve
BH	Bore Hole	FP	Flag Pole	SW	Surface Water
BL	Bed Level	FW	Foul Water	ST	Step
BO	Bollard	GG	Gully Grate	Tac	Tactile Paving
BrP	Brace Post	GV	Gas Valve	TC	Telecom Cover
BS	Bus Stop	HH	Head Height	Tre	Tree Pit
BU	Bush	IC	Inspection Cover	THL	Threshold Level
B/W	Barbed Wire Fence	IL	Invert Level	TL	Traffic Light
BX	Box (Utilities)	IR	Iron Railings	TcW	Top of Wall
C/B	Close Board Fence	KD	Kerb Outlet	TP	Telegraph Pole
CH	Cill Height	LP	Lamp Post	TV	Cable TV Cover
CL	Cover Level	MH	Manhole	UB	Universal Beam
CL	Chain Link Fence	MP	Marker Post	UC	Unknown Cover
CL	Ceiling Level	MB	Metal Barrier	UP	Unknown Pipe
Cot	Cottage	OHL	Overhead Line (approx)	USB	Under Side Beam
C/P	Chestnut Paling Fence	Pan	Panel Fence	UTL	Unable To Lift
CR	Cable Riser	PB	Post Box	VP	Vent Pipe
DC	Drainage Channel	PM	Parking Meter	WB	Waste Bin
DH	Door Head Height	PO	Post	WH	Wasp Hole
DP	Down Pipe	P/R	Post & Rail Fence	WL	Water Level
DR	Drain	P/W	Post & Wire Fence	WM	Water Meter
EL	Eaves Level	P/Wall	Partition Wall	WO	Wash Out
EP	Electric Pole	RE	Rodding Eye		Floor to Ceiling Height
ER	Earth Rod	RL	Ridge Level		FC Floor to Fake Ceiling Ht
ET	EP+Transformer	RP	Reflector Post		
FB	Flower Bed	RS	Road Sign		
FBD	Floor Board Direction	RSD	Roller Shutter Door		Survey Control Station

DRAWING NOTE

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

Do not scale from this drawing.

SURVEY GRID AND LEVEL DATUM

The co-ordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using GPS Smartnet, then orientated to Grid North with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies, any co-ordinated data used in conjuction with this survey must be derived directly from this control data.

SURVEY GRID AND LEVEL DATUM

The co-ordinate system for this survey is related to Ordnance Survey (OS) national grid at a single point using GPS Smartnet, then orientated to Grid North with a scale factor of 1.000.

The survey grid is based on arbitrary coordinates for survey control point [ST01] of 1000.000mE, 1500.000mN and a [magnetic] bearing of [180]° between [ST01] and [ST02] with a scale factor of 1.000.

The survey grid is based on the following existing survey control points which were previously established by others.

ST01 - 1234.000mE, 1234.000mN
ST02 - 1234.000mE, 1234.000mN

All levels relate to an arbitrary level datum value of 50.00m which has been assigned to survey control point ST01.

The level datum established for this survey is related to the Ordnance Survey (OS) using GPS Smartnet.

All levels relate to an Ordnance Survey (OS) benchmark situated on [big house] and taken as [123.4m].

All levels relate to an existing survey control point [ST01] and taken as [123.45m] which was previously established by others.

To avoid discrepancies, any co-ordinated data used in conjunction with this survey must be derived directly from this control.

The major contour interval is 1 metre and the minor contour interval is 0.500 metres.

SURVEY GRID AND LEVEL DATUM

The co-ordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using GPS Smartnet, then orientated to Grid North with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies, any co-ordinated data used in conjuction with this survey must be derived directly from this control data.

CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
SB03	516258.475	173172.864	8.040	Pk Nail
SB04	516241.665	173154.584	7.764	Pk Nail
SB05	516225.402	173126.501	7.163	Pk Nail
SB06	516193.681	173167.687	7.175	Pk Nail
SB09	516291.346	173257.364	7.768	Pk Nail
ST01	516314.247	173232.087	6.601	Pk Nail
ST04	516256.539	173211.240	7.649	Pk Nail
ST05	516277.855	173181.813	8.120	Pk Nail
BP01	516358.615	173186.327	4.139	Pk Nail
BP02	516333.265	173149.807	4.504	Pk Nail
BP03	516291.364	173059.512	4.484	Pk Nail
BP04	516279.810	173115.191	5.201	Pk Nail
BP05	516259.546	173053.094	5.390	Pk Nail

REV	DESCRIPTION	DRAWN	APPR	DATE

SURVEY SOLUTIONS

Ipswich Coventry Yeovil Norwich Perth Nottingham Brentwood

Tel No: 0845 0405 969 Fax No: 0845 0405 970
www.survey-solutions.co.uk enquiries@survey-solutions.co.uk

