

Land off Basingstoke Road, Spencers Wood - Flood Risk Assessment

A1-C11

March 2026

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This report describes work commissioned by Richborough Ltd by an instruction dated 14th November 2023. The Client's representative for the contract was Stuart Nelmes of Richborough Ltd. Fin Goodman of JBA Consulting carried out this work.

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Abbreviations

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
DTM	Digital Terrain Model
EA	Environment Agency
FMfP	Flood Map for Planning
FRA	Flood Risk Assessment
ID	Identifier
LiDAR	Light Detection And Ranging
LPA	Local Planning Authority
NGR	National Grid Reference
NPPF	National Planning Policy Framework
OS	Ordnance Survey
OS NGR	Ordnance Survey National Grid Reference
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Policy Guidance
SFRA	Strategic Flood Risk Assessment

1 Introduction

1.1 Terms of reference

JBA Consulting was commissioned by Richborough Ltd to undertake a Flood Risk Assessment (FRA) for a mixed-use development at Land off Basingstoke Road, Spencers Wood (hereafter referred to as 'the site').

This FRA provides information on all aspects of flood risk at the site in accordance with the National Planning Policy Framework (NPPF), associated Planning Practice Guidance (PPG) and Local Planning Policy. It also considers the flood risk mitigation relevant to the nature of the proposed development and the identified flood risks.

A sustainable Drainage Strategy has been prepared by RACE and submitted separately to inform the planning application.

1.2 FRA requirements

It is a requirement for applications to consider the potential risk of flooding from various sources to a proposed development over its lifetime and any possible impacts on flood risk elsewhere as a result of the development.

Where appropriate, the following aspects of flood risk should be addressed:

- The nature and expected lifetime of the development and the extent to which the development is designed to deal with flood risk.
- The area liable to flood from various sources.
- The probability of the current and future flood risk.
- The extent and standard of existing flood defences and their effectiveness over time.
- The likely depth of flooding.
- The rates of predicted flows.
- The likelihood of impacts on other areas, properties and habitats.
- The effects of climate change.

The level of flood risk to the site has been determined based on a review of the site topography and information provided to us by the client and a review of publicly available information including open licence flood risk datasets provided on the Defra Data Services website by the Environment Agency. This includes the Flood Map for Planning, LIDAR Digital Terrain Model (DTM) and flood history datasets. Site-specific hydraulic modelling has also been undertaken to inform this FRA.

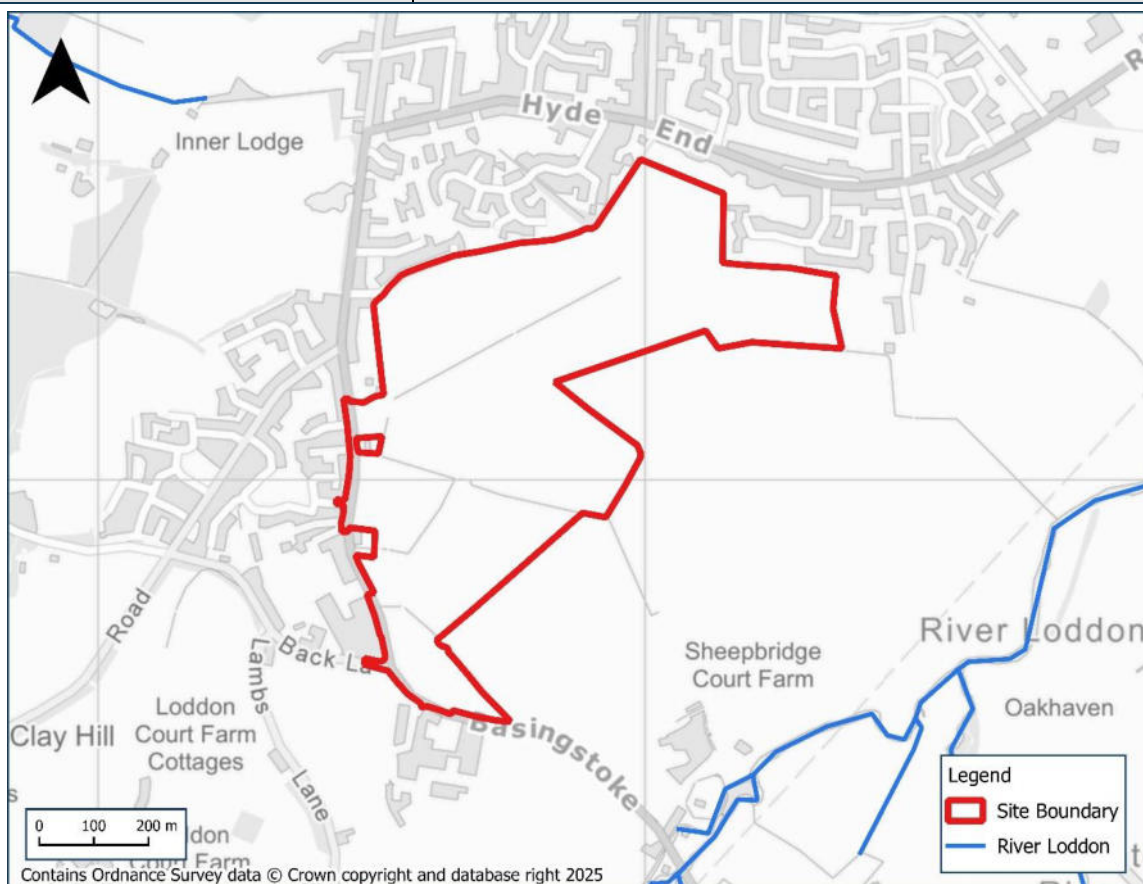
2 Site Details

2.1 Site description

The site is located to the east of the Basingstoke Road, south of Hyde End Road and is greenfield in nature. The site is located approximately 400m from The River Loddon, an Environment Agency designated Main River.

