ARDENT CONSULTING ENGINEERS

KINGSBRIDGE ASSETS LLP

1 MANOR HOUSE DRIVE, NORTHWOOD,
LONDON HA6 2UJ

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

REPORT REF. 194450-02
PROJECT NO. 194450
SEPTEMBER 2019

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DOCUMENT CONTROL SHEET

REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	DRAFT	VL	CC	**DRAFT**	02.10.19
-	FINAL	VL	CC	BC	18.12.2019

1. INTRODUCTION

1.1 Ardent Consulting Engineers (hereafter referred to as "Ardent") have been commissioned by Kings Oak Asset Portfolio Ltd to undertake a Flood Risk Assessment (FRA) and Drainage Strategy for the proposed redevelopment of the site at 1 Manor House Drive, Northwood HA6 2UJ, for residential (C3) use. The proposed scheme comprises the demolition of the existing detached house on the site and its replacement with seven flats in a single block with seven on-site car parking spaces.

1.2 The London Borough of Hillingdon (LBH) is the Local Planning Authority and Lead Local Flood Authority (LLFA).

1.3. This FRA has been prepared with specific reference to the requirements of National Planning Policy Framework (NPPF) released in February 2019 and the Planning Practice Guidance (PPG), which superseded the Technical Guidance to the NPPF, in March 2014. This report also takes into consideration the requirements within the Non-statutory technical standards for sustainable drainage systems (March 2015) and its Best Practice Guidance (July 2015).

Planning History

1.4 Two previous applications for the redevelopment of the site to provide five and six 2-bedroom flats respectively, have been submitted to LBH.

December 2016 application and subsequent appeal (six flats)

1.5 The first (LBH ref 27306/APP/2016/4520) was refused consent in June 2017 on five grounds, none of which related to flood risk or drainage matters. This scheme was the subject of a planning appeal (PINS Ref APP/R5510/W/17/3180250) which was dismissed.

1.6 LBH's Flood and Water Management Officer advised that the site is at risk of surface water flooding in accordance with the Environment Agency Flood Maps and stated that '*the development needs to manage surface water on site in order to reduce pressure on the main surface water sewer*. '

September 2018 application (five flats)

1.7 A further application (LBH ref 27306/APP/2018/3045) was submitted to LBH for five 2-bedroom flats, in September 2018; this was also refused but on grounds of bulk and massing, again with no objection from a flood risk/drainage perspective.

Current (2019) application

1.8 This report has been prepared to accompany a full application for a new scheme of seven flats and associated amenity space and parking, which is intended to address the concerns raised about bulk and massing cited by LBH in refusing the 2018 application.

1.9. The purpose of this document is to provide satisfactory information to meet the requirements of LBH as the LLFA in terms of surface water flood risk and drainage.

Site Location

1.10. The site is located within an existing cul-de-sac at Manor House Drive, Northwood, HA6 2UJ and centred at National Grid Reference TQ078911.

1.11. The area within the site boundary extends to 0.088ha and currently comprises of an existing detached dwelling and associated garden. The site is bound to the south by the A4180 Ducks Hill Road, Manor House Drive to the west, and further residential developments to the north and east. Refer to **Figure 1-1** below for a Site Location Plan.

Figure 1-1: Site Location Plan

1.12. The site is currently comprised of 550m^2 of hardstanding areas.

Development Proposals

1.13. The development proposals are for the demolition of the existing dwelling and construction of a two-storey building to comprise of seven no. flats with associated amenity space and parking. Refer to **Appendix B** for the full development plans, including the existing layout for reference.

1.14. The proposed development layout consists of 750m^2 of hardstanding areas and 130m^2 of permeable open landscaping.

2. POLICY CONTEXT

National Planning Policy Framework

2.1. The National Planning Policy Framework (NPPF) was updated on 19 February 2019; paragraph 155 to 165 inclusive, establishes the Planning Policy relating to flood risk management. The Technical Guide to the NPPF has been superseded by the Planning Practice Guidance (PPG) in March 2014.

2.2. The main focus of the policy is to direct development towards areas of the lowest practicable flood risk and to ensure that all development is safe, without increasing flood risk elsewhere. The main considerations are:

a) applying the sequential test and then, if necessary, the exception test as set out below;

b) safeguarding land from development that is required, or likely to be required, for current or future flood management;

c) using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques); and

d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

Flood and Water Management Act (2010)

2.3. The Flood and Water Management Act places a duty on all flood risk management authorities to co-operate with each other. The act also provides lead local flood authorities and the Environment Agency with a power to request information required in connection with their flood risk management functions.

Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems March 2015

2.4. The Non-statutory technical standards for sustainable drainage systems were published in March 2015. This document sets out non-statutory technical standards for sustainable drainage systems. They should be used in conjunction with the Planning Practice Guidance. In addition, the Best Practice Guidance for the Non-Statutory technical standards was published in July 2015.

2.5. The Local Planning Authority (LPA) may set local requirements for planning permission that have the effect of more stringent requirements than these non-statutory technical standards.

2.6. In addition, SuDS should be designed in accordance with CIRIA 753 "The SuDS Manual", which represents current best practice.

The London Plan & Supplementary Planning Guidance (SPG)

2.7 A new London Plan was published in December 2017, replacing the former 2011 London Plan.

2.8 London Plan Policy SI 12 Flood Risk Management outlines that "*Current and expected flood risk from all sources across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers. B Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Surface Water Management Plan, where necessary, to identify areas where particular flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should co-operate and jointly address cross-boundary flood risk issues including with authorities outside London."*

London Borough of Hillingdon Local Plan (November 2012)

2.9. Hillingdon's Local Plan is a collection of documents that provide the foundation for how planning will be controlled in the borough. The two primary documents are 'Local Plan Part 1 - Strategic policies' and 'Local

Plan Part 2'. Local Plan Part 1 was adopted in November 2012 and outlines the Council's vision up to 2026.

2.10. Policy EM1- Climate Change Adaptation and Mitigation provides guidance to ensure climate change mitigation will be addressed at every state of the development process and states that '*The Borough will ensure that climate change adaptation is addressed at every stage of the development process by:*

- *Locating and designing development to minimise the probability and impacts of flooding.*
- *Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.*
- *Giving preference to development of previously developed land to avoid the loss of further green areas.*

2.11. Policy EM6 within the Local Plan Part 1 is related to Flood Risk Management'.

2.12. Policy DMEI 9: Management of Flood Risk within Local Plan Part 2 provides policy and guidance on flood risk matters.

London Borough of Hillingdon Local Flood Risk Management Strategy (LFRMS, 2016)

2.13. The Local Flood Risk Management Strategy, published in 2016, provides an overview of previously undertaken flood risk studies. It is supported by other documents such as the PFRA, SWMP and SFRA.

2.14. Appendix 3 of the LFRMS provides a set of objectives, measures and actions. Objective three of the six objectives states "*Development in Hillingdon understands and takes account of flood risk issues and plans to reduce flood risk*." The measures associated with this objective are:

- Influence the local plan and creation of suitable policies on flood risk.

- Secure contribution to flood risk reduction from new developments.

- Major landowners to develop site wide long-term plans for managing water.

- Continue influencing developments through the planning process to ensure they meet the requirements of National Standards for Sustainable Drainage and London Plan requirements

London Borough of Hillingdon Surface Water Management Plan (SWMP), Part 1 Evidence Base (2003), and Part 2 Options and Actions Plan (2014)

2.15. The Surface Water Management Plan (SWMP) Parts 1 & 2 outline the evidence and the surface water management strategy for Hillingdon. They include consideration of flooding from sewers, drains, groundwater and run-off from land, small watercourses and ditches that could occur as a result of heavy rainfall.

2.16. The SWMP includes a number of maps and figures within the appendices which provides a visual representation of the flood risk associated with the borough and identifies a number of 'Critical Drainage Areas' (CDAs). It is noted from the SWMP that the site is not located within a Critical Drainage Area (CDA) although the surface water flood maps identify a risk of flooding to the site.

Sequential Test

2.17. The objective of the Sequential Test is to steer new developments toward areas with the lowest probability of flooding, i.e. Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 before Flood Zone 3 is considered.

2.18. As the Site is shown to be located within Flood Zone 1 of the Environment Agency flood mapping, it is not necessary for the Site to undergo the Sequential Test.

Exception Test

2.19. Table 3 of the PPG replicated below in **Table 2-1** Error! Reference source not found.confirms that the Exception Test is not required for "More Vulnerable" uses in Flood Zone 1.

