

Warrender Primary School, Ruislip
Flood Risk Assessment and Drainage Strategy

October 2016



DOCUMENT VERIFICATION RECORD

CLIENT:	The London Borough of Hillingdon
SCHEME:	Proposed school expansion at Warrender Primary School, Old Hatch Manor, Ruislip, HA4 8QG - Flood Risk Assessment and Drainage Strategy
INSTRUCTION:	The instruction to carry out this Flood Risk Assessment and Drainage Strategy was received from Zoe Palphramand of Arcadis LLP acting on behalf of the client

DOCUMENT REVIEW & APPROVAL

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ISSUE HISTORY

ISSUE DATE	COMMENTS
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Introduction

Waterco Consultants have been commissioned to undertake a Flood Risk Assessment (FRA) and Drainage Strategy to support the planning application in respect of a proposed expansion at Warrender Primary School, Old Hatch Manor, Ruislip, HA4 8QG.

The purpose of this report is to outline the potential flood risk to the site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified flood risk. This report has been prepared in accordance with National Planning Practice Guidance (NPPG).

From April 2015, the London Borough of Hillingdon as a Lead Local Flood Authority (LLFA) is a statutory consultee for planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a Sustainable Drainage Strategy. The aim of the Sustainable Drainage Strategy is to identify water management measures, including sustainable drainage systems (SuDS), to provide surface water runoff reduction and treatment.

Existing Conditions

The site is located at National Grid Reference: 509962E 187721N and covers an area of approximately 1.23hectares (ha). The existing site comprises of an existing school with associated car parking, access road and yard area occupying 3,834m² or 31.2% of the site area. The remaining 68.8% comprises of landscaped and soft play areas. A location plan and an aerial image are included in Appendix A.

The site is bordered by residential properties on all sides, with Eastcote Road to the north and Old Hatch Manor (road) to the south. Access is currently provided to the south of the site via Old Hatch Manor.

Local Topography

A Topographical Survey has been undertaken and is included in Appendix B. The topographical survey, with levels to an arbitrary site datum, indicates that the site slopes from the south to the north, with levels varying from 20.73meters Above Datum (m AD) to 14.43m AD, within the proposed development area. The lowest point on site is located at the end of the access road to the south of the site (13.51m AD).

Ground Conditions

The British Geological Survey online mapping (1:50,000 scale) indicates that the site is underlain by bedrock comprising the Lambeth Group consisting of Clay, Silt and Sand. No superficial deposits are identified.

According to the BGS online Aquifer Mapping, the Lambeth Group bedrock is identified as a Secondary A aquifer, which is described as permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases form an important source of base flow to rivers.

Reference to the Environment Agency's online groundwater Source Protection Zone maps indicates that the site is located within a Total Catchment (Zone 3) groundwater Source Protection Zone.

The soil is described 'slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils' with 'impeded drainage' by the National Soil Resources Institute.

Local Drainage

Reference to the Thames Water public sewer records (Appendix C) show that there is a 225mm public surface water sewer in Old Hatch Manor to the south of the site. This sewer flows north-east before continuing north along The Ridgeway (road). The Thames Water sewer plan identifies that the nearest manhole for this sewer (ref: 0501) has a cover level of 57.46m AOD and an invert level of 55.71m AOD. There is also a 225mm public foul sewer located within Old Hatch Manor. Manhole 9501 identifies a cover level of 58m AOD and an invert level of 53.09m AOD for this sewer.

Two no. 225mm public foul sewers are identified to the north of the site in Eastcote Road. The closest manhole to the site, ref: 9801, identifies a cover level of 48.04m AOD and an invert level of 45.26m AOD. There is also a 225mm public surface water sewer located in Eastcote Road. Manhole 8706 has a cover level of 48.57m AOD and an invert level of 46.91m AOD.

There is a 225mm public surface water sewer and a 225mm public foul sewer located approximately 50m west of the site in Windmill Hill (road). There is also a 225mm public foul sewer located approximately 53m east of the site in The Ridgeway.

Development Proposals

The proposed development is for the expansion of the existing Warrender Primary School with the erection of an additional building and nursery, additional car parking, playground, mini soccer field

and landscaping. A review of the Proposed Site Plan, included in Appendix B, indicates the development will include approximately 3,190m² of building footprint and hard-standing over both existing hard-standing and soft landscaped areas.

Flood Zone Category & Planning Policy

The Environment Agency (EA) 'Flood Map for Planning (Rivers and Sea)' included in Appendix D shows that the site is located within an area considered to be outside of the extreme flood extent (Flood Zone 1) meaning it has a less than 1 in 1000 (0.1%) annual probability of flooding.

In accordance with NPPF the risk-based 'Sequential Test' should firstly be applied to steer new development into areas of lower probabilities of flooding. The site is located in Flood Zone 1; an area considered at low risk of fluvial flooding. Table 2 of the NPPG: Flood Risk and Coastal Change categorises educational establishments as 'more vulnerable' development. Table 3 of the NPPG: Flood Risk and Coastal Change states that 'more vulnerable' development is considered appropriate in Flood Zone 1. The site therefore passes the Sequential Test.

In accordance with Table 3 of the NPPG the 'Exception Test' does not need to be applied for 'more vulnerable' development in Flood Zone 1.

Local Planning Policy

The London Borough of Hillingdon Council Local Plan Part 1 - Strategic Policies (Adopted November 2012) contains the following policies relating to flood risk and drainage;

Policy EM6: Flood Risk Management:

- *The Council will require new development to be directed away from Flood Zones 2 and 3 in accordance with the principles of the National Planning Policy Framework (NPPF).*
- *The subsequent Hillingdon Local Plan: Part 2 - Site Allocations LDD will be subject to the Sequential Test in accordance with the NPPF. Sites will only be allocated within Flood Zones 2 or 3 where there are overriding issues that outweigh flood risk. In these instances, policy criteria will be set requiring future applicants of these sites to demonstrate that flood risk can be suitably mitigated.*
- *The Council will require all development across the borough to use sustainable urban drainage systems (SUDS) unless demonstrated that it is not viable. The Council will*

encourage SUDS to be linked to water efficiency methods. The Council may require developer contributions to guarantee the long term maintenance and performance of SUDS is to an appropriate standard.

The development site is within the London Borough of Hillingdon which is covered by the London Plan, as amended in March 2015. The London Plan contains various policies pertaining to flood risk and drainage, the relevant aspects of which are reproduced below.

Policy 5.13 Sustainable drainage

'This policy states 'development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve Greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

- *store rainwater for later use;*
- *use infiltration techniques, such as porous surface in non-clay areas;*
- *attenuate rainwater in ponds or open water features for gradual release;*
- *attenuate rainwater by storing in tanks or sealed water features for gradual release;*
- *discharge rainwater direct to a watercourse;*
- *discharge rainwater to a surface water sewer/drain; and*
- *discharge rainwater to the combined sewer.*

Drainage should be designed and implemented in ways that deliver other policy objectives of the Plan, including water use efficiency and quality, biodiversity, amenity and recreation.'

The London Plan is supported by the Supplementary Planning Guidance: Sustainable Design and Construction, April 2014. In relation to Surface Water Flooding and Sustainable Drainage, the guidance states that developers should design Sustainable Drainage Systems (SuDS) that incorporate attenuation for surface water runoff. The Mayor's priority is to achieve greenfield runoff rates. Development on greenfield sites must maintain a greenfield runoff rate. Development on previously developed sites should have a runoff rate no greater than three times the calculated greenfield runoff rate.

Local guidance documents including the London Borough of Hillingdon Strategic Flood Risk Assessment (SFRA) (November 2008), the Addendum to the SFRA and Sequential Test (October

2015) and the London Borough of Hillingdon Preliminary Flood Risk Assessment (PFRA) (May 2011) have been reviewed to inform this report.

Consultation

The London Borough of Hillingdon as the LLFA has been consulted to establish any site specific requirements in relation to flood risk and surface water drainage. Correspondence is included in Appendix E. They state that they do not provide informal comments without undertaking a formal pre-application enquiry, which is a chargeable service.

Sources of Flooding and Probability

Fluvial

The nearest watercourse is River Pinn, which is located approximately 410m north of the site. The River Pinn flows south-west in this location, away from the site.

The SFRA and PFRA contain no records of fluvial flooding within the vicinity of the site. This is confirmed on the PFRA 'Summary Map of Past floods – Main River / Fluvial / Tidal incident' included in Appendix F.

The site is located in Flood Zone 1, an area considered to have the lowest risk of fluvial flooding. It can be concluded that the site is not at risk from fluvial flooding.

Tidal

The site is located at approximately 55m AOD and is significantly above sea level. It can therefore be concluded that the site is not at risk of tidal flooding.

Surface Water

Surface water flooding occurs when rainwater does not drain away through the normal drainage system or soak into the ground. It is usually associated with high intensity rainfall events, but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen or developed, resulting in overland flow and ponding in depressions in topography. Surface water

flooding can occur anywhere without warning. However, flow paths can be determined by consideration of contours and relative levels.

The EA 'Risk of Flooding from Surface Water' map (Appendix D) shows that the southern extent of the existing building is shown to be at low risk, with between a 1% and 0.1% annual probability of surface water flooding.

However, the EA map indicates that the proposed location for the new buildings, car parking and hard-standing areas are at a very low risk (less than 0.1% annual probability) of surface water flooding.

The SFRA and PFRA contain no records of surface water flooding at the site. The PFRA 'Summary Map of Past Floods – Surface Water Incidents' included in Appendix F indicates that there have been no historical flooding incidents at the site.

The PFRA 'Surface Water Depth (m) 1 in 200 Chance of rainfall event occurring in any given year (0.5% AEP)' map and the 'Surface Water Depth (m) 1 in 100 plus climate change chance of rainfall event occurring in any given year (1% AEP + CC)' map (included in Appendix F) indicates that the majority of the site is not at risk from surface water flooding during the 0.5% Annual Exceedance Probability (AEP) and 1% AEP + climate change (CC) events. Isolated low points within the site experience flood depths of up to 250mm during these events. The proposed buildings, car park and hard-standing areas are not shown within the surface water flood extent.

Any potential surface water flooding in the area would be directed north, away from the site, following the local topography.

It can therefore be concluded that the site is low risk from surface water flooding.

Sewer Flooding

Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged, or is of inadequate capacity. Flooding is mostly applicable to combined and surface water sewers.

The PFRA 'Summary Map of Past Floods – Sewer incidents' (Appendix F) indicates that there have been 6-10 recorded sewer flooding incidents within the site's postcode sector (HA4 8). However, there are no records of sewer flooding affecting the site.

Any potential sewer flooding arising within the vicinity of the site would be directed north, away from the site, following the local topography.

It can therefore be concluded that the risk of sewer flooding is low.

Groundwater Flooding

Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.

The PFRA 'Summary Map of Past Floods – Ground Water Incidents' (Appendix F) indicates that there have been no groundwater flooding incidents recorded within the vicinity of the site. It can therefore be concluded that the risk of groundwater flooding is low.

Artificial Sources of Flooding

There are no canals within the vicinity of the site. The site is not shown to be at risk of flooding from reservoirs on the EA 'Risk of Flooding from Reservoirs' map (Appendix D). Therefore the probability of flooding from artificial sources can be considered to be low.

Summary of Potential Flooding

It can be concluded that the site is at low risk of flooding from all sources. As such, no flood resilience measures are considered necessary for the new buildings.

Surface Water Management

The existing site comprises of an infant and junior school with associated hard-standing and playing fields. It is assumed that surface water from the site is currently discharging to the Thames Water 225mm public surface water sewer to the north of the site in Eastcote Road. This will be confirmed via a drainage survey (which has been commissioned).

To comply with London Borough of Hillingdon planning policy and The London Plan, all sites should aim to achieve greenfield runoff rates.

Greenfield runoff rates have been estimated using the ICP SuDS (Flood Studies Report) method within MicroDrainage (included as Appendix G). The existing QBAR rural runoff rate for the proposed

3,190m² development area (area of proposed buildings and hard-standing) is 1.4 l/s. The 1 in 100 year runoff rate is 4.4 l/s.

In order to facilitate a self-cleansing system a maximum discharge rate of 5 l/s should be utilised for the site.