Table 2-1: Site description

Site descriptors	Site details
Site location	Spencers Wood, Wokingham RG7 1PW
Site area	39.26ha
Existing land use	Greenfield land
Proposed land use	Mixed-use
OS NGR	SU 71880 66092
County	Wokingham Borough Council
Country	England
Local Planning Authority	Wokingham Borough Council
Lead Local Flood Authority	Wokingham Borough Council



2.2 Proposed development

This FRA supports a:

Hybrid planning application (part outline/ part detailed) comprising: Outline planning permission is sought with all matters reserved for future determination, save for the means of access via Basingstoke Road, for: up to 420 dwellings (Use Class C3), an 80 bed care home (Use Class C2), 0.8ha of employment land (Use Class E(g), primary school (Use Class F1), local centre (Use Classes E(a), (b), (c), (f)), sports pitch and changing facility, public open space and a full application for the proposed Suitable Alternative Natural Greenspace (SANG), associated landscaping/car park.

The proposed high level development concept is shown in Appendix A and an extract is shown in Figure 2-1.



Figure 2-1: Proposed development concept

2.3 Topography

Publicly available LiDAR elevation data shown in Figure 2-2 along with site-specific topographic survey data shows that the south and west of the site have a higher elevation than the east and north of the site with the lowest point of 48.62m above ordnance datum (AOD) being on the far east of the site. The elevation increases up to 57.85m AOD in the north-western corner of the site.

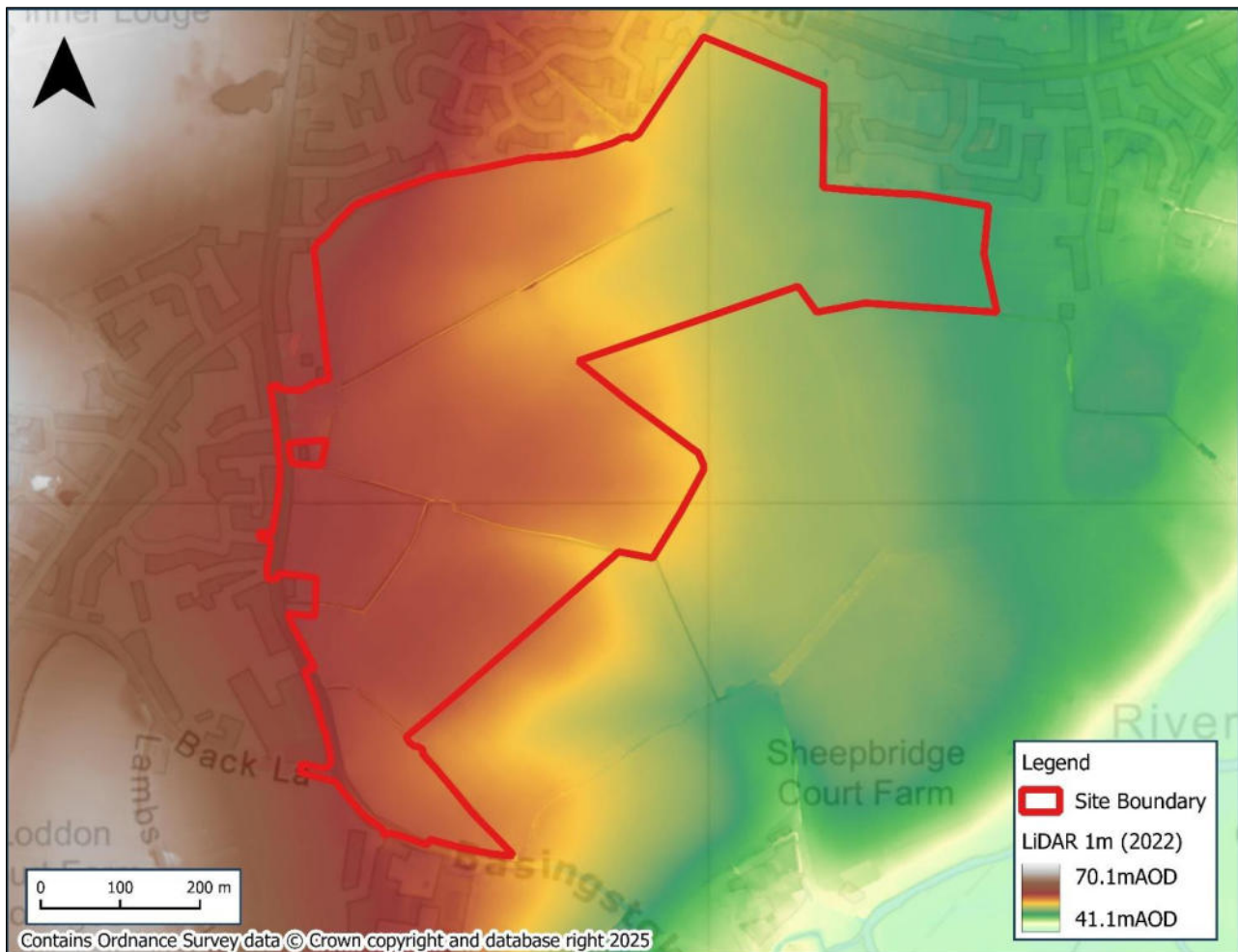


Figure 2-2: Topography (m AOD)

2.4 Geology

The British Geological Survey (BGS) 50k geological mapping¹ indicates the underlying bedrock at the site is London Clay Group- clay, silt, sand and gravel. Soils mapping² indicates that the underlying soil types are loamy and clayey soils that are naturally wet.

2.5 Watercourses

As shown in Figure 2-3, the River Loddon, an Environment Agency Main River, flows in a north-easterly direction approximately 400m to the south-east of the site. Three small ordinary watercourses flow through the centre of the site through a series of ditches.