Table 2-1: Extract from the PPG - Table 3: Flood Risk Vulnerability

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

3. BASELINE CONDITIONS

Topography

3.1. A topographical survey of the site was undertaken by KND Surveys and included in **Figure 3-1** below and **Appendix B**.

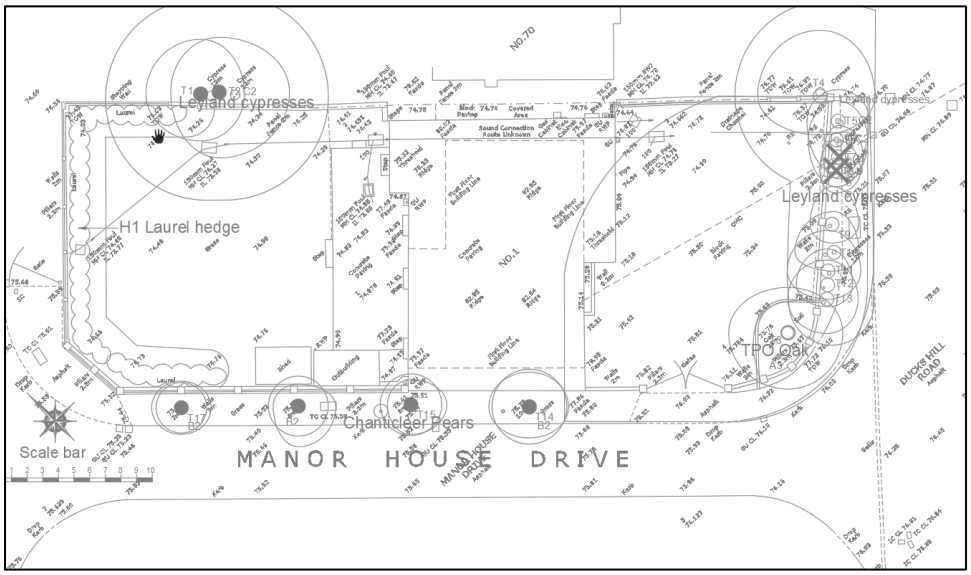


Figure 3-1: Topographical Survey

3.2. A Digital Terrain Model (DTM) generated from 1m and 2m LiDAR data was additionally reviewed in order to understand the topography of the site's surroundings.

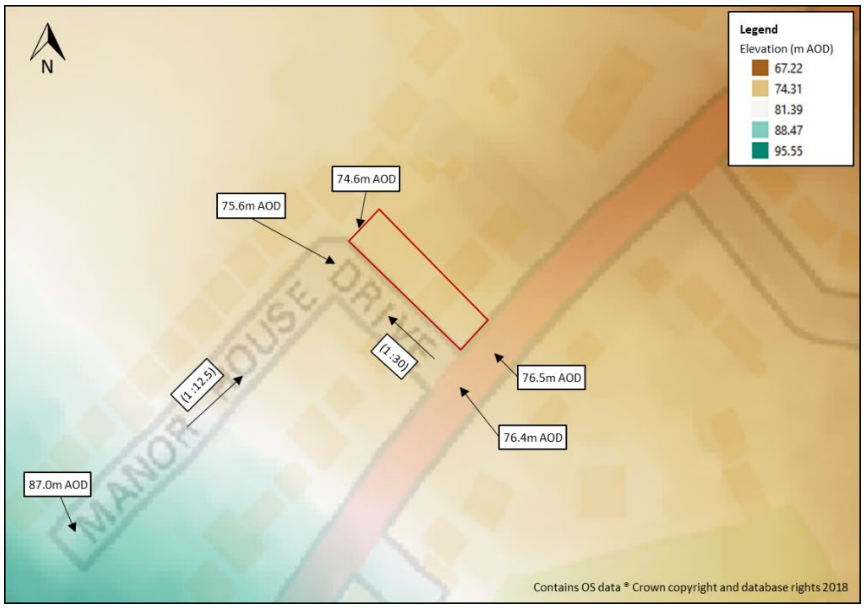


Figure 3-2: 1m LiDAR Data

3.3. Examination of the LiDAR data and topographical survey indicates that levels along Manor House Drive fall steeply from 87.0m AOD on the south-western end of the drive, to a low spot (75.6m AOD) on the north-eastern side. Levels along the length of Manor House Drive to the west of the site also fall gradually from Duck's Hill Road (76.4m AOD) to this low spot.

3.4. Site elevations are noted at 74.5mAOD on the rear garden; between 75.0 and 75.8 m AOD on the front drive and Finished Floor Levels at circa 75.0 m AOD.

Hydrology

3.5. There are no watercourses in close vicinity to the site, with the nearest watercourse starting approximately 200m to the north-east of the site, to the east of Ducks Hill Road.

Ground Conditions

3.6. A review of British Geological Survey (BGS) mapping indicates that the geology of the site consists of Lambeth Group Formation (clay, silt and sand) bounding London Clay Formation (clay, silt and sand) with no superficial deposits recorded across the Site. Refer to **Figure 3-3** below.

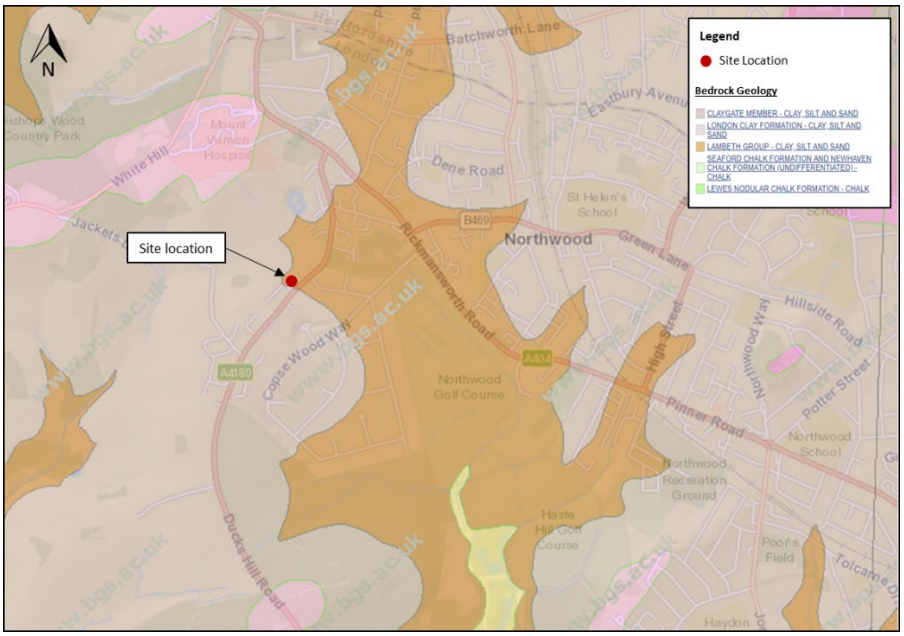


Figure 3-3: BGS Online Geology Mapping- Bedrock Geology

Existing Sewer Infrastructure

3.7. Thames Water sewer records show a 900mm surface water sewer along the access road to Manor House Drive, connecting into a further 900mm sewer along Manor House Drive. The network then falls into the site boundary and crosses the development site from north to south before connecting to a 225mm run along Duck's Hill Road. Existing Thames Water surface water sewers within the site are 150mm in diameter.

3.8. Thames Water have confirmed the 900mm sewers along Manor House Drive serve as temporary storage for surface water, using a flow control device to restrict downstream flows.

3.9. A 150mm foul sewer network runs parallel to the surface water sewer, before discharging into the 225mm diameter sewer along Duck's Hill Road. (refer to **Figure 3-5** below and **Appendix E**).