LAND SURVEYING BUILDING SURVEYING UNDERGROUND SURVEYING

PROJECT TITLE: KING STREET, TWICKENHAM, TW1 3SN.				
DRAWING DETAIL: TOPOGRAPHICAL SURVEY Sheet 1 of 1				
CLIENT: LDN BOROUGH OF RICHMOND UPON THAMES				SCALE: 1:200
SURVEYOR: BP/HF	SURVEY DATE: 26-05-2020	CHECKED BY: JM	APPROVED BY: JM	DWG STATUS: FINAL
DRAWING NUMBER: 26576se-01			REVISION:	ISSUE DATE: 25-06-2020

A2 Development Proposals

X:\JOBS\6975_TWICKENHAM_RIVERSIDE\7CAD\DRAWINGS\PLANING DRAWINGS\6975_100.DWG

KEY

- PLANNING APPLICATION BOUNDARY
- +(0.00) EXISTING LEVELS
- +0.00 PROPOSED LEVELS

HARDWORKS

- PAVING TYPE 01 - SMALL SIZED MODULES OF NATURAL STONE TO FOOTWAYS & SHARED SURFACE
- PAVING TYPE 02 - SMALL SIZED MODULES OF NATURAL STONE TO BOAT HOUSE ROOF
- PAVING TYPE 03 - LARGE SIZED NATURAL STONE TO SQUARE
- PAVING TYPE 04 - RESIN BOUND GRAVE
- PAVING TYPE 05 - SELF BINDING GRAVEL
- PAVING TYPE 06 - PLAY SAND
- PAVING TYPE 07 - TACTILE PAVING
- PAVING TYPE 08 - TARMAC;
- PAVING TYPE 10 - WET POUR RUBBER PLAY SURFACE
- PAVING TYPE 11- GRANITE SETTS
- RETAINING WALL
- BALUSTRADE
- EDGE TYPE 01 - LOW RAISED BRICK EDGE
- EDGE TYPE 02 - FLUSH BRICK EDGE
- EDGE TYPE 03 - RAISED GRANITE KERB EDGE
- EDGE TYPE 04 - RAISED GRANITE EDGE
- EDGE TYPE 05 - FLUSH GRANITE EDGE
- BRICK WALL TYPE 01 - RAISED BRICK WALL TO SERVICE ROAD PLANTER
- GARDEN STORAGE SHED- BRICK WALL TO MATCH ADJACENT PLANTER WITH GREEN ROOF; TO ARCHITECTS DETAIL
- PLANTED TERRACES - TIMBER EDGE, EUROPEAN OAK SLEEPER; 200MM X 100MM VERTICAL SLATS; FIXED TO SUPPORT FRAME; FINISH NATURAL; BY WOODSCAPE OR EQUAL AND APPROVED
- CYCLE STAND; SHEFFIELD CYCLE STAND 750MM X 900MM BY MARSHALL'S OR EQUAL AND APPROVED
- FIXED & TELESCOPIC BOLLARDS, STAINLESS STEEL GRADE 316; 900MM HIGH BY ATG ACCESS OR EQUAL AND APPROVED
- BINS PROPOSED TO MATCH EXISTING
- METAL EDGE AND SELF BINDING GRAVEL TO TREE SURROUNDS IN HARD STANDING
- SEATING TERRACES; EUROPEAN OAK SLEEPER; 200MM X 100MM VERTICAL SLATS; PREFIXED TO SUPPORT FRAME; FINISH NATURAL
- STEPS & ASSOCIATED HANDRAILS
- CHESS TABLE AND CHAIRS, SUPPLIER TBC

- BA BENCH TYPE A- ACCOYA WOOD, VIRGIN, POWDER COATED BASE TO RAL TBC BY STREET LIFE OR EQUAL AND APPROVED
- BB BENCH TYPE B- ACCOYA WOOD, VIRGIN, POWDER COATED BASE TO RAL TBC BY STREET LIFE OR EQUAL AND APPROVED
- BC BENCHE TYPE C - ACCOYA WOOD, VIRGIN, TO TOP OF WALL BASE; FINISH NATURAL BY WOODSCAPE OR EQUAL AND APPROVED
- PLAY EQUIPMENT
- EXISTING LAMPPOSTS (LP), GULLEYS (GG), SIGNS (SI), FEEDER PILLARS (FP) & MANHOLES (MH)
- PROPOSED POWER
- PROPOSED WATER FOUNTAIN
- PROPOSED MULTI DIRECTIONAL LIGHT POSTS
- LIFEBUOY (SPECIFICATION TBC)
- SLOT DRAIN/GULLEY

SOFTWORKS

- HERBACEOUS PLANTING
- RAIN GARDENS
- LAWN
- EXISTING TREES
- PROPOSED TREES
- PROPOSED PLEACHED TREES
- PROPOSED FLOATING HABITAT
- CLIMBERS ON TRELLIS SYSTEM
- EXISTING TREES RPA