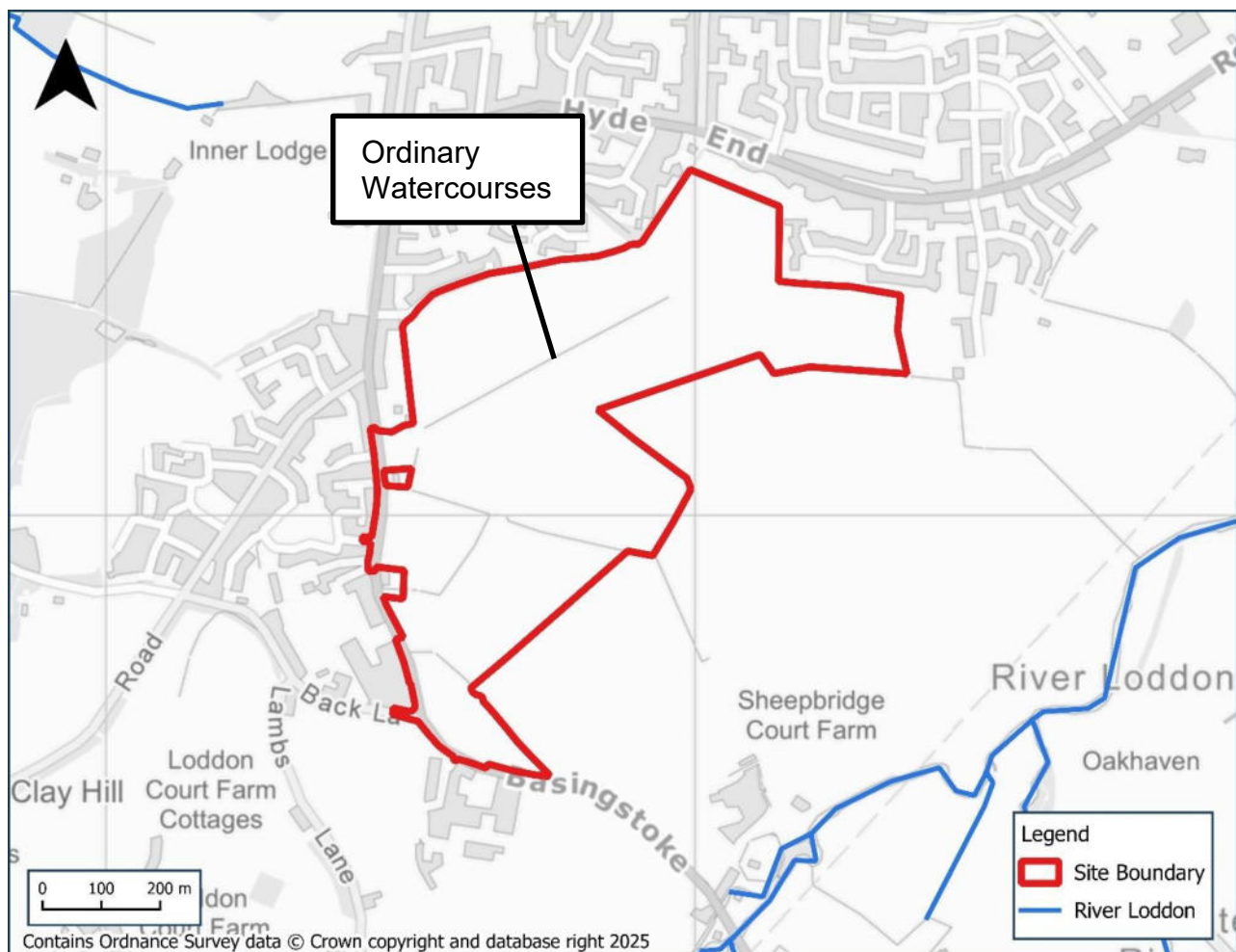


Figure 2-3: Watercourses

¹ BGS Geology of Britain viewer:

https://mapapps2.bgs.ac.uk/geoindex/home.html?layers=BGSBedrock50,BGSSuperficial50,BGSArtificial50,BGSMass50,BGSLinearFeat50&_ga=2.247862343.1190925926.1671547286-757587520.1671547286

² Soils mapping: <https://www.landis.org.uk/soilsmap/>

3 Planning Policy and Flood Risk

3.1 Planning context

The National Planning Policy Framework³ (NPPF) was issued by the Department for Communities and Local Government in March 2012 and last updated in December 2024. The NPPF is accompanied by the Planning Practice Guidance⁴ (PPG) on Flood Risk and Coastal Change, updated in August 2022, which gives further information on the approaches to be adopted in the assessment of flood risk for development. The PPG, in relation to development planning and flood risk, uses a sequential characterisation of risk based on planning zones and the Environment Agency Flood Map for Planning. A principal study requirement is to identify the Flood Zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

3.2 Development of sites in Flood Zones

Flood risk is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, from reservoirs and, canals, lakes and other artificial sources.

The Environment Agency categorise the fluvial and tidal risk in a series of Flood Zones within the Flood Map for Planning; a definition of such Flood Zones can be found in Table 3-1 (reproduction of Table 1 of the PPG). The Environment Agency's Flood Map for Planning shows the risk of flooding in England for different return period events. This map provides the basis for the assessment of flood risk and development suitability.

It is important to note that the Environment Agency's Flood Map for Planning, in some cases, is based on broad-scale river modelling and provides an indication of the potential flood risk in the area rather than a level of detail suitable for a site-specific assessment. In some areas the Flood Map is informed by historic flood mapping.

3.3 NPPF and PPG Flood Zones and development tables

Table 3-1 shows how the Flood Zones are defined (as based on Table 1 in the PPG). Figure 3-1 shows the Environment Agency's Flood Map for Planning in relation to the site. This shows that the entirety of the site is outside of Flood Zones 2 and 3 and is therefore located within Flood Zone 1. It should be noted that the Flood Map for Planning focuses on the Environment Agency Main Rivers and tidal risk and not Ordinary Watercourses, which are the responsibility of the Lead Local Flood Authority.

³ National Planning Policy Framework:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

⁴ Planning Practice Guidance: <https://www.gov.uk/government/collections/planning-practice-guidance>

Table 2 of the NPPF⁵ determines the classification of flood risk vulnerability in relation to a proposed development type. residential land-uses, such as that proposed, are considered to be 'More Vulnerable' development.