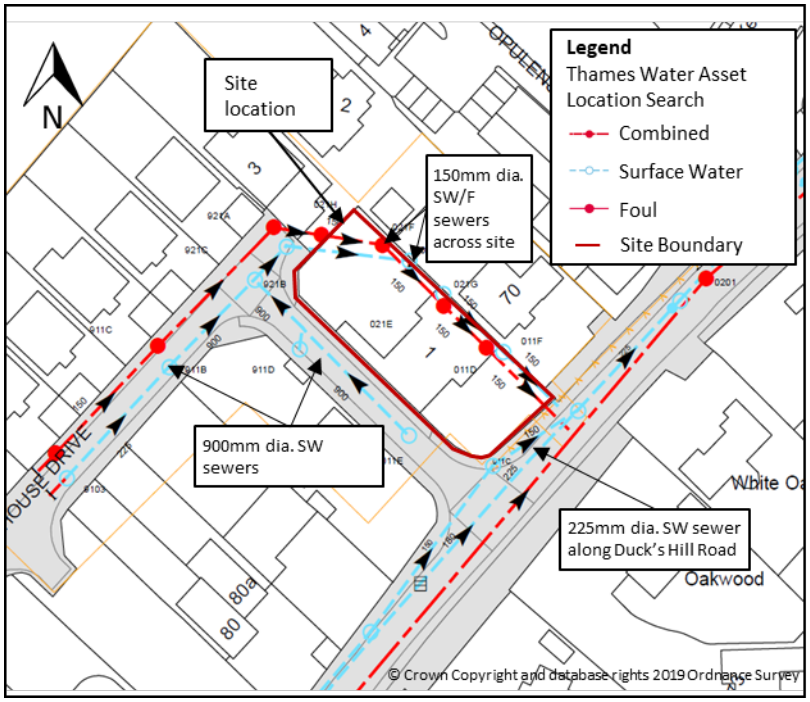


Figure 3-4: Thames Water Asset Map Extract (July 2019)

4. SOURCES OF FLOODING

4.1. The NPPF requires flood risk from the following sources to be assessed, each of which are assessed separately below:

1. Tidal sources (flooding from the sea);
2. Fluvial sources (river flooding);
3. Pluvial sources (flooding resulting from overland flows);
4. Groundwater sources;
5. Sewer flooding;
6. Artificial sources, canals, reservoirs etc.; and,
7. It also requires the risk from increases in surface water discharge to be assessed (surface water management).

Fluvial / Tidal Flooding

4.2. Based on the Environment Agency's Flood Map for Planning, the site is located entirely in Flood Zone 1 and therefore considered to be at 'low' risk. See **Figure 4-1** below.

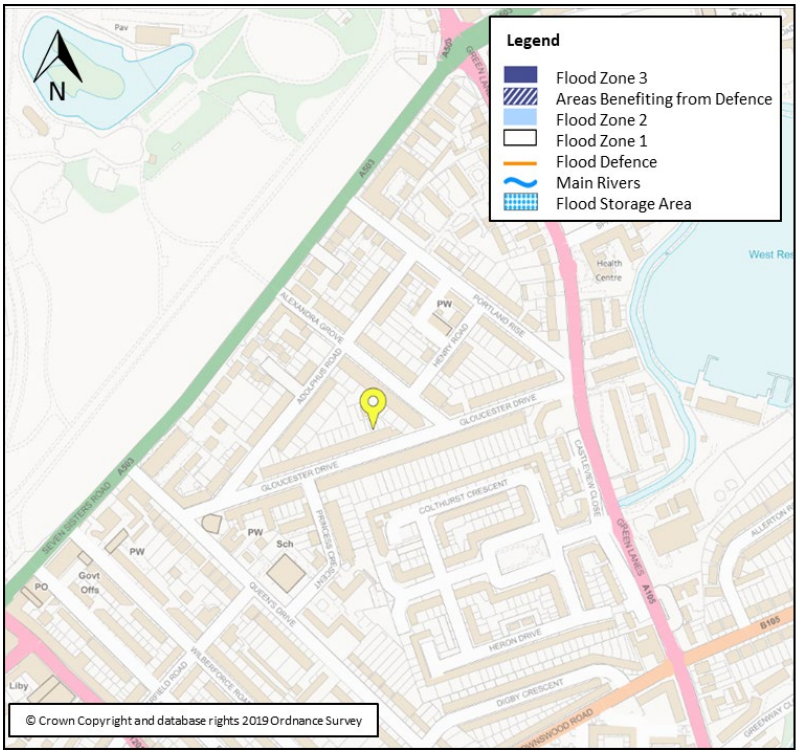


Figure 4-1: EA Flood Map for Planning

Pluvial Flooding

4.3. The Environment Agency surface water flood maps show that the rear garden of the site is in an area of 'Low' to 'Medium risk of surface water flooding. A flow path originating from Manor House Drive flows north-westwards and crosses the rear garden of the development Site and neighbouring properties, before flowing north along Ducks Hill Road. Refer to **Figure** 4-2 below.

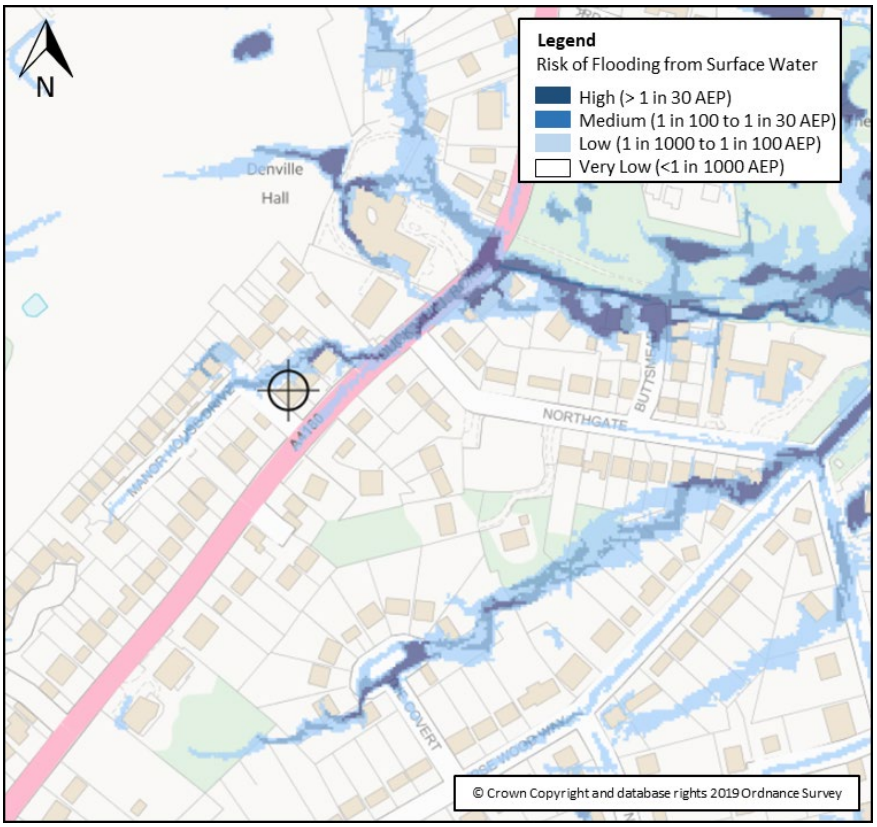


Figure 4-2: Environment Agency Flood Map for Surface Water

4.4. Predicted flood extents for the 'medium' risk scenario (equivalent to the 1 in 100 storm event) would be minimum and flood depths would be below 300mm at the rear of the property. Refer to **Figure** 4-3 below.

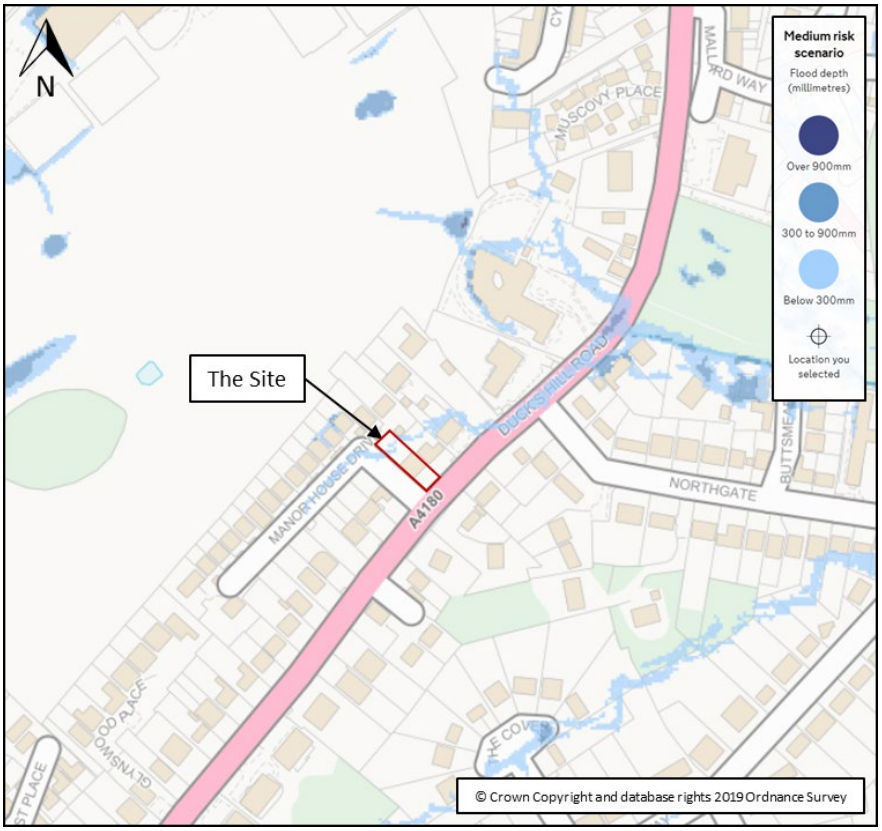


Figure 4-3: Environment Agency Flood Map for Surface Water: Flood Depth - 'Medium' risk