Attenuation Storage

In order to achieve a limited discharge rate of 5 l/s attenuation storage will be required. An attenuation storage estimate has been provided using MicroDrainage and is included in Appendix G. An estimated storage volume of 162m³ will be required to accommodate the 1 in 100 year plus 40% Climate Change (CC) event. The attenuation volume is based on storage within a tank or pond structure, hydro-brake flow control and an impermeable area of 3,190m² which accounts for all proposed impermeable areas including the new buildings and hard-standing areas.

The attenuation volume is provided for indicative purposes only and should be verified at detailed drainage design stage.

Discharge Method

Paragraph 080 of the NPPG: Flood Risk and Coastal Change sets out the following hierarchy of drainage options: into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain or another drainage system; to a combined sewer.

Infiltration

The first consideration for the disposal of surface water is infiltration (soakaways and permeable surfaces). As described above the site is underlain by Clays, Silts and Sands. Therefore, the use of infiltration techniques may be a feasible option for the site. Infiltration testing should be undertaken in accordance with BRE365 specification, to determine the suitability of infiltration techniques.

Watercourse

Where soakaways are not suitable a connection to watercourse is the preferred option. The nearest watercourse is River Pinn, located approximately 410m north of the site. The site is separated from this watercourse by third party urbanised land; therefore a connection to this watercourse will not

be feasible. There are no other suitable watercourses within the vicinity of the site. Therefore disposal of surface water to a watercourse will not be a feasible option.

Sewer

A connection to the public sewer system is the final consideration. There is a 225mm public surface water sewer located north of the site in Eastcote Road. It is assumed that surface water runoff from the existing site discharges to this sewer. It is proposed to utilise the existing drainage outfall from the site. The exact location of this will be confirmed via a drainage survey. Runoff from the proposed impermeable areas should be restricted to 5 l/s to comply with LLFA and London Plan requirements. A gravity connection appears feasible, however this will need to be confirmed through conversion of site levels to an Ordnance Datum.

Sustainable Drainage Systems

Attenuation storage should be provided in the form of Sustainable Drainage Systems (SuDS) where practical. The following SuDS options have been considered:

Soakaways

As stated above infiltration testing will determine the suitability of soakaways.

Swales, detention basins and ponds

The site is occupied by hard-standing in the form of buildings, hard-play areas and car parking, and soft landscaping in the form of soft play areas. Therefore there is limited space to place open water attenuation features such as ponds and basins. Furthermore, open water features would present a significant safety risk, considering the context of the site.

Rainwater Harvesting

The attenuation benefits provided through the use of rainwater harvesting are considered to be limited, and would only be realised when the tanks were not full. However, rainwater harvesting techniques could be incorporated within the final design.

Green Roofs

The proposed development plans do not identify green roofs for the proposed development. Green roofs provide limited attenuation benefits during wet winter months.

Porous / Permeable Paving

The site includes an area of car parking that may be suitable for the use of permeable paving. Storage could be provided within the sub-grade material prior to controlled discharge to the public sewer network.

The provision of storage within the sub-grade material would only be feasible in areas with a proposed gradient of <1 in 20 as detailed within CIRIA RP992/28 (Design Assessment Checklists for Permeable/Porous Pavement). Site gradients should be confirmed at the detailed design stage. The amount of storage provided within permeable paving is subject to sub-grade depth and gradient.

Underground Attenuation Tanks

Storage could be provided within an underground attenuation tank. Sufficient space for a below ground tank is available within the car park / site access in the eastern extent of the site.

Concept Surface Water Drainage Scheme

Surface water runoff will be discharged to the 225mm public surface water sewer located to the north of the site in Eastcote Road at a limited discharge rate of 5 l/s. It is proposed to utilise the existing drainage outfall from the site, which will be confirmed via a drainage survey. A gravity connection appears feasible. Attenuation storage will be provided in the sub-grade of permeable paving (where practical) or within a below ground tank and will accommodate the 1 in 100 year plus 40% CC event.

Exceedance Event

Storage will be provided for the 1 in 100 year plus 40% CC event. Storm events in excess of the 1 in 100 year plus 40% CC event should be permitted to produce shallow depth flooding within landscaped areas or car parking adjacent to an attenuation feature. Site levels should be designed to ensure that exceedance flooding is contained on site to eventually drain back into the drainage system.

Surface Water Treatment

In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), other roofs (non-residential) have a 'low' pollution hazard level, with low traffic roads and car parks with infrequent traffic movements (< 300 per day) also classified as having a 'low' pollution hazard level. Table 1 below shows the pollution hazard indices for each land use.

Table 1 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Other Roofs	Low	0.3	0.2	0.05
Low Traffic Roads / Car Parks	Low	0.5	0.4	0.4

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

** Indices values range from 0-1.*

Runoff will be directed to permeable paving where practical (subject to site gradients). Table 2 below demonstrates that permeable paving provides sufficient treatment to runoff.

Table 2 – SuDS Mitigation Indices

Type of SuDS	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Pavements	0.7	0.6	0.7

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.3

Where storage is provided below ground in the form of an attenuation tank, a suitable hydro-dynamic separator will be required to provide treatment prior to discharge to the public surface water sewer network.

Maintenance

The maintenance of the proposed surface water drainage system should be arranged through appointments of a site management company. The SuDS Maintenance Schedule included as Appendix H details the general maintenance required for permeable paving and attenuation tanks.

Water Efficiency

Water efficient fixtures and fittings should be utilised to reduce consumption of potable water across the development. The sanitary fittings specification could include:

- Low flush/dual flush WCs designed to operate with a reduced volume of water
- Water saving urinals with automatic flush
- Basins fitted with spray/aerating taps

Foul Drainage

There is a 225mm public foul sewer located north to the site in Eastcote Road. It is assumed that foul flows from the existing site discharge to this sewer. Any additional foul flows from the proposed new buildings should utilise the existing drainage outfall to this sewer. Thames Water should be contacted to determine the acceptability of additional foul flows into the sewerage system.

Conclusions

The proposal is for the expansion of Warrender Primary School through the introduction of an additional building and nursery, car parking, playground, mini soccer field and landscaping.

The site is located within Flood Zone 1 on the Environment Agency (EA) 'Flood Map for Planning (Rivers and Sea)' – an area considered to have the lowest probability of fluvial and tidal flooding.

Areas immediately adjacent to the existing building have been identified at low risk of surface water flooding. However the proposed new buildings, car parking and hard-standing areas will be located in an area at very low risk of surface water flooding.

In order to comply with the London Plan and LLFA requirements surface water from new development should aim to achieve greenfield runoff rates. A runoff rate of 5 l/s will be applied to ensure a self-cleansing drainage system and attenuation will be provided on site to accommodate the 1 in 100 year plus 40% climate change event.

All methods of surface water discharge have been assessed. Discharge of surface water to the public surface water sewer north of the site via the existing drainage outfall appears to be the most practical option. Discharge to this sewer should be restricted to 5 l/s.

Maintenance of the proposed surface water drainage system will be arranged through appointment of a site management company.

Water efficient fixtures and fittings should be utilised to reduce consumption of potable water across the development.

Recommendations

1. Undertake a drainage survey to confirm the existing drainage arrangements on site.
2. Verify the attenuation volumes included in this report when undertaking detailed drainage design.
3. Undertake BRE 365 infiltration testing to determine the suitability of soakaways.
4. Contact Thames Water to determine the acceptability of additional foul flows into the sewerage system

Appendix A – Location Plan & Aerial Image

Site location



Location Plan

(Source: Streetmap – October 2016)

Site location



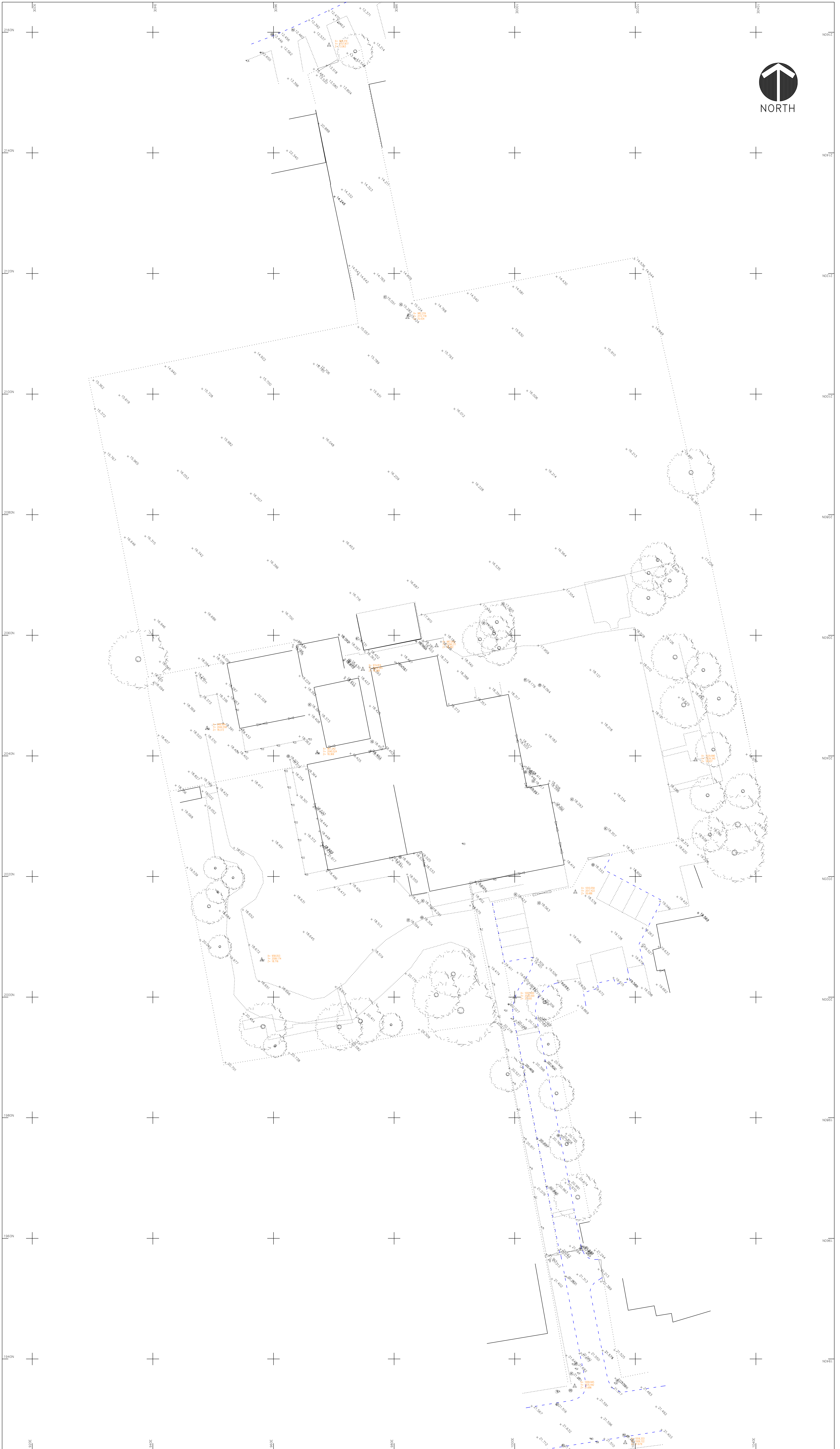
Aerial Image

(Source: Google Earth – October 2016)