Table 3-2 shows the compatibility of flood zones and vulnerability classifications. This shows that More Vulnerable development is comparable with sites within Flood Zone 1.

Table 3-1: Flood Zones

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
Zone 2 Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: - land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or - land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)
Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the Strategic Flood Risk Assessment when considering location and potential future flood risks to developments and land uses. Paragraph: 078 Reference ID: 7-078-20220825 Revision date: 25 08 2022	

⁵ <https://www.gov.uk/guidance/national-planning-policy-framework/annex-3-flood-risk-vulnerability-classification>

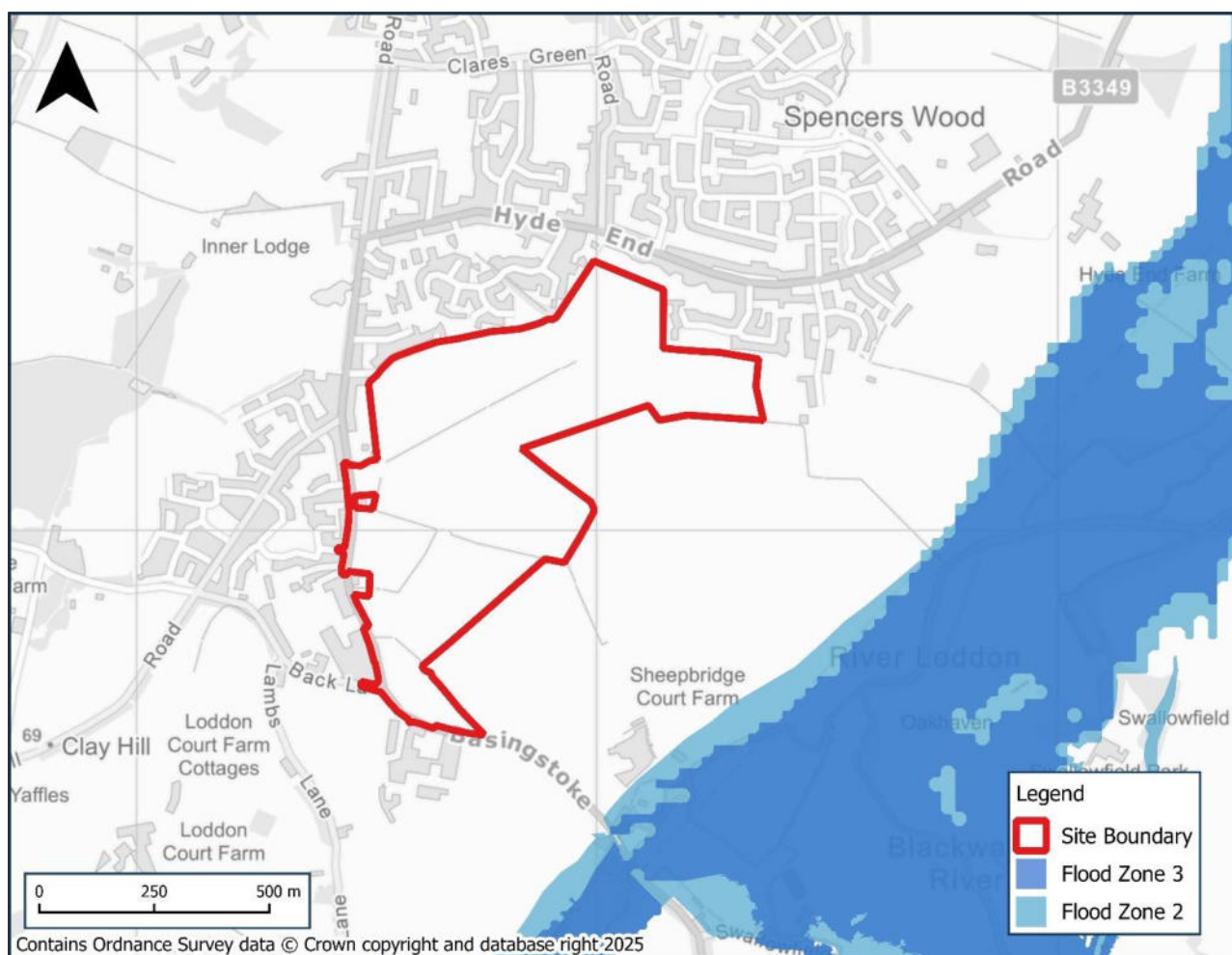


Figure 3-1: Flood Map for Planning

Table 3-2: Flood Risk Vulnerability and Flood Zone 'incompatibility'

Vulnerability Classification (NPPF Table 2)		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test	✓	✓	✓
	Zone 3a	Exception Test	✗	Exception Test	✓	✓
	Zone 3b	Exception Test	✗	✗	✗	✓
Source: Table 3, NPPF Technical Guidance						

✓ *Exception test is not required*

✗ *Development should not be permitted*

Notes:

1. *This table does not show the application of the Sequential Test which should be applied first to guide development to the lowest flood risk areas; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea.*
2. *The Sequential and Exception Tests should be applied to ‘major’ and ‘non major’ development.*
3. *Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.*

3.3.1 Sequential and Exception Tests

The NPPF requires the application of Sequential and Exceptional Tests when deciding the location of new development and the layout of the development site.

When planning a development, the Sequential Test requires that suitable sites which are at minimal risk from fluvial flooding, avoiding Flood Zones 2 and 3 where possible should be first considered. If no suitable areas can be identified in Flood Zone 1 then sites with the ensuing lowest flood risk should be considered next.

The proposed site is located within Flood Zone 1. More Vulnerable development is compatible with land within Flood Zone 1 without the requirement to apply the Exception Test.

As of 2022, the PPG states that consideration of all sources of flood risk should be considered as part of the Sequential Test and to also consider a sequential approach with regards to master planning and layout development. Section 4 of this FRA describes a comprehensive assessment of flood risk from all sources.

3.4 Climate change allowances

The NPPF and supporting PPG on Flood Risk and Coastal Change explain when and how flood risk assessments should be used. This includes demonstrating how flood risk will be managed now and over the development’s lifetime, taking climate change into account.