4.5. In addition, results of a surface water model of the LBH produced by Capita are shown within the SWMP. The results show the site is outside any risk of flooding up to the 1 in 200 year storm event, including the 1 in 100 year plus climate change (+30%) shown in **Figure 4-4** below. The results show the surface water flow path along Manor House Drive is contained within the roads.

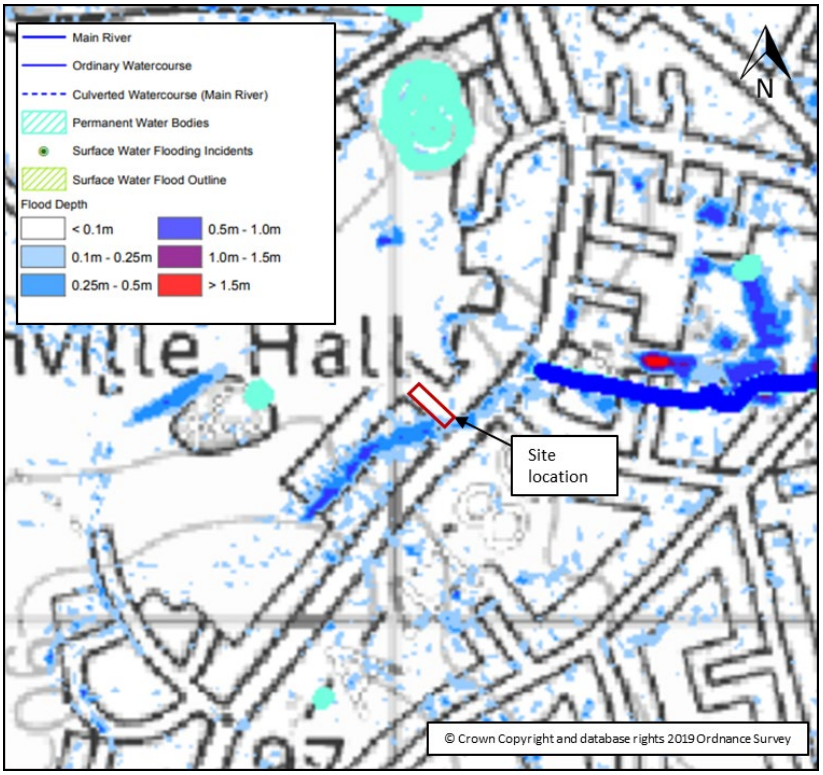


Figure 4-4 SFRA Extract: 1 in 100 year rainfall event (including Climate Change) modelled depths

4.6. In the worst case results (the EA Flood Map for Surface Water), the surface water flood risk is shown to be contained within the proposed car park and not affect the proposed building. However, in order to protect the property against any risk of surface water flooding, external levels should fall away from the proposed building. It is additionally recommended that Finished Floor Levels are raised a minimum of 150mm above existing ground levels.

Groundwater

4.7. The London Borough of Hillingdon Surface Water Management Plan (SWMP) provides information on the location of areas of 'increased Potential for Elevated Groundwater' in the Borough, where there is a risk of groundwater rising within 2m of the ground surface. Figure 10.1 included in the SWMP shows the site to be outside any areas where elevated groundwater may be an issue, and it confirms there are no records of groundwater flooding affecting the site in the past.

4.8. The risk of groundwater flooding is assessed as 'low'.

Sewer Flooding

4.9. There are no records of sewer flooding within the vicinity of the Site based on the LBH SFRA.

4.10. The risk of sewer flooding is assessed as being 'low'.

Artificial Sources

4.11. According to the Environment Agency's Flood risk from reservoir map, the Site is not in an area at risk of flooding from artificial sources.

4.12. The site is therefore considered to be at a 'very low' risk of flooding from artificial sources.

5. FOUL AND SURFACE WATER MANAGEMENT

Surface Water Management

5.1. The planning redline boundary equates to approximately 0.088 ha, of which 0.054 ha is existing hardstanding areas. The existing runoff rates from the Site were determined using the Wallingford Procedure Rational Method for an assumed critical 5-minute storm:

Q = 2.78*i*A

Where:

Q = Peak Discharge (l/s)
i = Rainfall Intensity (mm/hr)
(50.8mm/hr for 1yr 5 min storm - TRRL Report 595)
A = Contributing Impermeable Areas (ha)

5.2. The surface water run-off that is currently generated from the Site under the 1 year, 30 year, 100 year rainfall events are presented in

	Brownfield Discharge rates (l/s)			**Greenfield runoff rates (l/s)**		
	1 year	**30 year**	**100 year**	**1 year**	**30 year**	**100 year**
Existing Discharge (l/s)	7.72	17.19	21.88	0.1	0.4	0.5
Proposed Discharge (l/s)	2.5	2.5	2.5			
Proposed Reduction (%)	68%	86%	89%			

5.3. Table 5-1 below. The equivalent greenfield runoff rates for the site area also shown in **Table 6-1**. Copies of the calculations are included in **Appendix D**.

5.4. Hillingdon's Sustainable Drainage Design and Evaluation Guide states that brownfield sites should be reduced to greenfield runoff rates, where possible. Greenfield runoff rates for the site as per **Table 6-1** below are too low to be achieved, without significant risk of blockage, and therefore, a discharge of 2.5 l/s is proposed, which is considered to be the lowest practical discharge rate that can be achieved without risking blockages. This would result in a significant reduction in discharge rates relative to the existing site.

	Brownfield Discharge rates (l/s)			**Greenfield runoff rates (l/s)**		
	1 year	**30 year**	**100 year**	**1 year**	**30 year**	**100 year**
Existing Discharge (l/s)	7.72	17.19	21.88	0.1	0.4	0.5
Proposed Discharge (l/s)	2.5	2.5	2.5			
Proposed Reduction (%)	68%	86%	89%			

Table 5-1: Existing Surface Water Runoff Rates

5.5. The run-off generated as a result of the proposed development will be mitigated through the use of sustainable drainage systems (SuDS).

5.6. Based on the site's geology, the use of infiltration systems will not be feasible for the site.

5.7. After consideration of the CIRIA C753 Management Train approach, the most viable SuDS options for this site is by using a geo-cellular attenuation under car parking areas.

5.8. Surface water run-off from the dwelling will be conveyed to the existing Thames Water manhole 021D located within the site boundary, at a controlled rate of 2.5 l/s.

5.9. The proposed geocellular storage - plan area of $36m^2$ would provide a storage volume of $27m^3$ (0.8m deep with 95% void ratio). Microdrainage Source Control calculations demonstrate that the volumes proposed will allow run-off from the extension to be restricted to 2.5l/s up to the 1 in 100-year (including 40% climate change) rainfall event without increasing the risk of flooding on site or elsewhere (refer to **Appendix D**).

5.10. The indicative drainage strategy for the site is illustrated in **Drawing No. 194450-002**, included in **Appendix E**.

5.11. The drainage strategy and proposed connections are subject to approval by Thames Water.

Maintenance and Management of System

5.12. The maintenance of all SuDS components will be in accord with the best practices and the CIRIA Manual C753.

5.13. A private management company will be set up to maintain the surface water drainage network. The name of the Management Company to be advised.

Long Term Storage and Urban Creep

5.14. As the proposed development will not result in a significant increase in the the amount of impermeable area at the site, there is no need to provide Long Term Storage.

5.15. As the proposed development is for flats, there is a minimal risk of increases in impermeable area due to urban creep and therefore no allowance has been made for this.