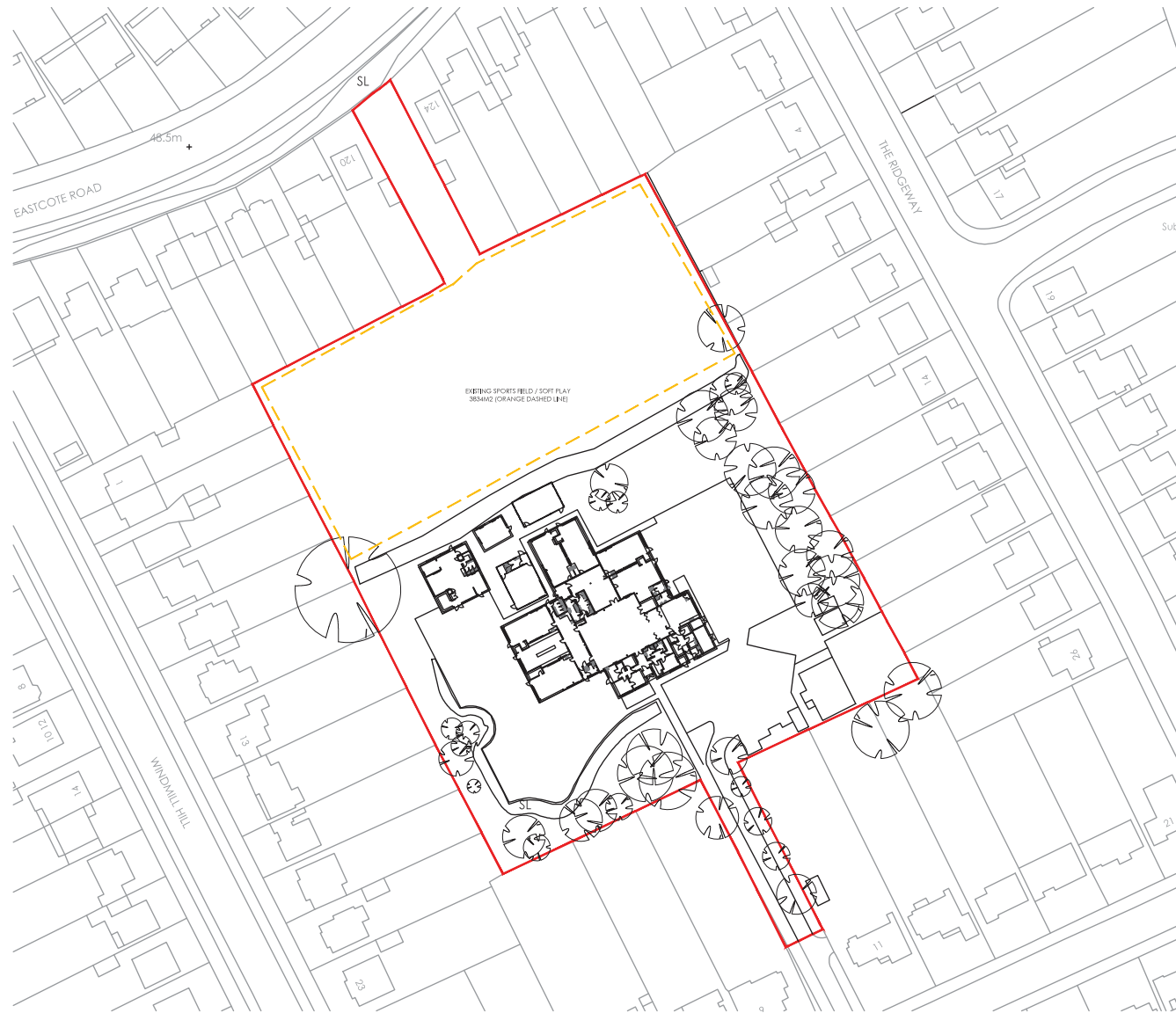
Appendix B – Proposed Development Plan & Topographical Survey



NORTH



SCALE 1:200



Existing Layout





NOTES:

- HARD PLAY AREAS
- ACCESS ROADS & PARKING AREAS
- SOFT PLAY & LANDSCAPED AREAS
- MUGA PITCH
- MINI SOCCER PITCH
- EXISTING TREE RETAINED
- EXISTING TREE REMOVED
- PROPOSED TREE

Rev	Date	Description	Drawn	Check	Approv	APP

Client:
 London Borough of Hillingdon Council
PROJECT:
 Extra Form of Entry School Expansions

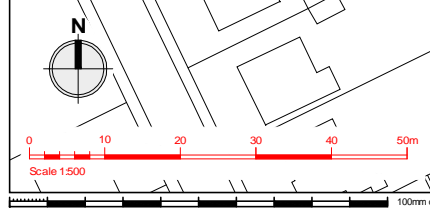
Site: Warrender Primary School, Old Hatch Manor, Ruslip HA4 8QG
Client: London Borough of Hillingdon Council, Hillingdon Civic Centre, High St, Uxbridge UB8 1UW, Phone +44 (0)1895 250111, Fax, www.hillingdon.gov.uk

ARCADIS
 Registered office: Arcadis House, 34 York Way, London N1 9AB
 Coordinating office: Arcadis House, 34 York Way, London N1 9AB, Tel: 44 (0) 20 7812 2000
 www.arcadis.com

TITLE:
 Warrender Primary School Proposed Site Layout

Designed	n/a	Signed	
Drawn	PSL	Signed	
Checked	AR	Signed	
Approved	AR	Signed	
Scale:	1:500	Datum:	
Original Size:	A1	Grid:	
Suitability Code:		Project Number:	35311100

Suitability Description: **PLANNING**
 Drawing Number: 35311100 / WAR / PL06
 Revision:



Appendix C – Thames Water Sewer Plan

Asset Location Search



Waterco Ltd
Lon Parcwr Industrial Estate
RUTHIN
LL15 1NJ

Search address supplied Ruislip
HA4 8QG

Your reference W10188

Our reference ALS/ALS Standard/2016_3420245

Search date 28 September 2016

Notification of Price Changes...

From **1 September 2016** Thames Water Property Searches will be increasing the prices of its Asset Location Searches. This will be the first price rise in three years and is in line with the RPI at 1.84%. The increase follows significant capital investment in improving our systems and infrastructure.

Enquiries received with a higher payment prior to 1 September 2016 will be non-refundable. For further details on the price increase please visit our website at

www.thameswater-propertysearches.co.uk



Asset Location Search



Search address supplied: Ruislip, HA4 8QG

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.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

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 0845 070 9148, or use the address below:

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

Email: searches@thameswater.co.uk

Web: www.thameswater-propertysearches.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.
- Any private sewers or lateral drains which are 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 these details be checked with the developer.

Clean Water Services

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

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

Affinity Water Ltd
Tamblin Way
Hatfield

Asset Location Search



AL10 9EZ
Tel: 0845 7823333

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

A charge will be added to your suppliers account.

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, budget estimates, diversions, 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
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2016 3420245



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 509967,187707

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. 100019345 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
9401	51.9	49.39
7403	52.84	50.79
7400	52.84	50.93
9502	55.51	52.88
8504	54.79	53.14
9503	55.59	53.77
7502	50.55	48.96
8502	55.13	53.11
851A	n/a	n/a
9504	56.93	55.21
851D	n/a	n/a
851C	n/a	n/a
8503	56.83	55.17
851B	n/a	n/a
851E	n/a	n/a
841B	n/a	n/a
841A	n/a	n/a
7402	51.07	47.86
7409	51.05	49.03
0403	53.48	51.18
0401	53.73	51.68
041A	n/a	n/a
0502	56.34	54.39
1602	55.7	53.88
1601	55.47	54
151C	n/a	n/a
151A	n/a	n/a
151E	n/a	n/a
151D	n/a	n/a
2602	56.04	55.14
1906	48.93	46.45
0601	53.81	52.17
1702	53.12	50.99
271A	n/a	n/a
1703	53.22	51.37
071D	n/a	n/a
071B	n/a	n/a
0701	51.77	49.64
071C	n/a	n/a
071A	n/a	n/a
1701	50.09	48.5
1802	50.83	47.68
1803	50.85	47.97
181D	n/a	n/a
181H	n/a	n/a
181F	n/a	n/a
081A	n/a	n/a
081B	n/a	n/a
181C	n/a	n/a
181E	n/a	n/a
181B	n/a	n/a
1801	50.22	46.78
181A	n/a	n/a
0902	45.39	44.11
0901	45.24	42.39
091A	n/a	n/a
091B	n/a	n/a
091C	n/a	n/a
1901	45.57	43.14
1904	45.55	43.82
1902	46.76	44.36
1903	46.78	44.47
8904	44.79	43.94
8707	51.83	49.8
8702	48.83	47.72
8708	51.95	49.8
851F	n/a	n/a
871B	n/a	n/a
871A	n/a	n/a
8801	45.63	44.63
8802	45.62	44.65
8701	48.49	46.11
8706	48.57	46.91
8601	56.95	54.91
9601	56.93	54.95
9801	48.04	45.26
981B	n/a	n/a
981C	n/a	n/a
981A	n/a	n/a
9501	58	53.09
9804	47.49	46.25
9806	n/a	n/a
9802	46.7	43.88
9505	57.99	56.49
9805	46.43	44.99
9803	46.25	43.39
0801	49.01	47.02
0702	50.4	48.55
0501	57.46	55.71
8905	44.31	43.41
8903	44.21	43.23



















Manhole Reference	Manhole Cover Level	Manhole Invert Level
991B	n/a	n/a
991A	n/a	n/a
9904	45.05	43.7
9903	45	43.46
7701	47.24	44.71
7704	47.37	46.4
7601	50.76	48.51
7602	52.09	50.08
7702	n/a	n/a
7801	47.46	44.21
7802	47.49	45.89
7503	53.69	51.75
781A	n/a	n/a
881B	n/a	n/a
8704	48.58	47.09
881A	n/a	n/a
8501	54.33	52.13
8703	48.71	47.33
8705	48.73	47.29
8906	45.27	44.22

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 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
-  Gully
-  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 millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

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 (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

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 Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	BACS Payment	Telephone Banking	Cheque
<p>Call 0845 070 9148 quoting your invoice number starting CBA or ADS.</p>	<p>Account number 90478703 Sort code 60-00-01 A remittance advice must be sent to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW. or email ps.billing@thameswater.co.uk</p>	<p>By calling your bank and quoting: Account number 90478703 Sort code 60-00-01 and your invoice number</p>	<p>Made payable to 'Thames Water Utilities Ltd' Write your Thames Water account number on the back. Send to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW or by DX to 151280 Slough 13</p>

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.



Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

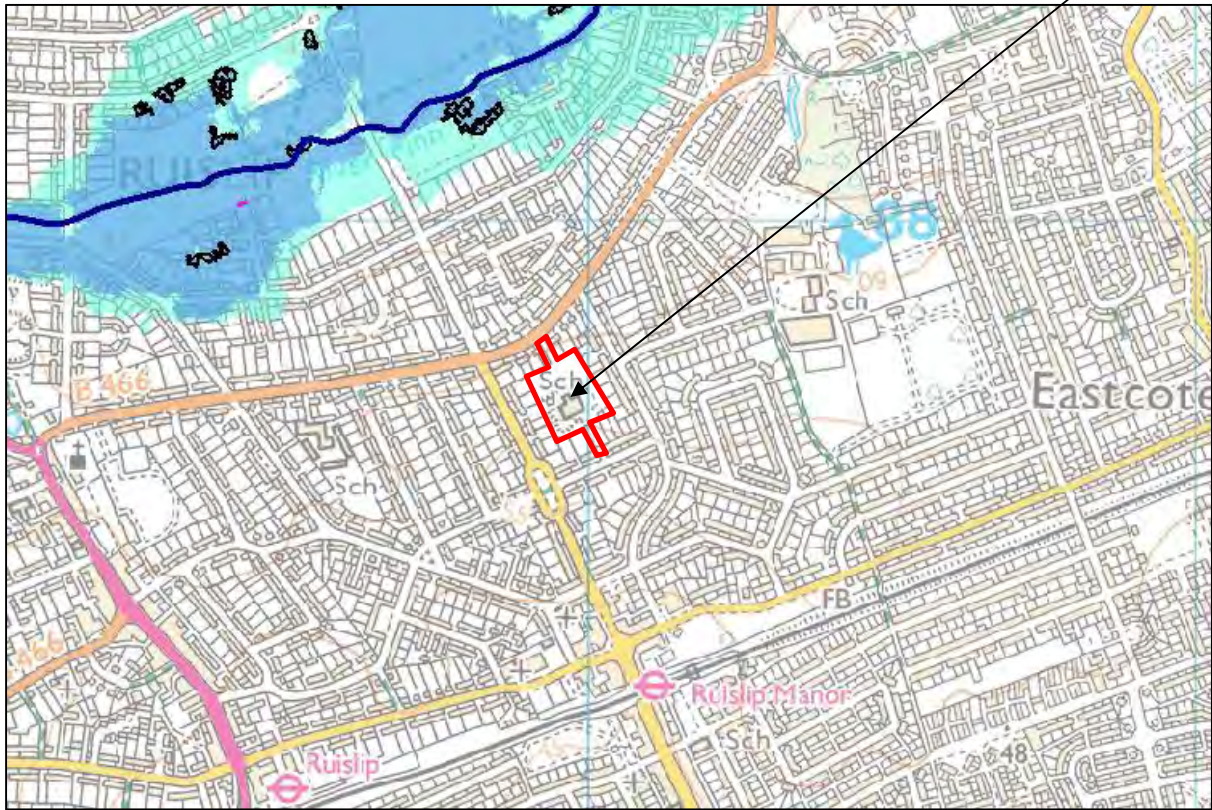
The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Appendix D – Environment Agency Flood Maps