In May 2022, the Environment Agency released new guidance on climate change allowances⁶ to support the NPPF.

⁶ Flood Risk Assessments – <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Table 3-3 shows peak river flow allowances⁷ for the Loddon and tributaries Management Catchment. For 'more vulnerable' developments the guidance states the central allowance should be used for the development lifetime i.e. 14%.

Table 3-3: Loddon and tributaries Management Catchment peak river flow allowances

Epoch	Central	Higher	Upper End
2020s	7%	11%	23%
2050s	4%	10%	25%
2080s	14%	23%	46%

Table 3-4 shows the peak rainfall allowances⁸ for the Loddon and tributaries Management Catchment that should be used to assess the impacts of climate change on surface water flood risk. The Upper End 2070s allowance should be used for development proposed with a lifetime beyond 2100.

Table 3-4: Loddon and tributaries Management Catchment peak rainfall allowances

Epoch	3.3% annual exceedance rainfall event		1% annual exceedance rainfall event	
	Central	Upper End	Central	Upper End
2050s	20%	35%	20%	40%
2070s	25%	35%	25%	40%

3.5 Policy and guidance review

3.5.1 Wokingham Local Plan (2010-2026)

The Wokingham Local Plan⁹ sets out the vision and objectives for the growth of the borough up to 2026.

The document sets out a series of policies which includes:

- Sustainable Development: "Development within the borough should enhance the overall sustainability of the area through minimising impact on the environment, including access to facilities." (Wokingham Borough Council Local Plan, 2010-2026)
- Biodiversity: "Sites designated as of importance for nature conservation at an international or national level will be conserved and enhanced and inappropriate development will be resisted. The degree of protection given will be appropriate

⁷ Peak river flow allowances: <https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow>

⁹ <https://www.wokingham.gov.uk/planning-policy/adopted-development-plan/local-plans>

to the status of the site in terms of its international or national importance." (Wokingham Borough Council Local Plan, 2010-2026)

- Housing Delivery: "Provision will be made for the development of at least 13,230 dwellings and associated development and infrastructure in the Borough in the period 2006- 2026 for which substantial investment in infrastructure will be required." (Wokingham Borough Council Local Plan, 2010-2026).

3.5.2 Wokingham Borough Council Level 1 Strategic Flood Risk Assessment (2020)

A Strategic Flood Risk Assessment (SFRA)¹⁰ is undertaken by the Local Planning Authority to assess the current and future flood risk within their administrative boundary and, to determine the impact development may have on flood risk. This informs the allocation of land within the Local Plan, through the application of the Sequential Test and, if necessary, the Exception Test. The current version of the Wokingham Borough Council Level 1 Strategic Flood Risk Assessment was published in January 2020 and shows that there is no significant flood risk to the site at Spencers Wood.

The recommendations and policies section relating to flood risk are summarised below:

- Developers are required to manage surface water flood risk to ensure it is not worsened for their site or the surrounding area and ideally, that betterment of existing conditions is achieved to as near greenfield as possible.
- SuDS should be used wherever possible, however it is recommended infiltration SuDS are not used in areas of high groundwater levels.
- Alternative access and egress routes should be made in the event that primary routes are inundated with flood water.

3.5.3 Wokingham County Council Local Flood Risk Management Strategy

Wokingham Borough Council Local Flood Risk Management Strategy¹¹ (LFRMS) was adopted by Leicestershire County Council in April 2015. This document sets out the main recommendations for flood risk management in the area in the council's role as the Lead Local Flood Authority (LLFA).

The LFRMS is an important tool to help understand and manage flood risk within the county. Flood risk management is beginning a new stage which will be marked by better knowledge of the risks in the county, better co-operation between organisations involved in flood risk management, and better communication with the public about those risks.

There are 6 objectives for managing local flood risk in Wokingham. The objectives of the LFRMS include:

1. Continue to improve knowledge and understanding of current and future local sources of flood risk within Wokingham.

¹⁰ <https://www.wokingham.gov.uk/sites/wokingham/files/2023-07/1.%20WBC%20SFRA%202020%20Report.pdf>

¹¹ [https://www.wokingham.gov.uk/sites/wokingham/files/2023-](https://www.wokingham.gov.uk/sites/wokingham/files/2023-06/Local%20Flood%20Risk%20Management%20Strategy%20April%202015%2028PDF%20document%29.pdf)

[06/Local%20Flood%20Risk%20Management%20Strategy%20April%202015%2028PDF%20document%29.pdf](https://www.wokingham.gov.uk/sites/wokingham/files/2023-06/Local%20Flood%20Risk%20Management%20Strategy%20April%202015%2028PDF%20document%29.pdf)

2. Continue to work collaboratively and develop effective partnerships with other Flood Risk Management Authorities and local communities to deliver a sustainable, cost-effective approach to flood risk management, that reduces flood risk and provides wider environmental and socio-economic benefits where possible.
3. Ensure that land use planning and application decisions take full account of flood risk, avoiding development in inappropriate locations, minimising and preventing an increase in flood risk wherever possible.
4. Maintain and, where necessary, improve local flood risk management infrastructure and privately owned flood defence assets, features and Ordinary watercourses, to reduce risk.
5. Ensure that emergency plans and responses to flood incidents are effective and that communities are prepared and resilient to local flood risk.
6. Identify national, regional and local funding mechanisms to deliver flood risk management solutions and schemes.

4 Assessment of Flood Risk

4.1 Historic flooding

The Environment Agency's Recorded Flood Outlines dataset for the site and surrounding area has been reviewed. Figure 4-1 highlights that although historic flooding has occurred approximately 350m south-east of the site, the site itself does not fall within the Environment Agency's historical flood outlines.