Foul Drainage

5.16. In the same manner as the surface water drainage system, it is proposed that the additional foul flows generated by the introduction of additional flats will be directed into the foul combined drainage network located on the front garden. It is proposed to re-use an existing connection into the public sewer as shown in **Drawing No. 194450-002**, included in **Appendix E**.

5.17. The existing foul flow, calculated based on the existing single property, produces a foul water flow of 0.046 l/s. It has been estimated that the increase in number of units (to seven no.) will increase the foul water flows to 0.321 l/s. Please refer to **Appendix C** for the proposed calculations. Connection to the public network is subject to the relevant approvals from Thames Water.

6. CONCLUSIONS

6.1. This Flood Risk Assessment (FRA) and Drainage Strategy have been produced in support of the planning application for the proposed redevelopment of the site at 1 Manor House Drive, Northwood HA6 2UJ, for residential (C3) use.

6.2. The proposed scheme comprises the demolition of the existing detached house on the site and its replacement with 7 flats in a single block with seven on-site car parking spaces.

6.3. According to the EA flood maps, the site is located wholly within Flood Zones 1. It is considered to be at low risk of flooding from tidal, fluvial, groundwater, sewer and artificial sources.

6.4. The Environment Agency surface water flood maps show that the rear garden of the existing property is in an area of 'Low' to 'Medium risk of surface water flooding. A flow path originating from Manor House Drive flows north-westwards and crosses the rear garden of the site and neighbouring properties, before flowing north along Ducks Hill Road. Predicted flood depths within the garden of the site are below 300mm. This area is proposed to be developed as a car park and therefore, the risk is considered minimum.

6.5. In order to protect the property against any risk of surface water flooding, external levels should fall away from the proposed building. It is additionally recommended that Finished Floor Levels are raised a minimum of 150mm above existing ground levels

6.6. Surface Water run-off form the development will be managed by using a geo-cellular attenuation under car parking areas. Surface water run-off from the dwelling will be conveyed to a geo-cellular storage tank before discharging to the existing Thames Water manhole 021D located within the site boundary, at a controlled rate of 2.5 l/s for all

storm events up to, and including, the 1 in 100 year, including 40% climate change.

6.7. Microdrainage Source Control calculations demonstrate that the proposed volume of attenuation ($27m^3$) will allow run-off from the extension to be restricted to 2.5l/s up to the 1 in 100-year (including 40% climate change) rainfall event without increasing the risk of flooding on site or elsewhere.

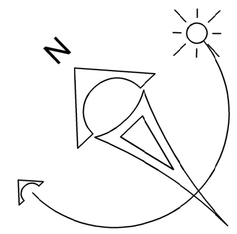
6.8. A management company will be appointed to maintain the SuDS within the development.

6.9. In conclusion, this FRA demonstrates that the proposals are consistent with the aims of the NPPF and the PPG. The Site will not be at significant risk of flooding, or increase the flood risk to others.

Appendix A

Proposed Development Layout

Notes:



Approximate Site Area:
0.08902 Hectare

Total Parking: 7

Accommodation Schedule:
Unit 1 - 2B 4p (92.3m2)
Unit 2 - 2B 4p (110.2m2)
Unit 3 - 2B 4p (78.5m2)
Unit 4 - 2B 4p (93.2m2)
Unit 5 - 2B 4p (102.0m2)
Unit 6 - 1B 2p (61.2m2)
Unit 7 - 1B 2p (70.3m2)

Amenity Space:
312.9sq m

Proposed Ground Floor Plan

0 2 4 6 8 10 m

Rev:	Date:	Details:	By:	Chk:

EngineRoom
2 Cardinal Street
Ipswich
IP1 1LG

PLANNING

Client / Location:
1 Manor House Drive
Northwood

Drawing:
PROPOSED
GROUND FLOOR

Scale:	Date:	Drawn:	Check:
A1 @ 1:100	27-09-19	IB	PB

Job No:	Dwg No:	Rev:
ER1901006	301	

Appendix B

Topographical Survey

NO.2
First Floor Building Line
83.92 Ridge
82.72 Ridge
80.38 Fascia
NO.70
82.53 Ridge
82.52 Ridge
NO.3
80.72 Fascia
82.91 Ridge
80.71 Fascia
80.66 Ridge
Garage
76.01
78.27 Fascia
74.60
74.54
77.43 TOW
74.33
Stepping Wall
Laurel
78.03 TOW
Cypress 13m
Cypress 13m
74.26
74.24
Panel Fence 2m
74.25
*150mm Foul MH CL 74.45 IL 73.47
78.62 Fascia
Panel Fence 2m
74.41
74.456
74.43
Steps
74.78
Block Paving
74.76
Covered Area
74.76
Step
Gates
78.62 Fascia
150mm SW2 MH CL 74.72 IL 72.62
Panel Fence 2m
74.64
74.87
100
3
74.662
74.72
Drainage Channel
74.61
76.77 TOW
76.61 TOW
76.80 TOW
Cypress
74.74
74.79
74.70
MH CL 74.77
74.87
74.79
76.57 TOW
74.59
RE
RE
74.72
Cypresses 12m
GU CL 74.86
MH CL 74.89
Asphalt
74.70
Walls 2m
74.26
150mm Foul MH CL 74.27 IL 73.58
74.30
74.39
100
Step
75.32 Threshold
78.33 Ridge
Sound Connection Route Unknown
Gas Cabinet
Elec. Cabinet
79.99 Fascia
GU
RWP
GU
74.76
100
150mm Foul MH CL 74.76 IL 73.27
74.90
Pipe
74.94
Pillars 2.3m
75.18
75.21
75.07
Kerb
75.31
75.14
Kerb
Pillars 2.3m
Laurel
100mm Foul MH CL 74.85 IL 73.86
77.49 Fascia
74.87
GU
RWP
First Floor Building Line
82.85 Ridge
First Floor Building Line
75.09
75.00
OHC
RS
TC CL 75.43
75.33
Gate
Pillar 2.3m
75.68
SC
75.59
150mm Foul MH CL 74.48 IL 73.77
74.48
Grass
74.50
Step
74.83
74.83
74.89
Step
79.96 Fascia
Concrete Paving
Concrete Paving
NO.1
75.18 Threshold
75.12
75.30
Block Paving
75.34
Walls 2m
Cypresses 12m
75.63
75.59
1
74.878
74.91
Step
75.28
Wall 0.2m
75.18
75.14
82.85 Ridge
82.84 Ridge
75.31
75.42
75.40
75.83
6
75.825
75.78
MH CL 75.76
75.67
MH CL 75.72
75.61
74.66
74.76
RWP
74.90
77.23 Fascia
Step
Shed
Outbuilding
74.99
79.97 Fascia
First Floor Building Line
79.95 Fascia
75.81
4
75.784
75.63
75.76 Oak 16m
Soil
Pillars 2.3m
75.67
76.10
77.73 TOW
Kerb
Kerb
Kerb
75.69
75.60
TC CL 75.61
Drop Kerb
Asphalt
Pillars 2.3m
74.73
74.76
Laurel
74.97
GU
RWP
75.51
Walls 2m
75.82
Pillars 2.3m
Gates
76.11
Walls 2m
76.22
76.00
Drop Kerb
DUCKS HILL ROAD
Asphalt
75.89
Drop Kerb
75.52
75.53
75.57 7m
Walls 2m
Grass
75.52
75.58 8m
TC CL 75.58
Pillars 2.3m
75.61 8m
75.64
75.75 10m
Grass
77.86 Fascia
75.80
75.81
76.03
Asphalt
Kerb
MH CL 75.65
75.73
75.64
GU CL 75.35
GU CL 75.33
75.46
75.40
75.46
Kerb
75.52
75.58
GU CL 75.55
MANOR HOUSE DRIVE
Asphalt
75.68
75.78
75.88
75.93
Drop Kerb
GU CL 76.10
Setts
76.35
76.45
76.36
Drop Kerb
7
75.639
75.60
75.53
Kerb
75.52
75.65
75.81
Kerb
75.96
76.15
5
76.127
Drop Kerb
Drop Kerb
75.76
Kerb
75.96
Kerb
76.00
75.95
IC CL 76.81
IC CL 76.84
IC CL 76.89
76.83
Kerb
76.85
Kerb
77.33
Drop Kerb
77.33
77.27

Appendix C

Thames Water Asset Map

Asset location search

Property Searches

Ardent Consulting Engineers
Hallmark Building
Third Floor52-56 Leadenhall Street
LONDON
EC3M 5JE

Search address supplied 1
Manor House Drive
Northwood
HA6 2UJ

Your reference 194450- 1 Manor House Drive

Our reference ALS/ALS Standard/2019_4049400

Search date 30 July 2019

Keeping you up-to-date

Notification of Price Changes

From 1 September 2018 Thames Water Property Searches will be increasing the price of its Asset Location Search in line with RPI at 3.23%.