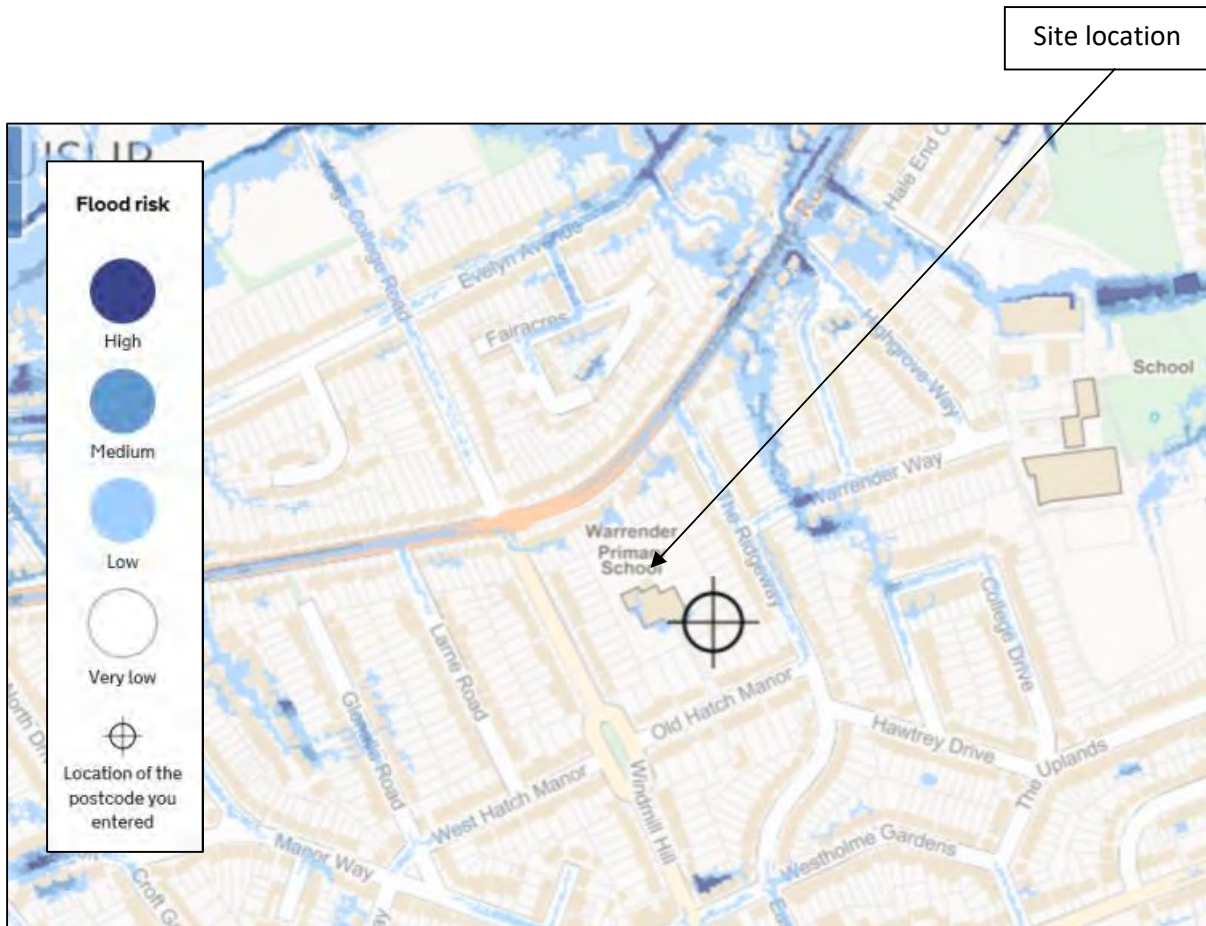
Site location



Environment Agency Flood Map for Planning (Rivers and Sea)

(October 2016)

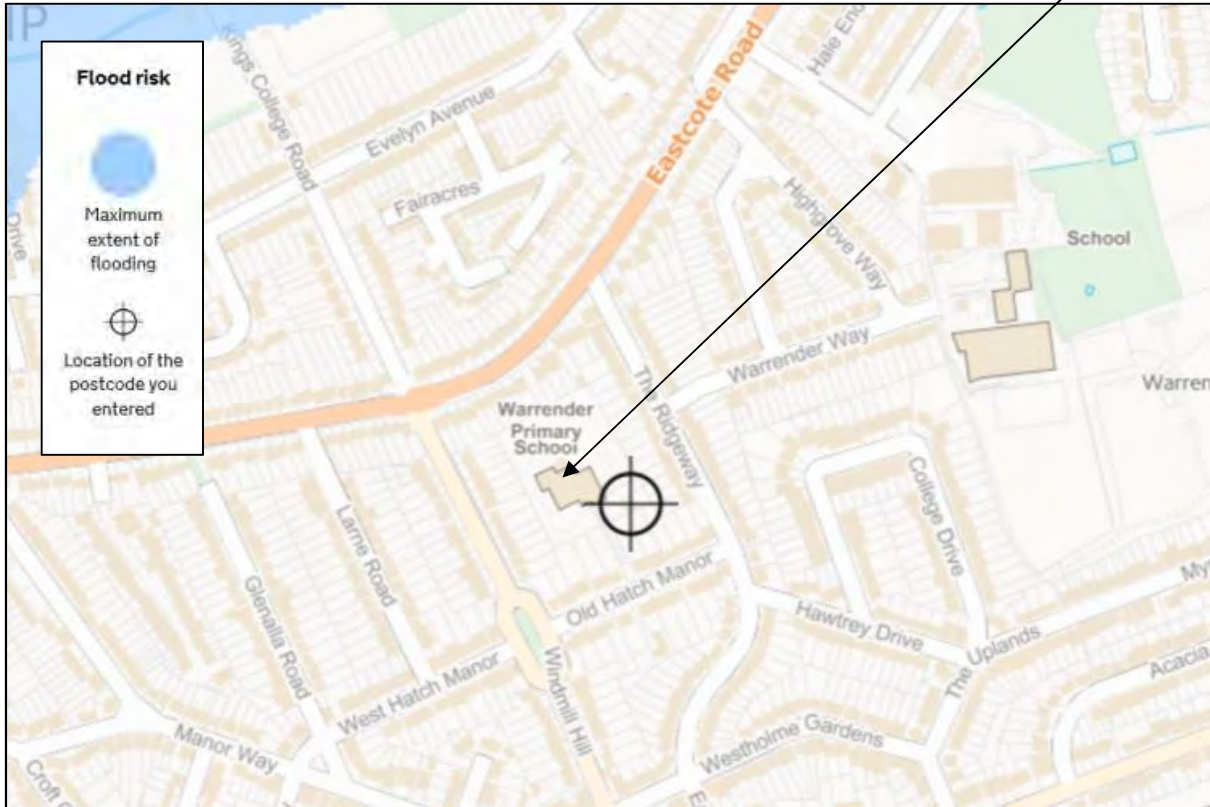




Environment Agency Risk of Flooding from Surface Water

(October 2016)

Site location



Environment Agency Risk of Flooding from Reservoirs

(October 2016)

Appendix E – London Borough of Hillingdon Council Correspondence

Jordan Jones

From: Victoria Boorman <vboorman@hillington.gov.uk>
Sent: Friday, September 30, 2016 5:00 PM
To: Jordan Jones
Cc: flooding@hillington.gov.uk
Subject: Re: w10186, w10187, w10188 - LLFA email

Categories: Information received

Dear Mr Jones

Thanks for your email, please can any correspondence go through your planning case officer so that information can be tracked. If it is not yet an application and the application has not undertaken a formal preapplication I do not provide informal comments.

Regards

Vicky

Vicky Boorman
Flood and Water Management Specialist
Contact Centre: 01895 556000
Email: flooding@hillington.gov.uk

For more information on action to take in a flood event please visit the Hillington website.

<http://www.hillington.gov.uk/flooding>

For information about road drainage & flooding on roads and who to contact please visit

<http://www.hillington.gov.uk/article/26542/Road-drainage-and-gullies>

For information on Sustainable Drainage requirements please visit the Hillington

website: <http://www.hillington.gov.uk/article/12578/Sustainable-drainage-requirements-for-planning-applications>

Any comments made in this email relating to a planning application, represent officer opinion and cannot be seen to prejudice the Local Planning Authority's formal determination in relation to any application or planning matter.

The Hillington Flood Risk Management Portfolio of documents, which includes the Local Flood Risk Management Strategy can be found on the Council website.

<http://www.hillington.gov.uk/article/24117/Flood-risk-management>

Planning Specialists Team 3N/02
Residents Services
London Borough of Hillington ([Directions](#))
Civic Centre, High Street,
Uxbridge. Middlesex. UB8 1UW

On 30 September 2016 at 16:43, Jordan Jones <jordan.jones@waterco.co.uk> wrote:

Dear Sir / Madam,

We are preparing Flood Risk Assessments and Drainage Strategies for extensions at the below schools:

Hillside Primary School

Northwood Way

Northwood

HA6 1RX

Newnham Primary School

Newnham Avenue

Ruislip

HA4 9RW

Warrender Primary School

Old Hatch Manor

Ruislip

HA4 8QG

We are seeking Lead Local Flood Authority comments in relation to surface water drainage. I attach existing and proposed development plans for reference.

We are currently awaiting for confirmation for the existing drainage arrangements on each site. Where infiltration is not feasible, we would propose to utilise any existing connections to the Thames Water sewer network, restricting runoff to greenfield rates. Please can you advise if this is acceptable.

Attenuation will be provided in the form of SuDS. Please can you advise if you have any specific guidance on the use or hierarchy of SuDS.

Under new EA climate change guidance please could you confirm the councils requirements for attenuation storage, i.e. should storage be designed to accommodate 20%, 30% or 40% climate change allowance.

Please can you also advise if you have any historical records of flooding at either site.

If you require any further information, please do not hesitate to contact me.