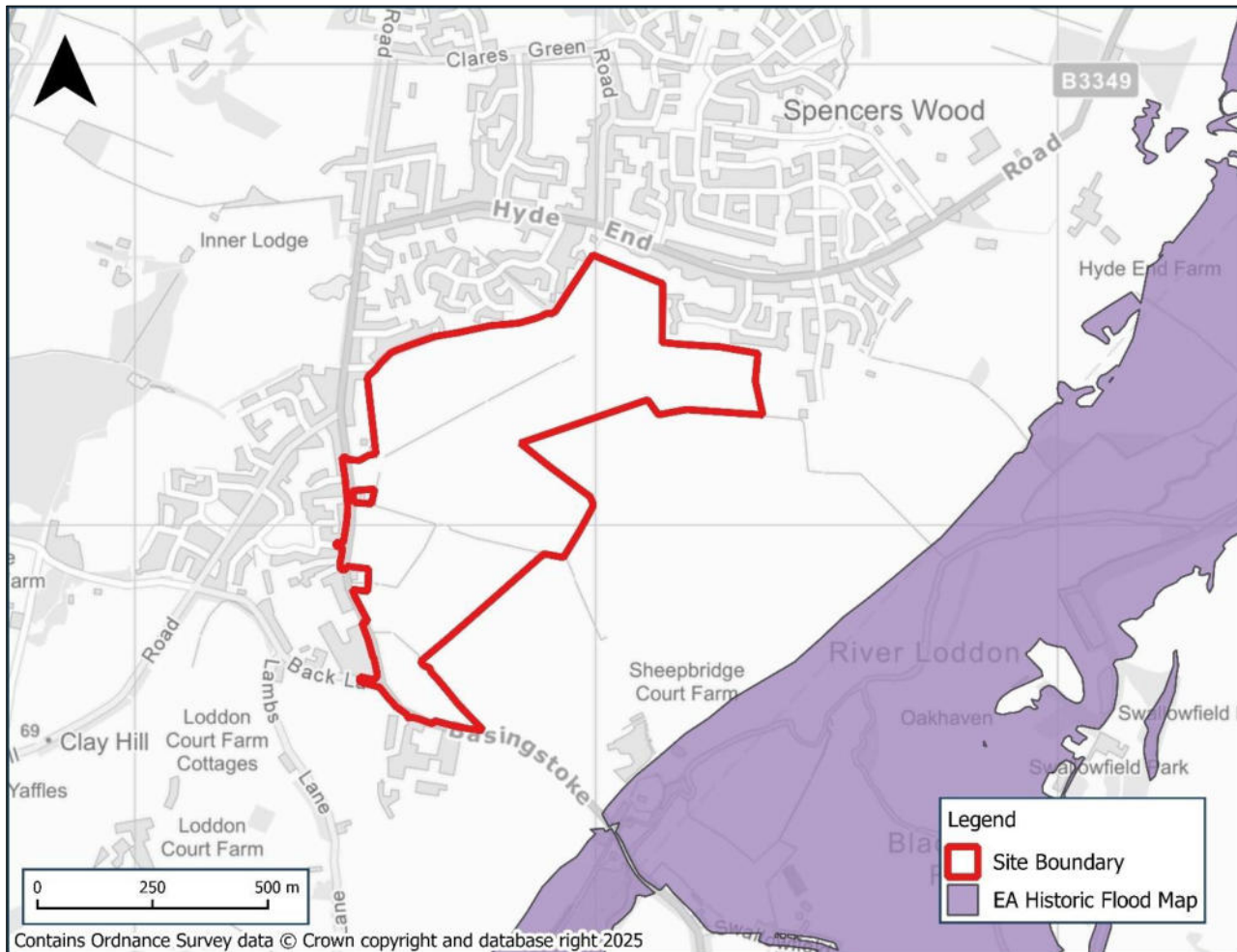


Figure 4-1: Recorded Flood Outlines

4.2 Fluvial flood risk

4.2.1 Flood Map for Planning

Figure 3-1 shows the Environment Agency's Flood Map for Planning. The entirety of the site is outside of Flood Zones 2 and 3. The nearest area within Flood Zone 3 is situated approximately 350m south-east of the site. The Flood Map for Planning is focused on the risk from Environment Agency Main Rivers so should accurately represent the risk from the River Loddon. In the event of a breach of the River Loddon bank, it is very unlikely flood

water will travel towards the site due to the site topography sloping south-east. Therefore, the risk of flooding from fluvial sources is **Low**.

4.3 Surface water flood risk

Surface water flooding arises following periods of intense rainfall, or rain falling on saturated soil, that is unable to soak into the ground or where drainage systems are unavailable or unable to manage surface water runoff. This surface water runoff forms overland flow when following the topography of the land, often pooling in topographic low spots. Surface water flooding and subsequent overland flow can also originate from surcharging or blocked sewers and drains.

Figure 4-2 shows the Environment Agency's NaFRA2 Risk of Flooding from Surface Water (RoFSW) mapping. The site has areas within the 3.3% (1 in 30-year), 1% (1 in 100-year) and 0.1% AEP (1 in 1,000-year) surface water flood events, on account of the Ordinary Watercourses which cross the site. However, the RoFSW mapping is informed by a generalised mapping approach and does not accurately account for the ditches, culverts and structures locally to the site. Therefore, a detailed hydraulic model has been developed to refine the flood risk shown within the RoFSW and to provide results suitable for a site-specific assessment of flood risk.