For further details on the price increase please visit our website: www.thameswater-propertysearches.co.uk
Please note that any orders received with a higher payment prior to the 1 September 2018 will be non-refundable.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

searchcode

Asset location search

Property Searches

Search address supplied: 1, Manor House Drive, Northwood, HA6 2UJ

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 searchprovides 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

Thames Water Property Searches

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
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.

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: 0800 009 3921
Email: developer.services@thameswater.co.uk

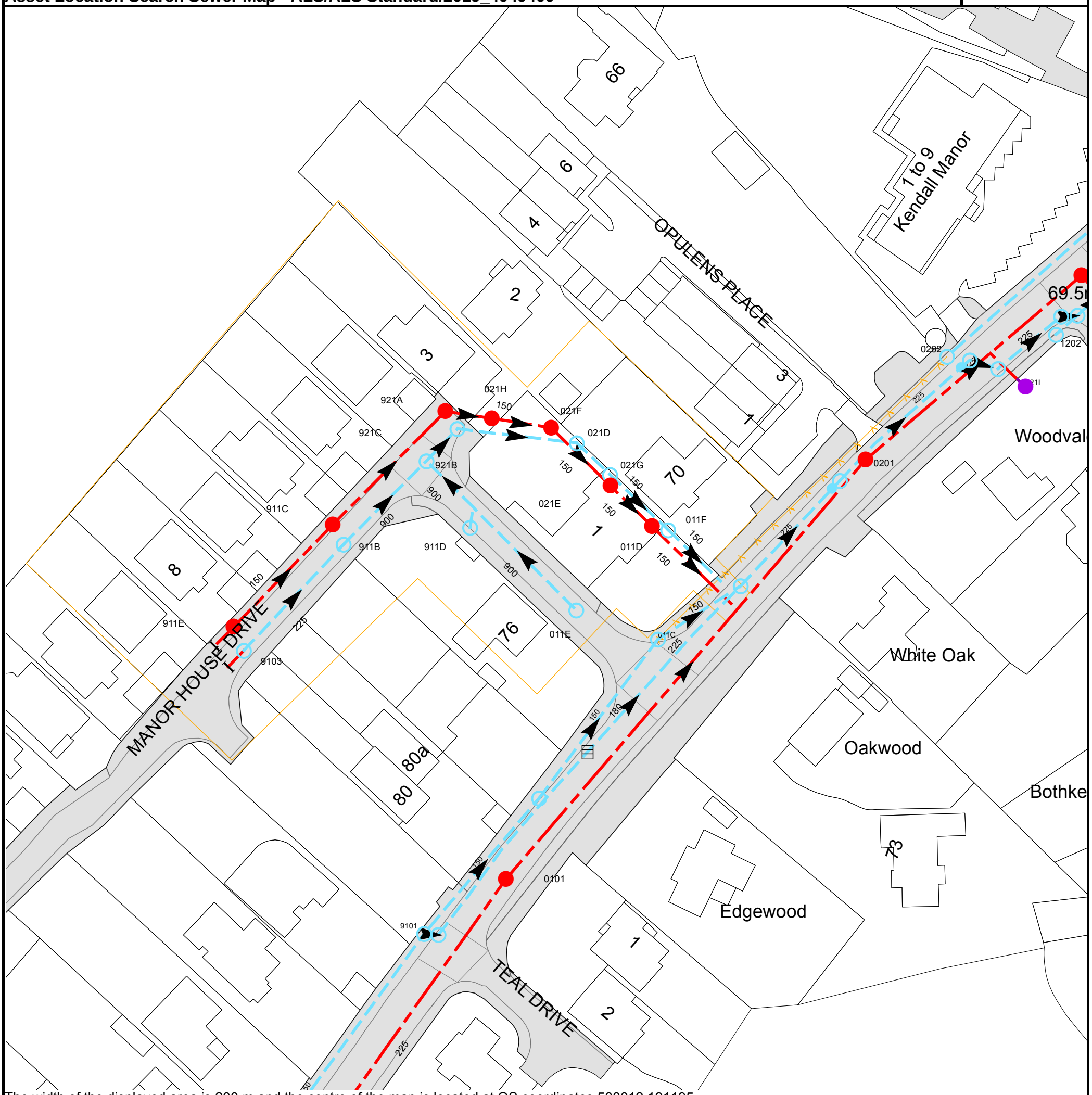
Clean Water queries

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: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2019_4049400



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 508012,191195

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.

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
921C	75.7	73.6
021F	74.3	73.6
021H	75.7	73.75
921A	75.75	74.25
021A	70.636	69.436
021B	70.743	69.873
0202	70.73	69.6
1202	69.77	69.1
121B	69.58	68.83
121C	69.58	68.83
121A	69.61	67.5
911A	81.863	80.813
9101	82.48	81.43
0101	80.26	77.95
011B	78.857	77.827
9103	78.1	76.3
011C	75.91	74.61
911E	78.2	76.7
011E	75.6	73.6
011A	74.653	72.11
911B	76.8	73.6
011F	74.4	72.43
911D	n/a	n/a
011D	74.4	73.29
911C	n/a	n/a
021E	74.4	73.46
021C	72.592	71.092
021G	74.4	72.62
921B	75.6	73.4
0201	72.29	69.77
021D	74.3	72.71

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

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 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 her 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**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	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**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	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**

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 the Ombudsman finds that you have suffered actual loss and/or aggravation, distress or inconvenience 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
Web site: www.tpos.co.uk
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

Greenfield Runoff Calculations

Existing Surface Water Runoff Calculations

Proposed Surface Water Drainage Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	0.088	Urban	0.000
SAAR (mm)	700	Region Number	Region 6

Results l/s

QBAR Rural	0.2
QBAR Urban	0.2
Q100 years	0.5
Q1 year	0.1
Q30 years	0.4
Q100 years	0.5

PRELIMINARY DRAINAGE CALCULATIONS

22/08/2019

EXISTING SURFACE WATER

Existing site information:

Site Boundary Area	886	m²
Developable Area	0.0886	ha
Impermeable Area	0.055	ha

Modified Rational Method Equation:

$$Q_n = 2.78\,CiA$$

where:

C *Runoff Coeffic* = 1 (in this case 1 as using impermeable area)

i_n *Rainfall Intensity for n return period (mm/hr)*

A *Impermeable Area (Ha)*

Q_n *Runoff for n return period (l/s)*

Rainfall Intensity:

The rainfall intensities for various return periods were extracted from Table 1(a) of the Transport and Road Research Laboratory Report - Estimated rainfall for drainage calculations in the United Kingdom (TRRL Report LR 595) by C. P. Young. For the 5 min duration.

i_1	50.8	mm/hr
i_{30}	113.02	mm/hr
i_{100}	143.9	mm/hr

Existing Surface Water Runoff:

Therefore:

			C		i_n		A		Q_n	
Q_1	2.78	x	1	x	50.8	x	0.0547	=	**7.72**	**l/s**
Q_{30}	2.78	x	1	x	113.0	x	0.0547	=	**17.19**	**l/s**
Q_{100}	2.78	x	1	x	143.9	x	0.0547	=	**21.88**	**l/s**

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

Half Drain Time : 88 minutes.