Kind regards,

Jordan Jones

T: 01824 702220 | **E:** jordan.jones@waterco.co.uk | **W:** www.waterco.co.uk



Specialists of choice for water, drainage and flood risk

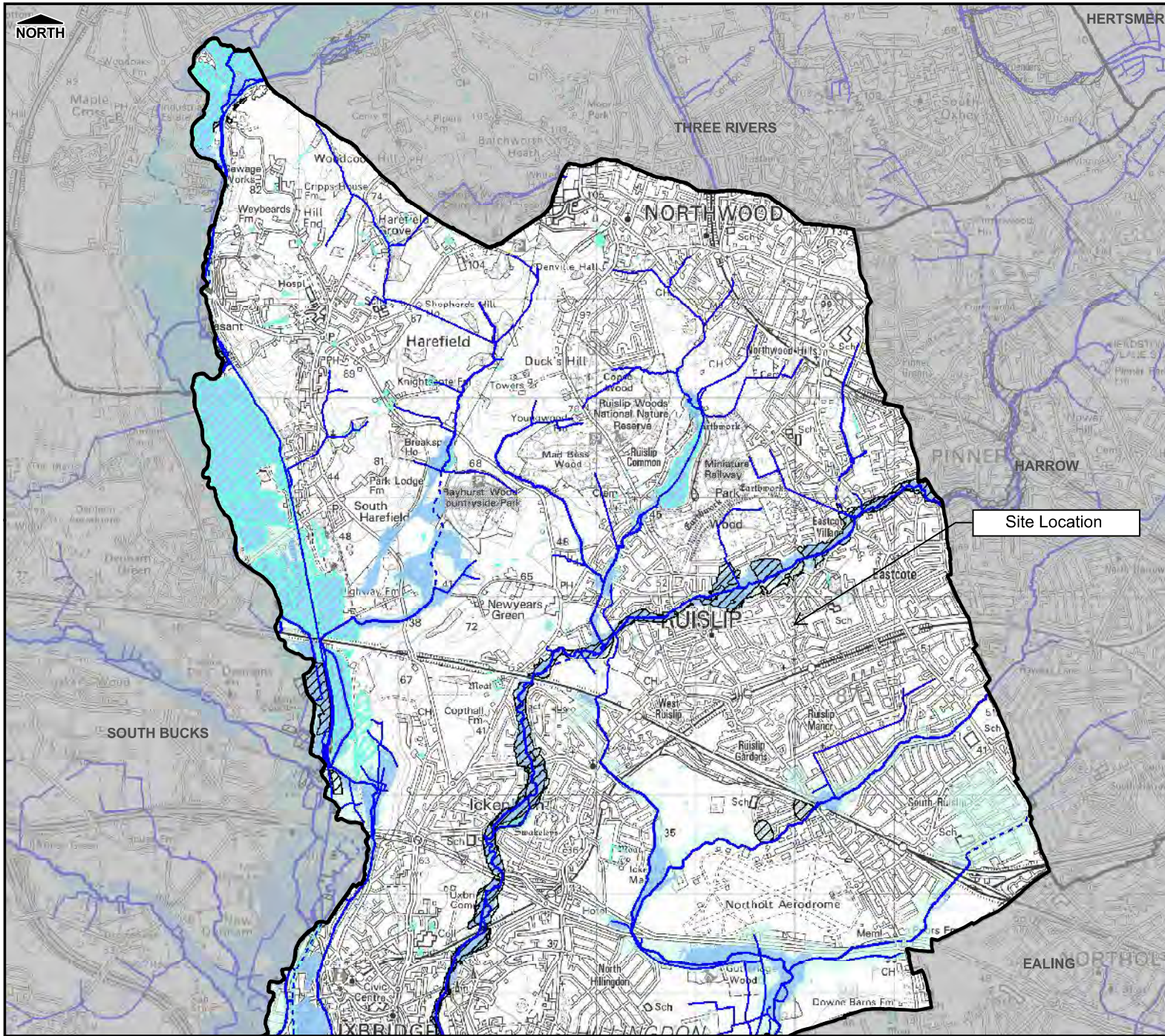
Head Office	Regional	International
Ruthin, Denbighshire	Hanover St, Manchester	Hyderabad, India
(+44) 1824 702220	(+44) 161 214 0850	(+91) 406536060

For email confidentiality, limitations and company details please see our [disclaimer webpage](#).
Registered office address: Waterco Ltd, Eden Court, Lon Parcwr Business Park, Ruthin, Denbighshire LL15 1NJ.

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Appendix F – PFRA Maps



Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Fluvial Flooding Incidents
- Historic Fluvial Flood Outline
- Environment Agency Flood Zone 3
- Environment Agency Flood Zone 2

Notes

1. Environment Agency Flood Zone 3: Land assessed, ignoring the presence of flood defences, as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding.
2. Environment Agency Flood Zone 2: Land assessed, ignoring the presence of flood defences, as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding in any year.

London Borough of Hillingdon



HILLINGDON LONDON

Preliminary Flood Risk Assessment

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Scale at A3 1:40,000	Date 06/04/2011	Drawn by R. MOORE	Approved by P. ILINOVSKY
-------------------------	--------------------	----------------------	-----------------------------

Summary Map of Past Floods - Main River / Fluvial / Tidal Incidents

Consultants

CAPITA SYMONDS Flood Risk Management

Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

Drain London Programme Board Members

GREATER LONDON AUTHORITY

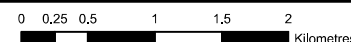
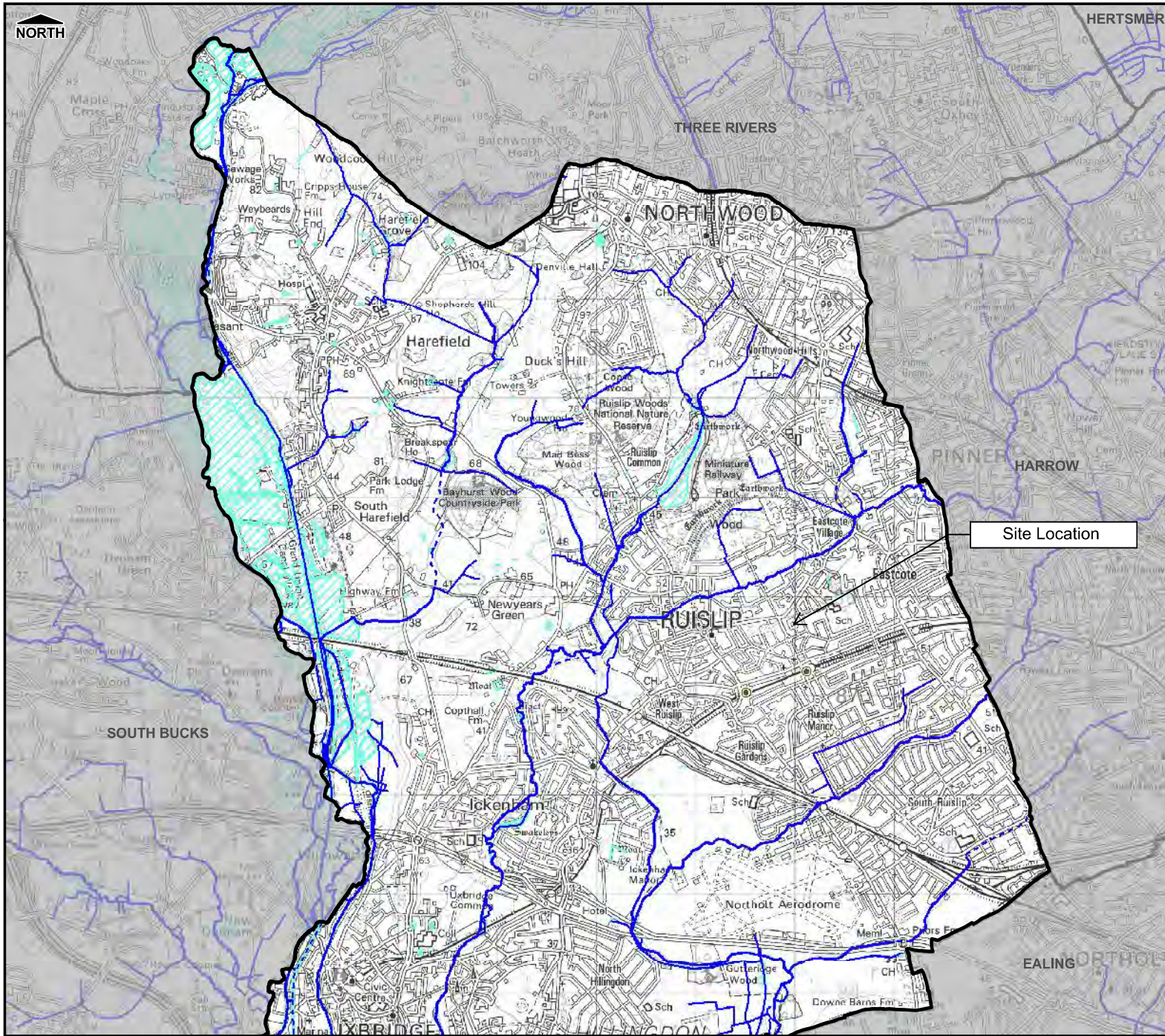









FIGURE A-2.1



Legend

-  Borough Administrative Boundary
-  Main River
-  Ordinary Watercourse
-  Culverted Watercourse (Main River)
-  Permanent Water Bodies
-  Surface Water Flooding Incidents
-  Surface Water Flood Outline

London Borough of Hillingdon



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Preliminary Flood Risk Assessment

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Scale at A3 1:40,000	Date 06/04/2011	Drawn by R.MOORE	Approved by P.HILINOVSKY
-------------------------	--------------------	---------------------	-----------------------------

Summary Map of Past Floods - Surface Water Incidents

Consultants

CAPITA SYMONDS  
 Flood Risk Management

Capita Symonds
 Level Seven,
 52 Grosvenor Gardens,
 Belgravia,
 London
 SW1W 0AU

Drain London Programme Board Members

GREATER LONDON AUTHORITY

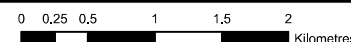
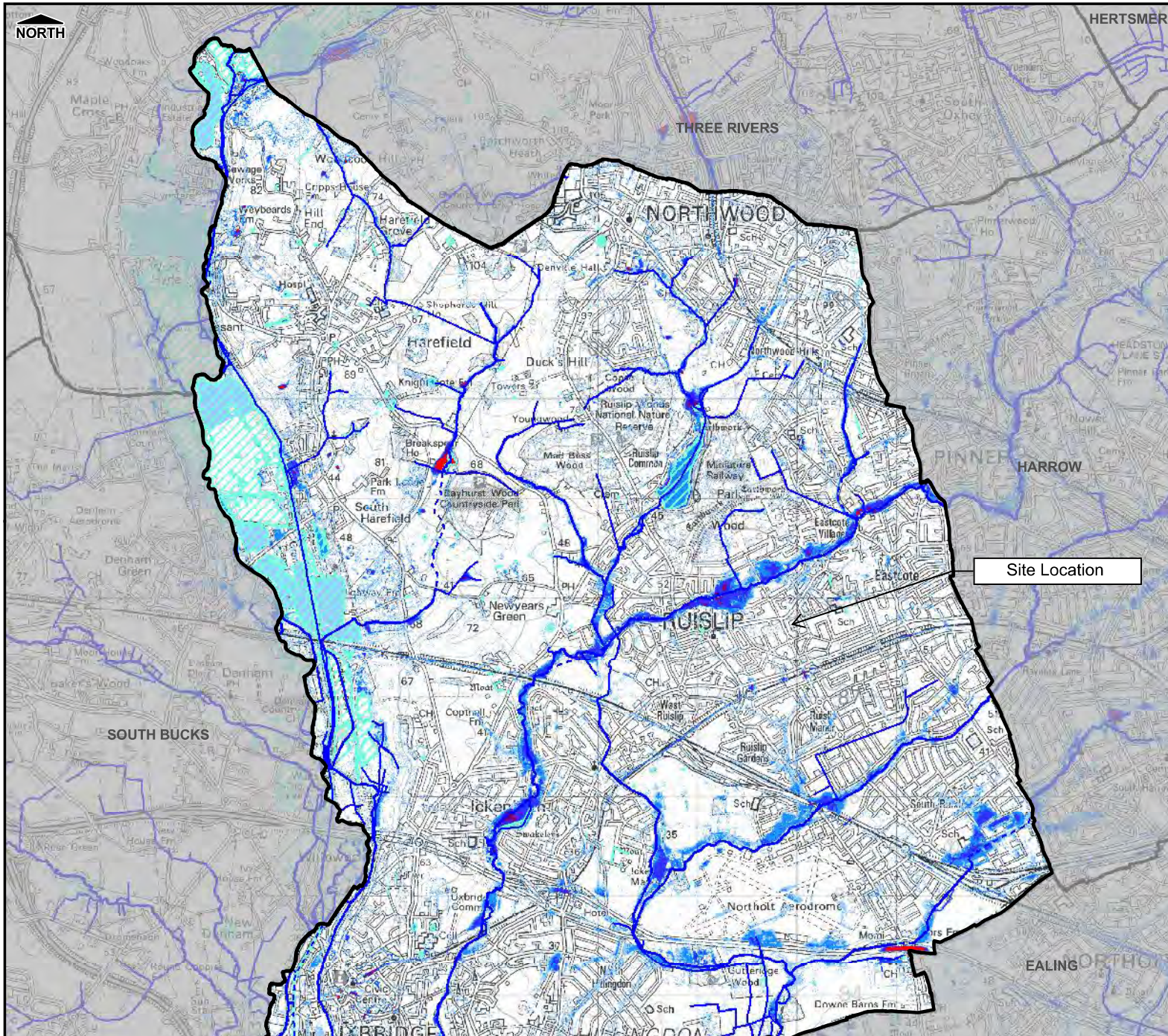