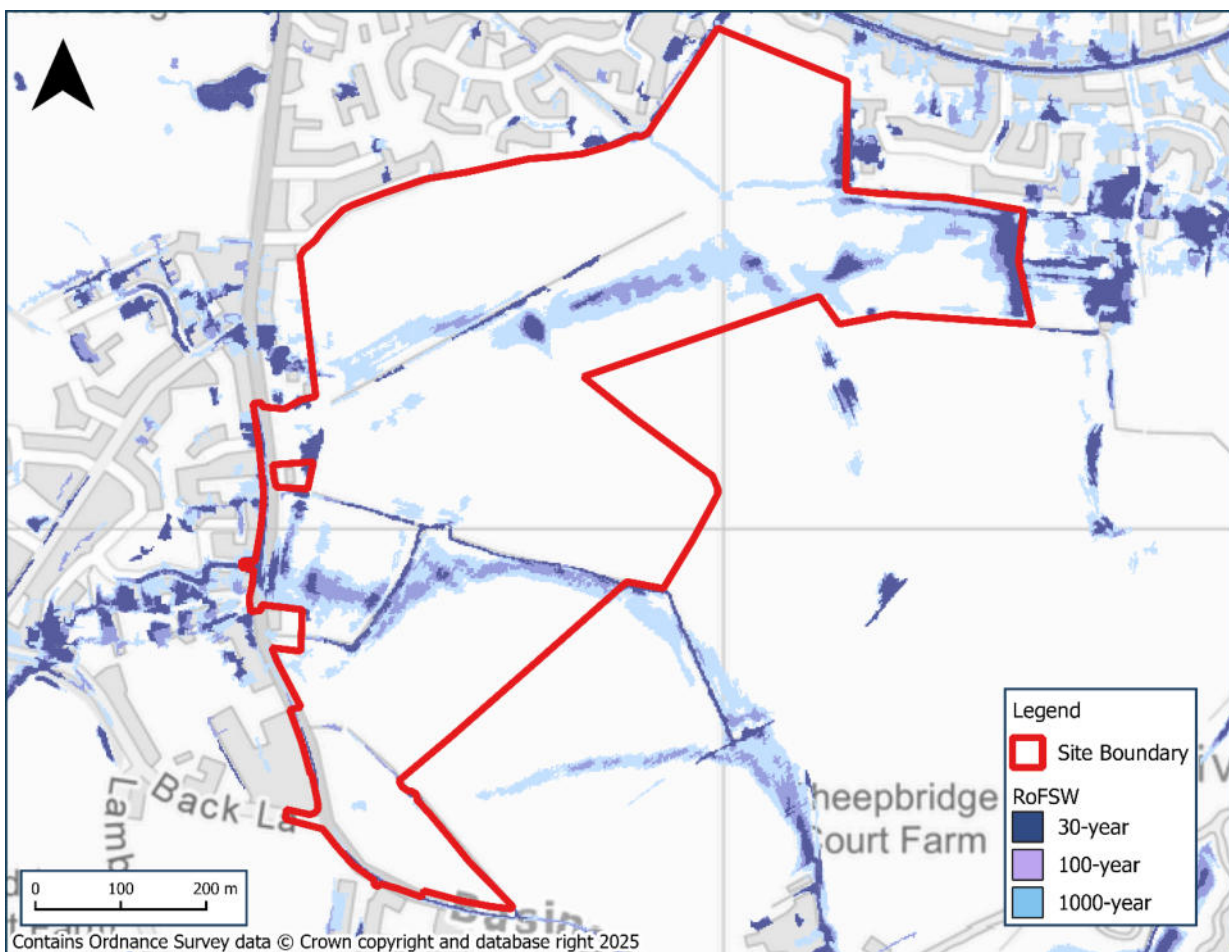


Figure 4-2: Environment Agency's Risk of Flooding from Surface Water mapping

4.3.1 Hydraulic modelling

A surface water rainfall-runoff hydraulic modelling study to allow the detailed representation of flood depths, velocity and hazard within the site boundary was undertaken. A 1D-2D linked Infoworks-ICM hydraulic model was built, and a hydrological assessment was carried out to derive rainfall hyetographs. Detailed technical reporting is included within Appendix B. The predicted baseline flood extents during the 3.3%, 1% and 0.1% AEP events are shown in Figure 4-3.