	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15	min Summer	73.641	0.491	0.0	2.5	2.5	16.8	O K
30	min Summer	73.773	0.623	0.0	2.5	2.5	21.3	O K
60	min Summer	73.857	0.707	0.0	2.5	2.5	24.2	O K
120	min Summer	73.862	0.712	0.0	2.5	2.5	24.4	O K
180	min Summer	73.833	0.683	0.0	2.5	2.5	23.4	O K
240	min Summer	73.797	0.647	0.0	2.5	2.5	22.1	O K
360	min Summer	73.724	0.574	0.0	2.5	2.5	19.6	O K
480	min Summer	73.652	0.502	0.0	2.5	2.5	17.2	O K
600	min Summer	73.569	0.419	0.0	2.5	2.5	14.3	O K
720	min Summer	73.500	0.350	0.0	2.5	2.5	12.0	O K
960	min Summer	73.396	0.246	0.0	2.5	2.5	8.4	O K
1440	min Summer	73.284	0.134	0.0	2.4	2.4	4.6	O K
15	min Winter	73.707	0.557	0.0	2.5	2.5	19.1	O K
30	min Winter	73.856	0.706	0.0	2.5	2.5	24.2	O K
60	min Winter	74.190	1.040	0.0	2.8	2.8	27.6	O K
120	min Winter	74.358	1.208	0.0	3.0	3.0	27.8	O K
180	min Winter	73.933	0.783	0.0	2.5	2.5	26.8	O K
240	min Winter	73.883	0.733	0.0	2.5	2.5	25.1	O K
360	min Winter	73.776	0.626	0.0	2.5	2.5	21.4	O K
480	min Winter	73.668	0.518	0.0	2.5	2.5	17.7	O K

	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15	min Summer	140.352	0.0	19.2	24
30	min Summer	91.674	0.0	25.1	37
60	min Summer	57.005	0.0	31.2	62
120	min Summer	34.241	0.0	37.5	102
180	min Summer	25.078	0.0	41.2	136
240	min Summer	19.989	0.0	43.8	170
360	min Summer	14.479	0.0	47.5	240
480	min Summer	11.517	0.0	50.4	308
600	min Summer	9.637	0.0	52.7	368
720	min Summer	8.327	0.0	54.7	428
960	min Summer	6.608	0.0	57.9	540
1440	min Summer	4.764	0.0	62.6	760
15	min Winter	140.352	0.0	21.5	24
30	min Winter	91.674	0.0	28.1	37
60	min Winter	57.005	0.0	34.9	62
120	min Winter	34.241	0.0	42.0	100
180	min Winter	25.078	0.0	46.1	144
240	min Winter	19.989	0.0	49.0	182
360	min Winter	14.479	0.0	53.3	258
480	min Winter	11.517	0.0	56.5	334

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
600 min Winter	73.537	0.387	0.0	2.5	2.5	13.2	O K
720 min Winter	73.439	0.289	0.0	2.5	2.5	9.9	O K
960 min Winter	73.313	0.163	0.0	2.5	2.5	5.6	O K
1440 min Winter	73.239	0.089	0.0	2.0	2.0	3.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	9.637	0.0	59.1	392
720 min Winter	8.327	0.0	61.3	446
960 min Winter	6.608	0.0	64.8	546
1440 min Winter	4.764	0.0	70.1	748

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)	20.100	Shortest Storm (mins)	15
Ratio R	0.412	Longest Storm (mins)	1440
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.073

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.024	4	8	0.024	8	12	0.024

Model Details

Storage is Online Cover Level (m) 74.700

Cellular Storage Structure

Invert Level (m) 73.150 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	36.0	0.0	0.800	36.0	0.0
0.400	36.0	0.0	0.801	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFP-0076-2500-0800-2500
Design Head (m)	0.800
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Future Proof
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	73.150
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	2.5
Flush-Flo™	0.213	2.5
Kick-Flo®	0.482	2.0
Mean Flow over Head Range	-	2.2

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

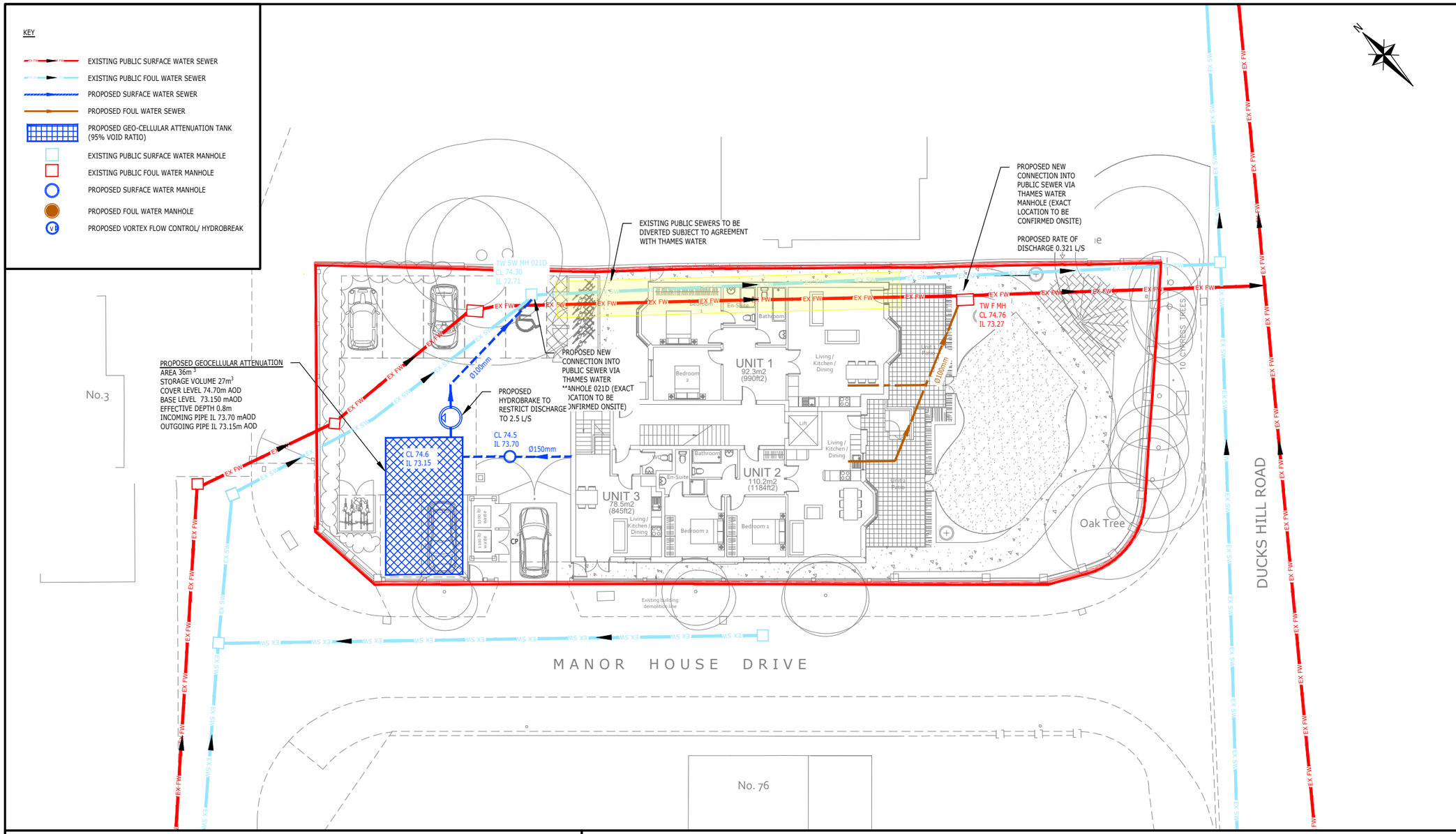
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	3.0	3.000	4.6	7.000	6.8
0.200	2.5	1.400	3.2	3.500	4.9	7.500	7.1
0.300	2.4	1.600	3.4	4.000	5.2	8.000	7.3
0.400	2.3	1.800	3.6	4.500	5.5	8.500	7.5
0.500	2.0	2.000	3.8	5.000	5.8	9.000	7.7
0.600	2.2	2.200	4.0	5.500	6.1	9.500	7.9
0.800	2.5	2.400	4.1	6.000	6.4		
1.000	2.8	2.600	4.3	6.500	6.6		