FIGURE A-1.1



Legend

- Borough Administrative Boundary
 - Main River
 - Ordinary Watercourse
 - Culverted Watercourse (Main River)
 - Permanent Water Bodies
- Flood Depth**
- < 0.1m
 - 0.1m - 0.25m
 - 0.25m - 0.5m
 - 0.5m - 1.0m
 - 1.0m - 1.5m
 - > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Hillingdon



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Scale at A3 1:40,000	Date 06/04/2011	Drawn by R. MOORE	Approved by P. ILINOVSKY
--------------------------------	---------------------------	-----------------------------	------------------------------------

Surface Water Depth (m)
1 in 200 Chance of rainfall event occurring in any given year (0.5% AEP)

Consultants
CAPITA SYMONDS
 Flood Risk Management
 Capita Symonds Level Seven, 52 Grosvenor Gardens, Belgravia, London SW1W 0AU

Drain London Programme Board Members



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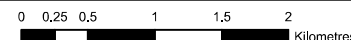
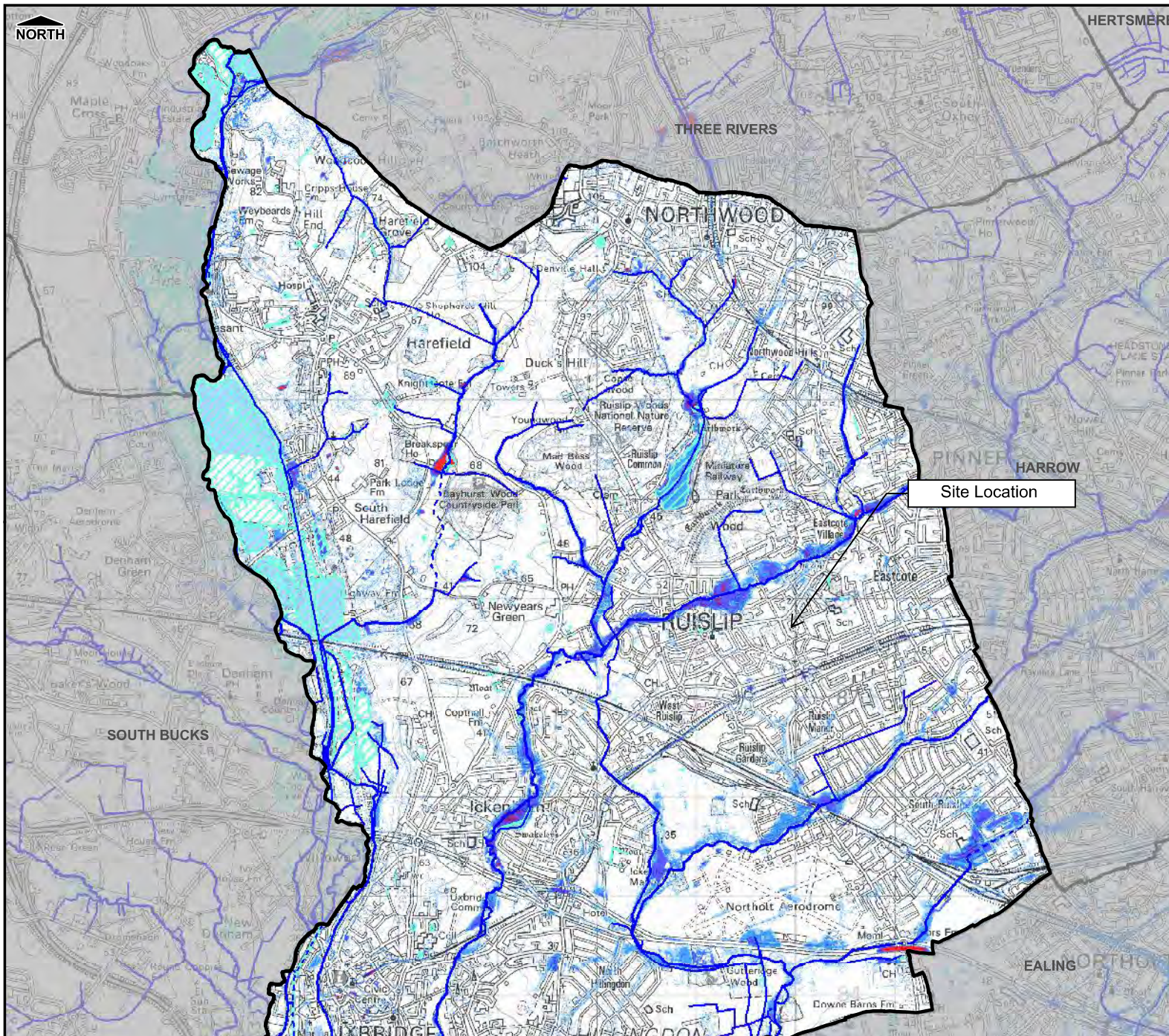


FIGURE B-1.1



Legend

- Borough Administrative Boundary
 - Main River
 - Ordinary Watercourse
 - Culverted Watercourse (Main River)
 - Permanent Water Bodies
- Flood Depth**
- < 0.1m
 - 0.1m - 0.25m
 - 0.25m - 0.5m
 - 0.5m - 1.0m
 - 1.0m - 1.5m
 - > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

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Scale at A3 1:40,000	Date 06/04/2011	Drawn by R.MOORE	Approved by P.HILINOVSKY
--------------------------------	---------------------------	----------------------------	------------------------------------

Surface Water Depth (m)
1 in 100 plus climate change Chance of rainfall event occurring in any given year (1% AEP + CC)

Consultants

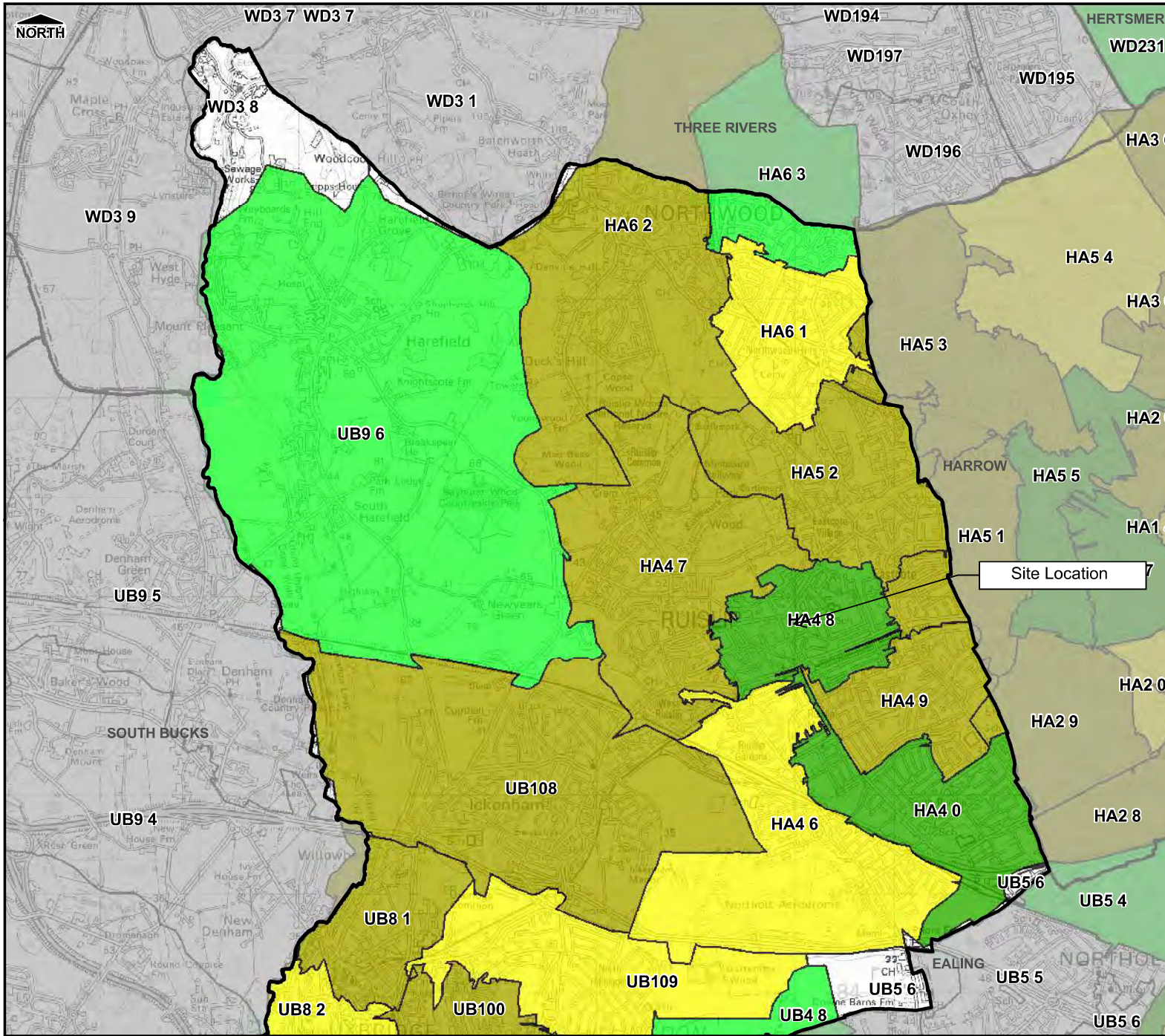
CAPITA SYMONDS
 Flood Risk Management

Capita Symonds
 Level Seven,
 52 Grosvenor Gardens,
 Belgravia,
 London
 SW1W 0AU

Drain London Programme Board Members

GREATER LONDON AUTHORITY

FIGURE B-3.1



Legend

- Borough Administrative Boundary
- Sewer Flooding Incidents
- Sewer Flood Outline
- No. of Sewer Flood Records
 - None
 - 1 - 5
 - 6 - 10
 - 11 - 20
 - 21 - 50
 - 51 - 100
 - 101+

Notes

1. Sewer flood records relate to internal and external flooding of properties
2. Data supplied by Thames Water Ltd and is correct as at June 2010

London Borough of Hillingdon



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Scale at A3 1:40,000	Date 06/04/2011	Drawn by R.MOORE	Approved by P.HLINOVSKY
-------------------------	--------------------	---------------------	----------------------------