REV.	DESCRIPTION	APP.	DATE
F	Update to include changes to Trees	AH	04/08/22
E	Response to Planners Comments	AH	26/07/22
D	Wharf Lane Highways Amendment	AH	27/04/22
C	Response to Planners Comments	AH	21/04/22
B	Response to Planners Comments	AH	10/12/21
A	Planning Issue	AH	29/07/21

LDĀDESIGN

PROJECT TITLE
TWICKENHAM RIVERSIDE

DRAWING TITLE
General Arrangement Plan

ISSUED BY	London	T: 020 7467 1470	
DATE	JULY 2021	DRAWN	NR
SCALE@A1	1:250	CHECKED	AH
STATUS	Planning	APPROVED	AH

DWG. NO 6975_100

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

Sources Ordnance Survey

0 10m

A3 Environment Agency Gauge Level Data Analysis

Gauge level data for Teddington Lock (Downstream) was downloaded from River Levels UK at: River Thames at Teddington Lock (Downstream) :: the UK River Levels Website

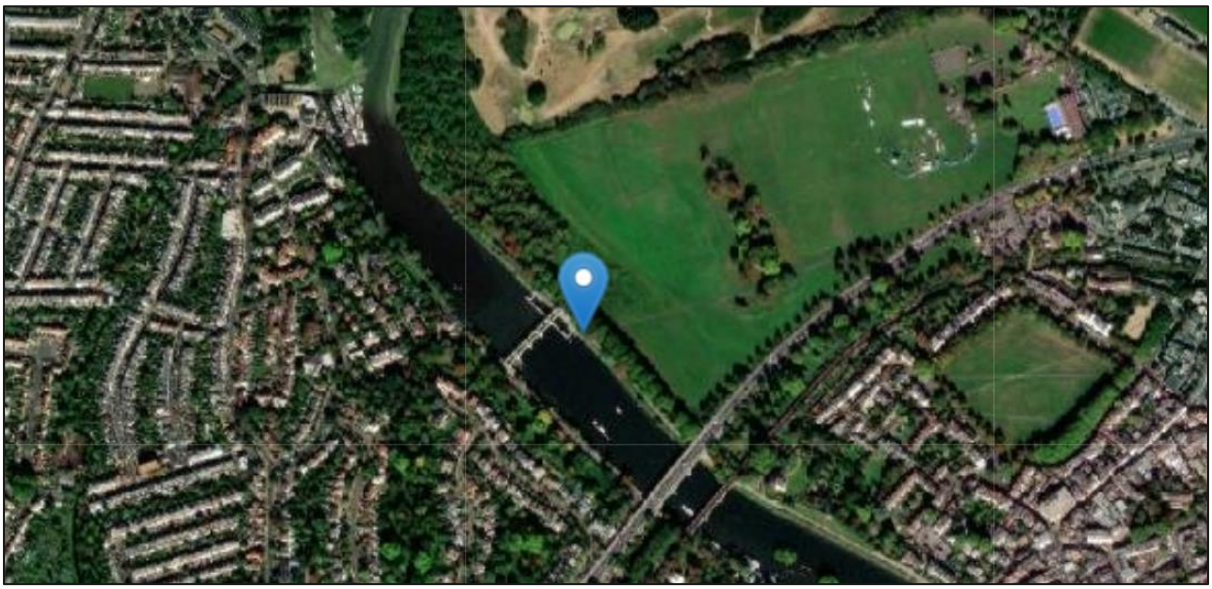
The exact location of this gauge is shown below.

The Location and Technical Data details for this gauge is as follows:

- Monitoring Station: Teddington Lock
- Watercourse: Thames
- Coordinates: 51°25'46"N 0°19'6"W (51.429566,-0.318416)
- OS Grid: TQ169714 (516999,171404)
- Environment Agency Location ID: 3401TH
- Environment Agency Gauge ID: 3401TH-level-downstage-i-15_min-mASD
- Operational Area: Tidal Thames
- Datum Type: Above Stage Datum (ASD)
- Stage Datum: -1.079m AOD

Gauge Level data for Thames Tideway at Richmond Upon Thames was downloaded from River Levels UK at: [Thames Tideway at Richmond :: the UK River Levels Website]

The exact location of this gauge is shown below.



The Location and Technical Data for this gauge is as follows:

- Monitoring Station: Richmond
- Watercourse: Thames Tideway
- Coordinates: 51°27'44"N 0°18'58"W (51.462258,-0.316193)
- OS Grid: TQ170750 (517070,175043)
- Environment Agency Location ID: 0009
- Environment Agency Gauge ID: 0009-level-tidal_level-i-15_min-mAOD
- Operational Area: Tidal Thames
- Datum Type: Above Ordnance Datum (AOD)

The distance between the two gauges, along the central course of the River Thames, was measured to be 5.62km. The Site is 2.17km downstream from the Teddington Lock (Downstream) gauge, which is 38.6% of the distance between the two gauges. In order to calculate the interpolated water level at the Site a factor of 0.386 was applied to all water level differences from Teddington Lock (Downstream) to Richmond Upon Thames (Thames Tideway) gauge.