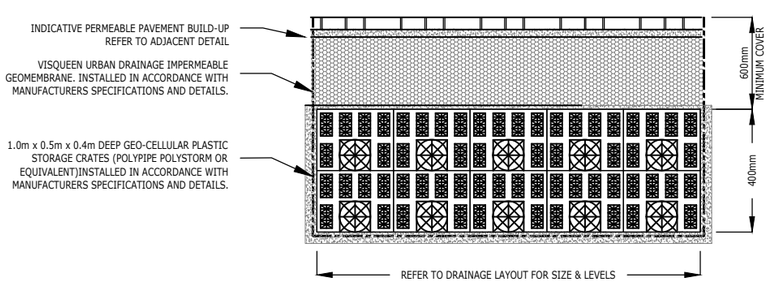
Appendix E

Foul and Surface Water Drainage Strategy
Drawing no. 194450-002

KEY

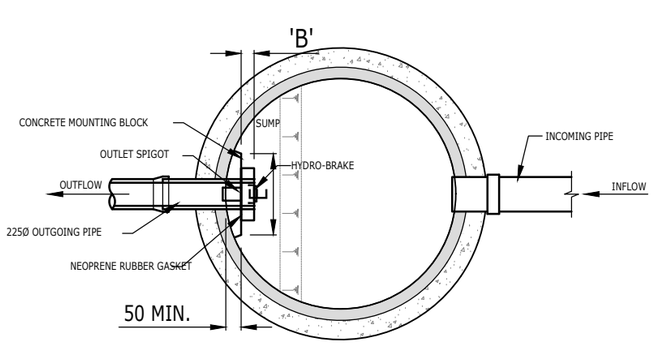
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING PUBLIC FOUL WATER SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED FOUL WATER SEWER
- PROPOSED GEO-CELLULAR ATTENUATION TANK (95% VOID RATIO)
- EXISTING PUBLIC SURFACE WATER MANHOLE
- EXISTING PUBLIC FOUL WATER MANHOLE
- PROPOSED SURFACE WATER MANHOLE
- PROPOSED FOUL WATER MANHOLE
- PROPOSED VORTEX FLOW CONTROL/ HYDROBREAK



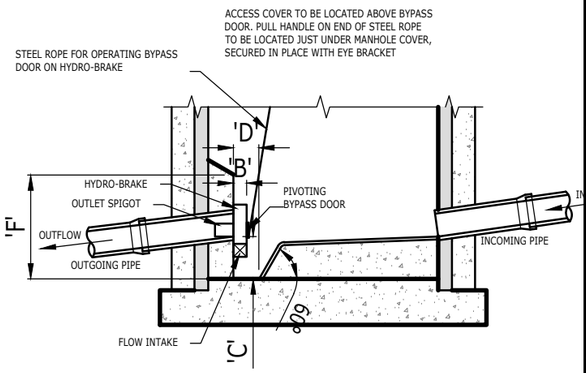


CELLULAR ATTENUATION TANK CONSTRUCTION DETAILS
(1:20)

DETAILS SHOWN ARE INDICATIVE. REFER TO MANUFACTURER FOR FULL DETAILS AND SPECIFICATIONS. REFER TO MANUFACTURERS DETAILS FOR INLET & OUTLET MANIFOLDS AND INSPECTION ACCESS. (REFER TO LAYOUT FOR LOCATIONS).



TYPICAL FLOW CONTROL CHAMBER
NTS



SECTION THROUGH
FLOW CONTROL CHAMBER
NTS

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RELEVANT SPECIFICATION, INC. RISK ASSESSMENTS (SEE CDM NOTES) AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER.
2. DO NOT SCALE FROM THIS DRAWING.
3. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES UNLESS OTHERWISE STATED.
4. ALL DIMENSIONS, LEVELS AND SURVEY GRID CO-ORDINATES ARE TO BE CHECKED ON SITE AND THE ENGINEER NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF THE WORKS.
5. DRAWING HAS BEEN BASED ON DRAWING NO. ER1901006 SK-01 BY ENGINE ROOM ARCHITECTS, 24.06.2019.
6. LOCATION OF EXISTING SEWERS HAVE BEEN TRANSCRIBED FROM THAMES WATER ASSET PLAN.
7. DETAILS OF THE EXISTING DRAINAGE (INCLUDING CONDITION, COVER AND INVERT LEVELS TO BE CONFIRMED IN-SITU WITH CCTV DRAINAGE SURVEY.
8. PROPOSED CONNECTIONS TO THE PUBLIC SEWER SUBJECT TO THAMES WATER APPROVAL.
9. SURFACE WATER DRAINAGE STRATEGY SUBJECT TO LB HILLINGDON (IN THEIR ROLE AS LEAD LOCAL FLOOD AUTHORITY) APPROVAL.

CDM NOTES

THE ATTENTION OF THE CLIENT, PRINCIPAL DESIGNER, PRINCIPAL CONTRACTOR, DESIGNERS AND CONTRACTORS IS DRAWN TO THE FOLLOWING POTENTIAL RISKS IN CONJUNCTION WITH THE PROPOSED ON-SITE AND OFF-SITE WORKS AS DESIGNED FOR THIS PROJECT:

1. WORKS IN THE VICINITY OF LIVE SERVICES INCLUDING GAS, ELECTRICITY AND BT WILL BE NECESSARY AND THE ADVICE OF ALL STATUTORY SERVICE COMPANIES MUST BE SOUGHT BEFORE ANY WORKS COMMENCE.
2. WORKS WITHIN AND ABUTTING THE EXISTING HIGHWAY WILL ENTAIL TRAFFIC HAZARDS AND ALL APPROPRIATE SAFETY MEASURES INCLUDING BARRIERS, SIGNS AND LIGHTING MUST BE UNDERTAKEN TO THE APPROVAL OF THE LOCAL AUTHORITY, THE HIGHWAY AUTHORITY AND THE POLICE DEPARTMENT.
3. HAZARDOUS MATERIALS INCLUDING CEMENT AND BITUMINOUS MATERIALS ARE SPECIFIED AND THE MANUFACTURERS ADVICE ON SAFE HANDLING PROCEDURES MUST BE OBTAINED AND MADE CLEAR TO ALL OPERATIVES.
4. THE CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING ALL EXISTING SERVICES WITHIN THE VICINITY OF THE WORKS HAND DUG AND ENSURE THESE ARE PROTECTED THROUGHOUT THE DURATION OF THE WORKS. ALL UTILITY PLANT SHOULD BE CLEARLY MARKED ON THE GROUND PRIOR TO COMMENCEMENT OF THE WORKS.
5. THE CONTRACTOR MUST ENSURE ALL WORKING AREAS ARE FULLY SECURE.

Rev	Description	Drn	Chk	App	Date

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Client
KINGSBRIDGE ASSETS LLP

Project Title:
1 MANOR HOUSE DRIVE, NORTHWOOD

Drawing Title:
PROPOSED FOUL AND SURFACE WATER DRAINAGESTRATEGY

A3 Scale	Date	Designed by
1:250	18.12.2019	VL
Drawn by	**Checked by**	**Approved by**
VL	CC	BC

Drawing Number: 194450-02 | Rev: -

Appendix F

Existing and Proposed
Foul Water Discharge Calculations

PRELIMINARY DRAINAGE CALCULATIONS

22/08/2019

EXISTING FOUL WATER

ARDENT
CONSULTING ENGINEERS

Development Type	Existing Area / Units	Hours (hrs)	Thames Water Flow Rate l/day	Peak Factor	Peaked Loading l/s	Development Loading (l/s)
General Housing	1 Unit	24	600 per property	6.6	0.045833 per property	0.046

TOTAL EXISTING FOUL LOADING (l /s) = **0.046**

PRELIMINARY DRAINAGE CALCULATIONS

22/08/2019

PROPOSED FOUL WATER

ARDENT
CONSULTING ENGINEERS

Development Type	Proposed Area/Units	Hours (hrs)	Thames Water Flow Rate l/day	Peak Factor	Peaked Loading l/s	Development Loading (l/s)
General Housing	7 Units	24	600 per unit	6.6	0.045833 per property	0.321

TOTAL PROPOSED FOUL LOADING (l /s) = **0.321**

PRELIMINARY DRAINAGE CALCULATIONS

22/08/2019

	Dry weather flow (in litres per day)	Daily Discharge (in litres)
General Housing per property	600	4000
School per pupil	80	528
Assembly Hall per seat	10	66
Cinema per seat	10	66
Theatre per seat	10	66
Sports Hall per person	50	330
Hotel per room	550	3630
Guest House per room	200	1320
Motel per room	300	1980
Holiday Apartment per person	150	990
Leisure Park per person	220	1452
Caravan Pk standard per space	250	1650
Caravan Site serviced per space	450	2970
Camping site standard per space	200	1320
Camping site serviced per space	350	2310
Public House per seat	150	990
Restaurant/Day Care Centre per person	270	1782
Drive in restaurant per seat	380	2508
Hospital per bed	750	4950
Nursing/Care Home per bed	375	2475
Offices per 100m sq	750	4950
Shopping Centre per 100m sq	400	2640
Warehouse per 100m sq	150	990
Commercial premises per 100 m sq	300	1980
Manufacturing unit per 100m sq	550	3630