Summary Map of Past Floods - Sewer Incidents

Consultants

CAPITA SYMONDS Flood Risk Management

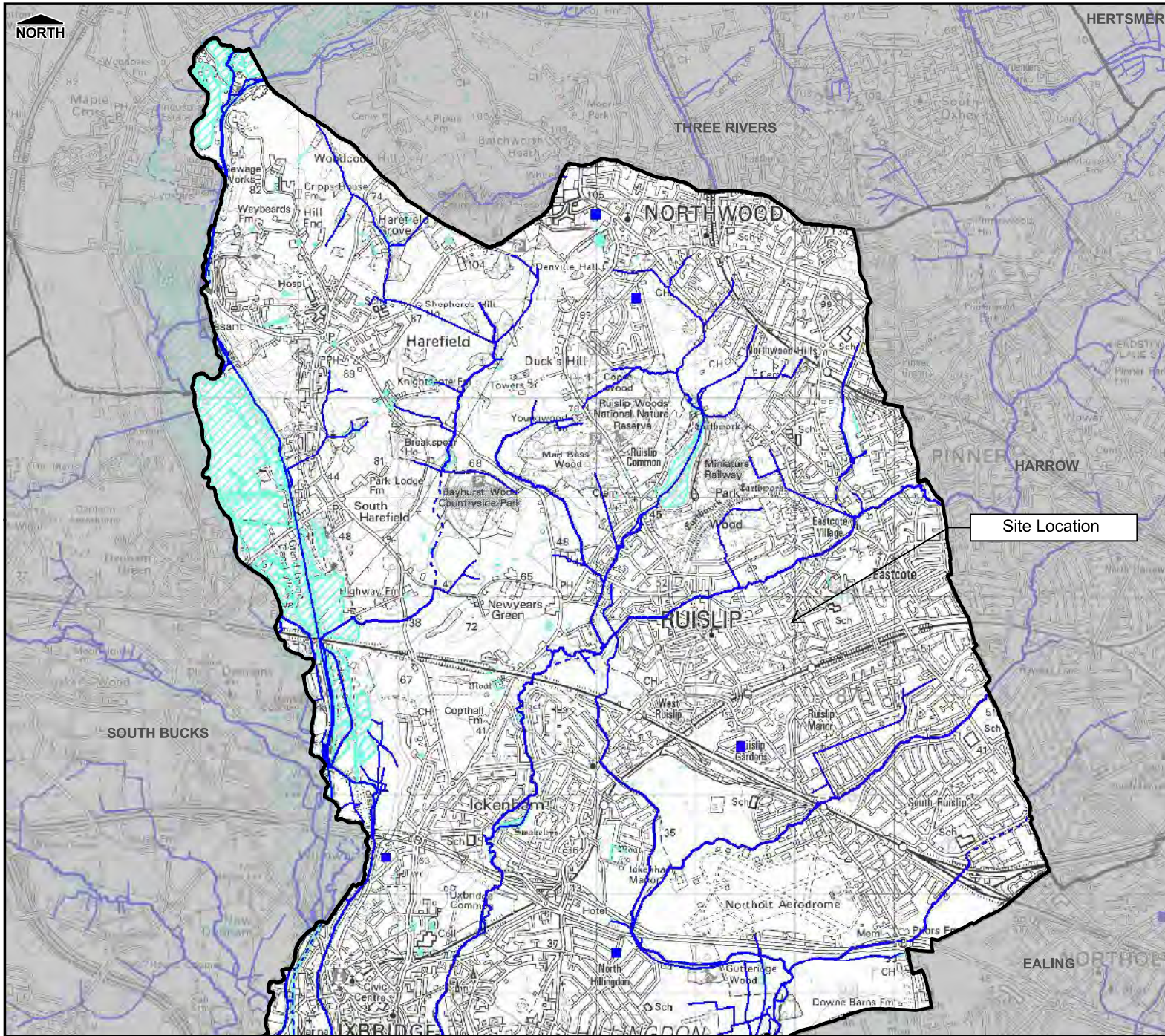
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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Environment Agency Thames Water LONDON COUNCILS

GREATER LONDON AUTHORITY

FIGURE A-4.1



Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Groundwater Flood Incident (EA Records)
- Ground Water Flood Outline

Notes

London Borough of Hillingdon

Preliminary Flood Risk Assessment

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Scale at A3 1:40,000	Date 06/04/2011	Drawn by R.MOORE	Approved by P.HILINOVSKY
--------------------------------	---------------------------	----------------------------	------------------------------------

Summary Map of Past Floods - Ground Water Incidents

Consultants

CAPITA SYMONDS
 Flood Risk Management

Capita Symonds
 Level Seven,
 52 Grosvenor Gardens,
 Belgravia,
 London
 SW1W 0AU

Drain London Programme Board Members



FIGURE A-3.1

Appendix G – MicroDrainage Runoff and Storage Estimates

Eden Court
Lon Parcwr Business Park
Denbighshire LL15 1NJ

Warrender Primary School
Ruislip
Greenfield Calcs



Date 06/10/16

Designed by IJ

File

Checked by JJ

XP Solutions

Source Control 2016.1

ICP SUDS Mean Annual Flood

Input


Return Period (years)	100	Soil	0.450
Area (ha)	0.319	Urban	0.000
SAAR (mm)	684	Region Number	Region 6

Results 1/s

QBAR Rural 1.4
QBAR Urban 1.4

Q100 years 4.4

Q1 year 1.2
Q30 years 3.1
Q100 years 4.4

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	9.496	0.496	5.0	80.9	O K
30 min Summer	9.641	0.641	5.0	104.5	O K
60 min Summer	9.768	0.768	5.0	125.1	Flood Risk
120 min Summer	9.853	0.853	5.0	139.1	Flood Risk
180 min Summer	9.869	0.869	5.0	141.7	Flood Risk
240 min Summer	9.857	0.857	5.0	139.7	Flood Risk
360 min Summer	9.824	0.824	5.0	134.4	Flood Risk
480 min Summer	9.791	0.791	5.0	128.9	Flood Risk
600 min Summer	9.757	0.757	5.0	123.4	Flood Risk
720 min Summer	9.723	0.723	5.0	117.8	Flood Risk
960 min Summer	9.654	0.654	5.0	106.6	O K
1440 min Summer	9.510	0.510	5.0	83.1	O K
2160 min Summer	9.349	0.349	5.0	56.8	O K
2880 min Summer	9.241	0.241	4.9	39.3	O K
4320 min Summer	9.136	0.136	4.5	22.1	O K
5760 min Summer	9.104	0.104	3.9	16.9	O K
7200 min Summer	9.088	0.088	3.3	14.4	O K
8640 min Summer	9.078	0.078	2.9	12.7	O K
10080 min Summer	9.071	0.071	2.5	11.6	O K
15 min Winter	9.560	0.560	5.0	91.3	O K
30 min Winter	9.723	0.723	5.0	117.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	144.018	0.0	86.1	25
30 min Summer	93.832	0.0	112.2	40
60 min Summer	58.167	0.0	139.1	68
120 min Summer	34.816	0.0	166.5	124
180 min Summer	25.441	0.0	182.5	182
240 min Summer	20.245	0.0	193.7	234
360 min Summer	14.656	0.0	210.3	290
480 min Summer	11.648	0.0	222.9	354
600 min Summer	9.740	0.0	232.9	422
720 min Summer	8.412	0.0	241.4	492
960 min Summer	6.670	0.0	255.2	632
1440 min Summer	4.802	0.0	275.7	882
2160 min Summer	3.452	0.0	297.3	1240
2880 min Summer	2.729	0.0	313.3	1584
4320 min Summer	1.957	0.0	337.0	2248
5760 min Summer	1.544	0.0	354.5	2944
7200 min Summer	1.284	0.0	368.6	3672
8640 min Summer	1.104	0.0	380.4	4400
10080 min Summer	0.972	0.0	390.6	5136
15 min Winter	144.018	0.0	96.4	25
30 min Winter	93.832	0.0	125.6	39

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
60 min Winter	9.867	0.867	5.0	141.4	Flood Risk
120 min Winter	9.971	0.971	5.0	158.3	Flood Risk
180 min Winter	9.996	0.996	5.0	162.4	Flood Risk
240 min Winter	9.990	0.990	5.0	161.4	Flood Risk
360 min Winter	9.947	0.947	5.0	154.4	Flood Risk
480 min Winter	9.906	0.906	5.0	147.7	Flood Risk
600 min Winter	9.861	0.861	5.0	140.3	Flood Risk
720 min Winter	9.813	0.813	5.0	132.6	Flood Risk
960 min Winter	9.716	0.716	5.0	116.8	Flood Risk
1440 min Winter	9.496	0.496	5.0	80.9	O K
2160 min Winter	9.270	0.270	5.0	44.0	O K
2880 min Winter	9.155	0.155	4.7	25.3	O K
4320 min Winter	9.097	0.097	3.6	15.8	O K
5760 min Winter	9.079	0.079	2.9	12.9	O K
7200 min Winter	9.069	0.069	2.4	11.3	O K
8640 min Winter	9.062	0.062	2.1	10.1	O K
10080 min Winter	9.057	0.057	1.8	9.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
60 min Winter	58.167	0.0	155.8	68
120 min Winter	34.816	0.0	186.5	124
180 min Winter	25.441	0.0	204.4	180
240 min Winter	20.245	0.0	216.9	234
360 min Winter	14.656	0.0	235.6	308
480 min Winter	11.648	0.0	249.6	376
600 min Winter	9.740	0.0	260.9	454
720 min Winter	8.412	0.0	270.4	532
960 min Winter	6.670	0.0	285.9	684
1440 min Winter	4.802	0.0	308.7	944
2160 min Winter	3.452	0.0	333.0	1280
2880 min Winter	2.729	0.0	350.9	1588
4320 min Winter	1.957	0.0	377.4	2216
5760 min Winter	1.544	0.0	397.1	2944
7200 min Winter	1.284	0.0	412.9	3672
8640 min Winter	1.104	0.0	426.1	4408
10080 min Winter	0.972	0.0	437.4	5136

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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)	20.500	Shortest Storm (mins)	15
Ratio R	0.417	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.319

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4	0.106	4	8	0.106
				8	12
					0.106

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	163.0	1.000	163.0

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.296	5.0
Kick-Flo®	0.637	4.1
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.4	3.000	8.4	7.000	12.5
0.200	4.8	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.0	1.600	6.2	4.000	9.6	8.000	13.3
0.400	4.9	1.800	6.6	4.500	10.1	8.500	13.7
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.1
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.5
0.800	4.5	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.1		

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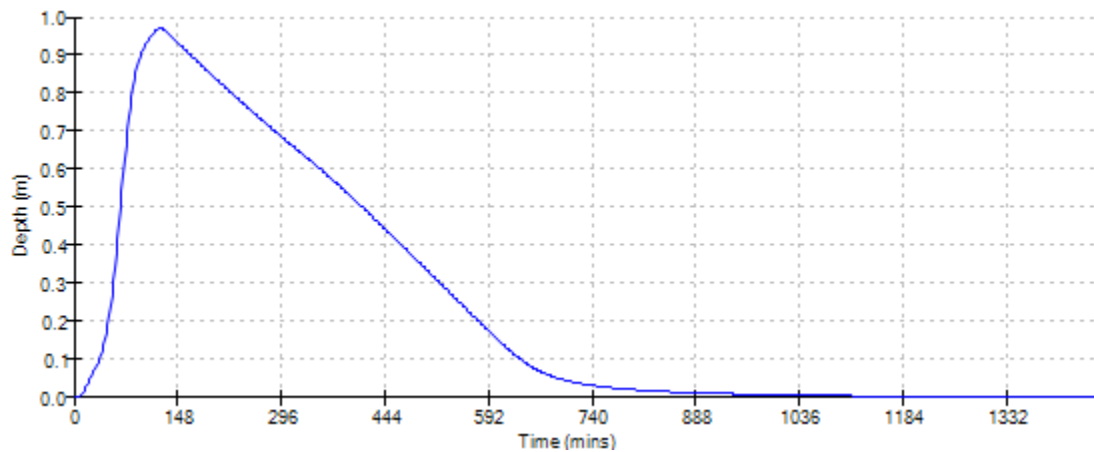
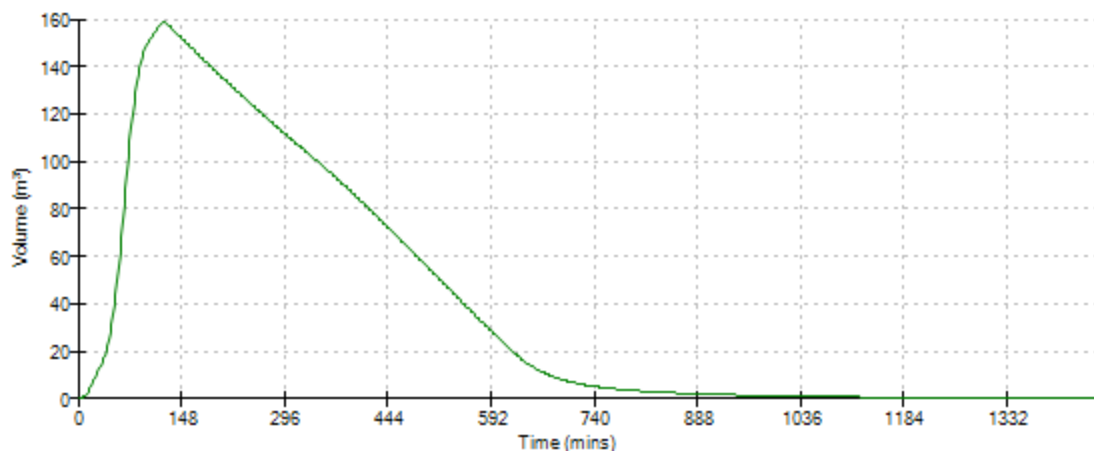
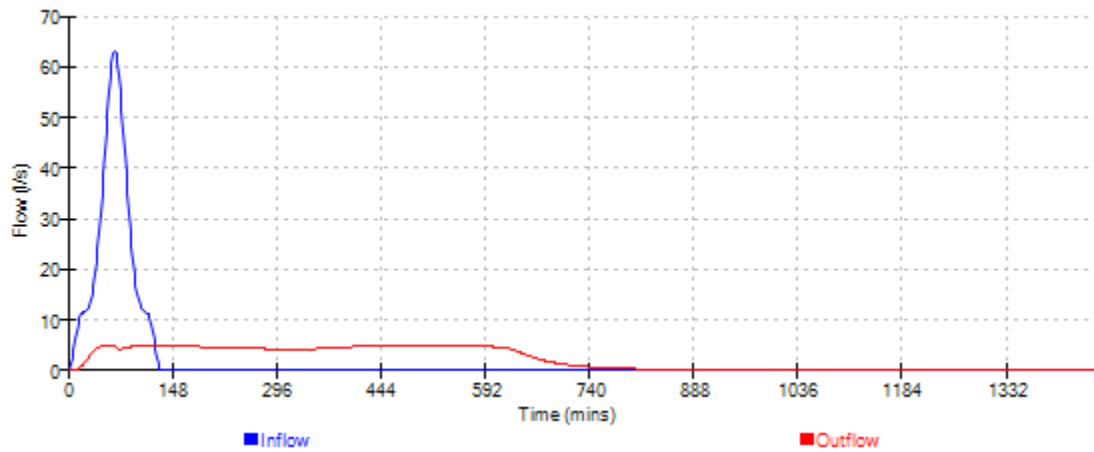
Checked by JJ



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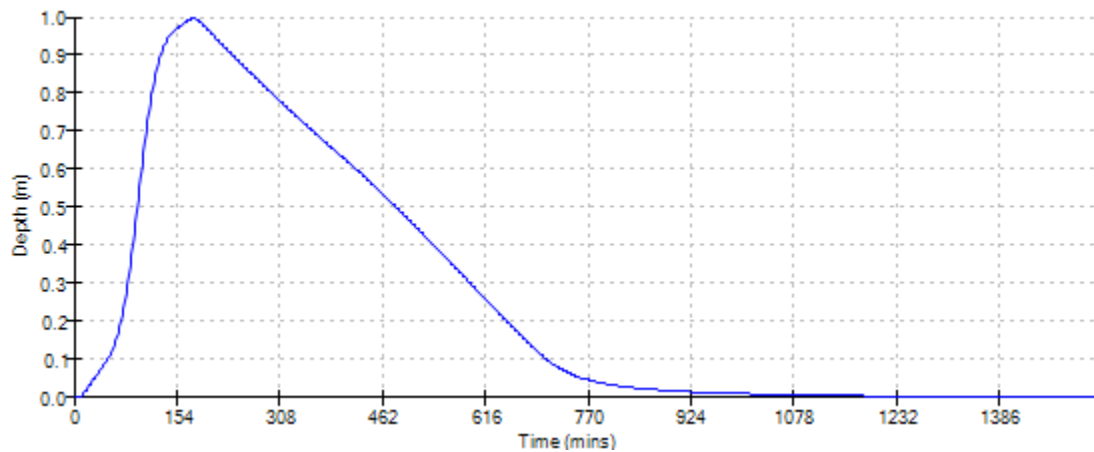
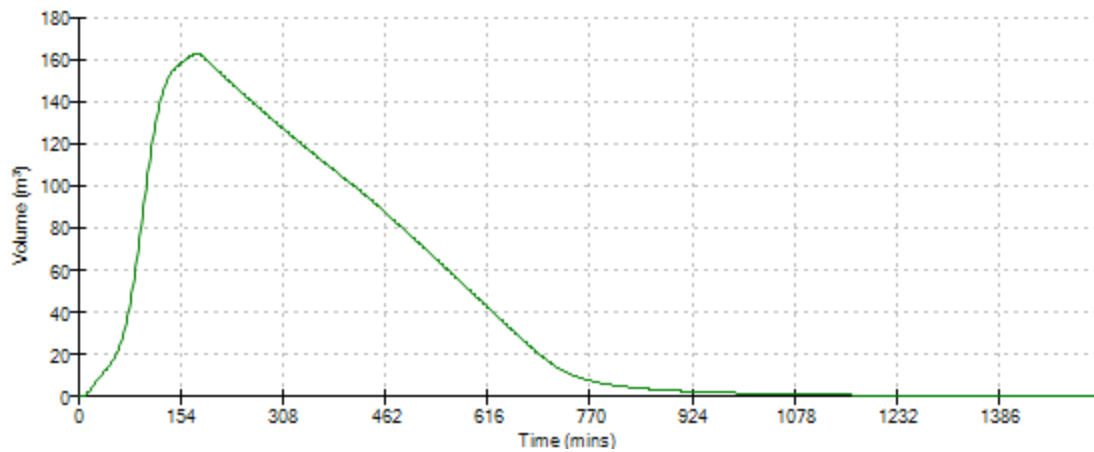
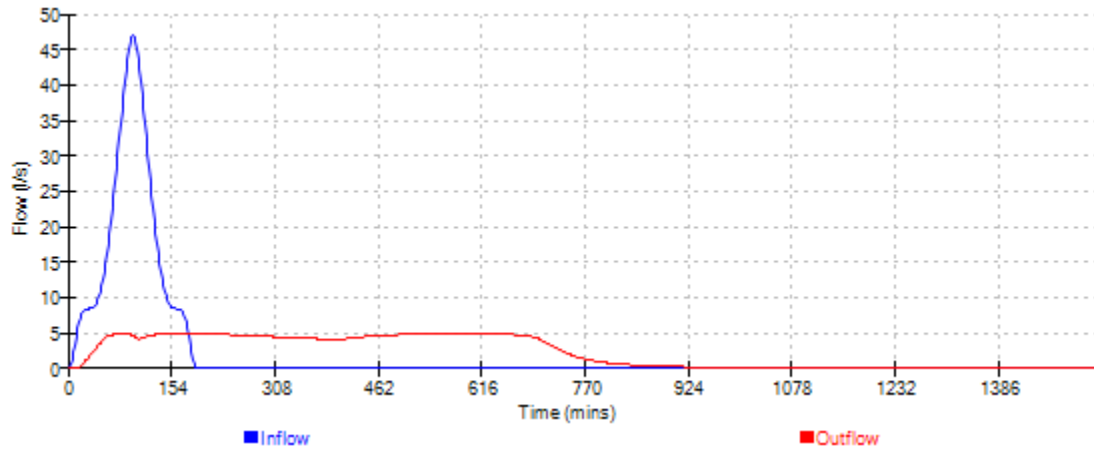
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Event: 120 min Winter



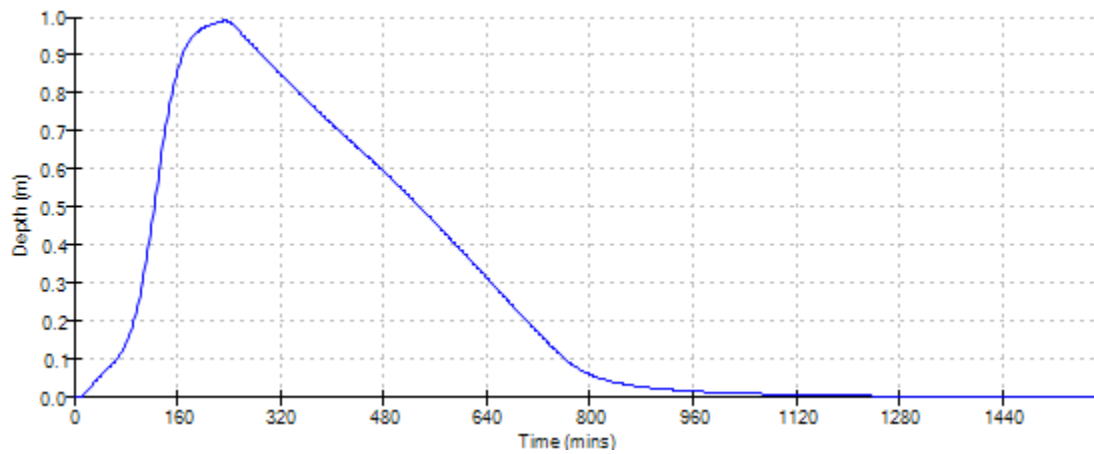
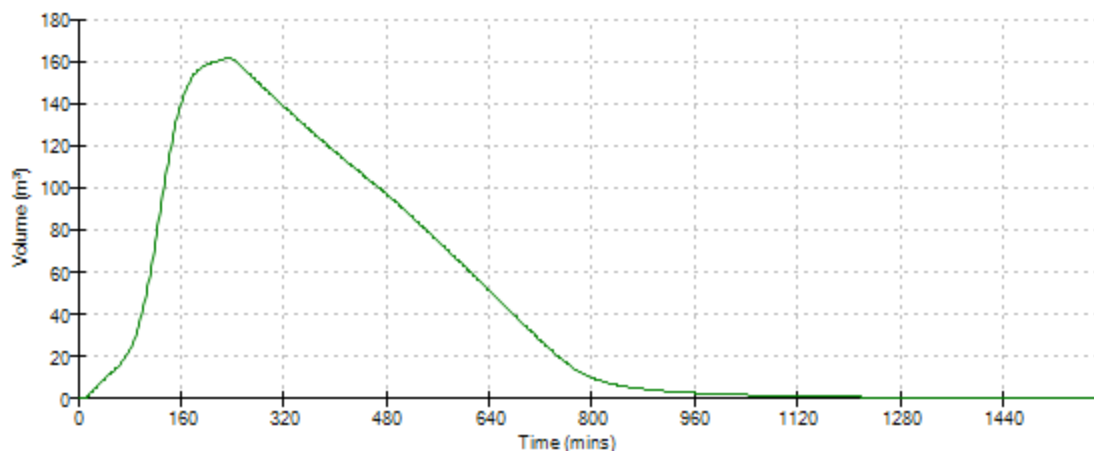
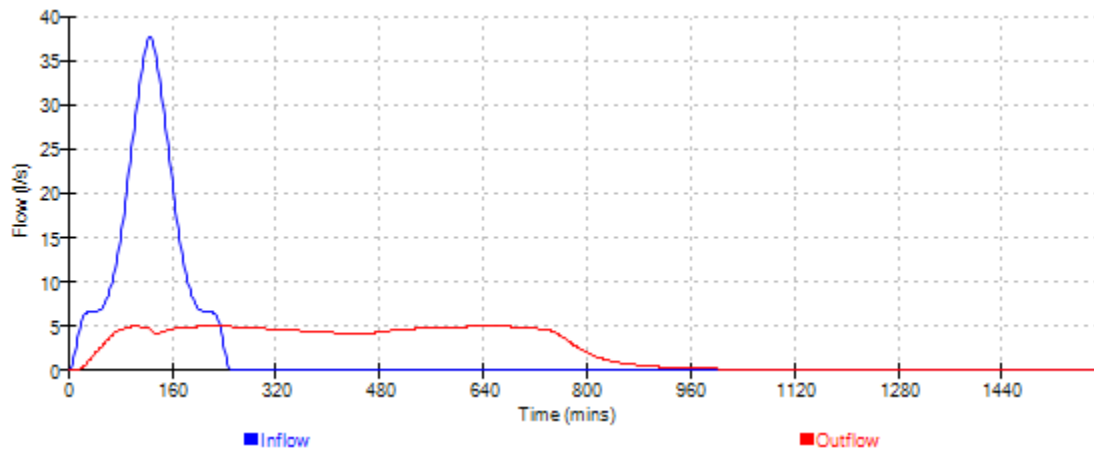


Event: 180 min Winter





Event: 240 min Winter



Appendix H – SuDS Maintenance Schedules

Operation and Maintenance Requirements for Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and move contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level or the paving	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and / or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Ref. Table 20.15, CIRIA C753 'The SuDS Manual

The maintenance requirements detailed above are to be undertaken by the site owner.

Name:

Position:

Date:

**Signed on behalf
Of the site owner**

Operation and Maintenance Requirements for Attenuation Storage Tanks

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Ref. Table 21.3, CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name:

Position:

Date:

**Signed on behalf
Of the site owner**