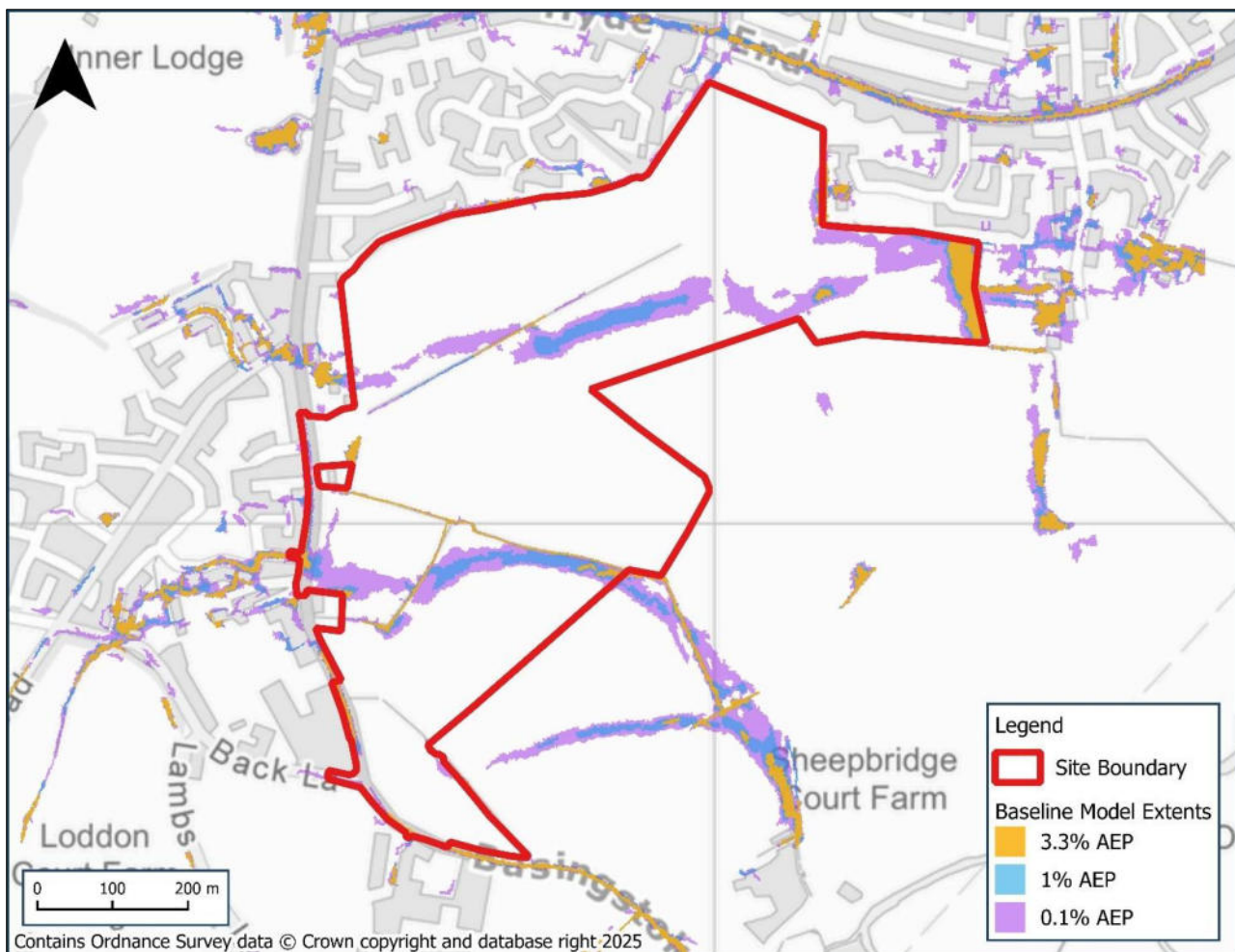


Figure 4-3: Baseline Flood Extents

Figure 4-3 shows that a proportion of the site is within the 3.3% AEP, 1% AEP and 0.1% AEP extents on account of overland flow paths which cross the site. Flooding is predicted to occur within the site during all modelled events.

Due to this being a rainfall-runoff hydraulic model, the allowance used to represent climate change during the design flood event (1% AEP plus climate change) has been set in line with EA guidance for rainfall i.e. 40% (Table 3-4). The predicted 1% AEP plus climate change (40%) modelled flood extent is shown in Figure 4-4.

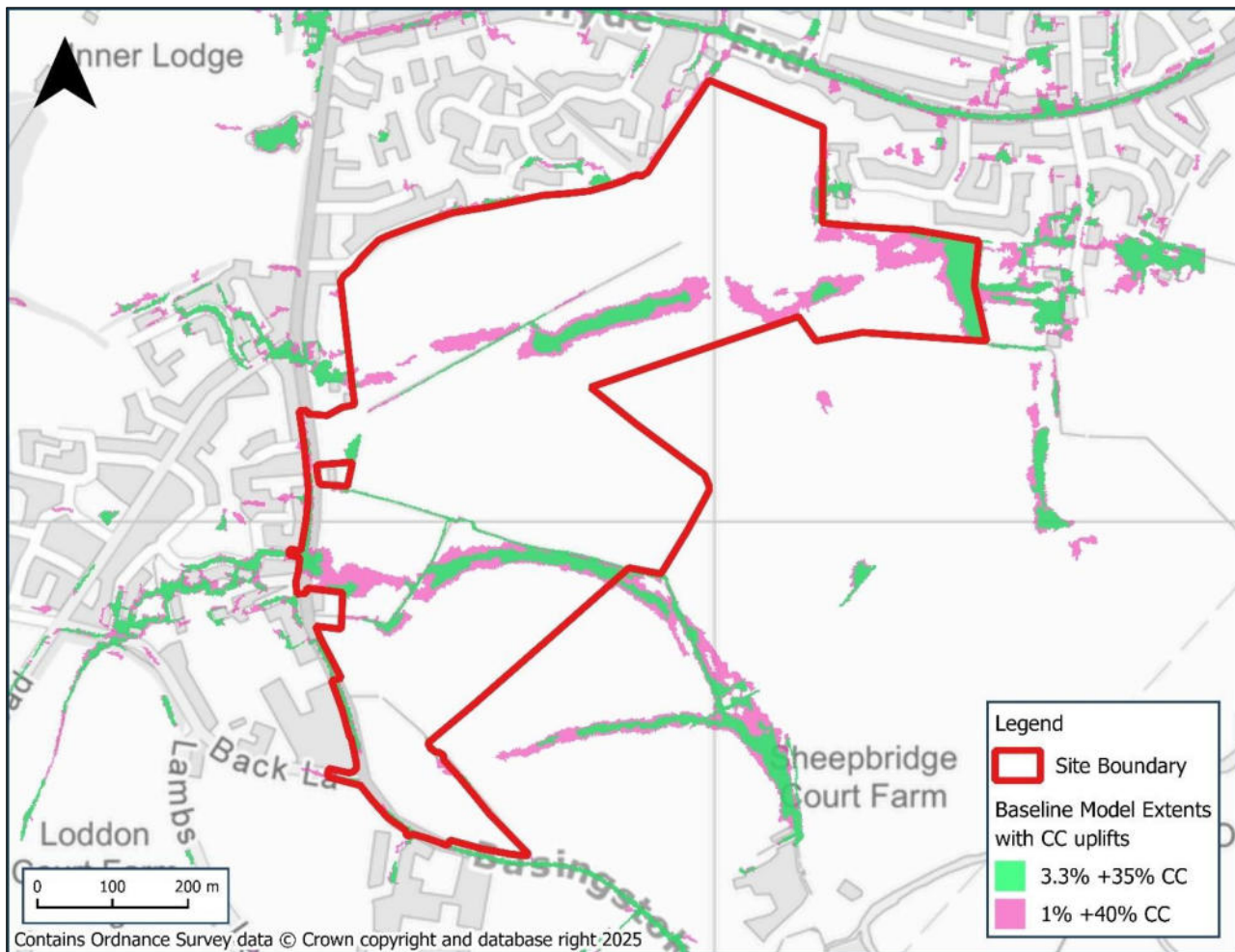


Figure 4-4 Baseline flood extents with climate change uplifts

Figure 4-4 shows the 1% AEP plus climate change (40%) surface water extent is similar to the 0.1% AEP extent within the site. Flooding is predicted to occur within the site during all modelled climate change events.

4.3.1.1 Peak flood depths

Figure 4-5 shows the peak flood depths within the site boundary during the 1% AEP plus 40% climate change event for the baseline scenario i.e. the design flood event.

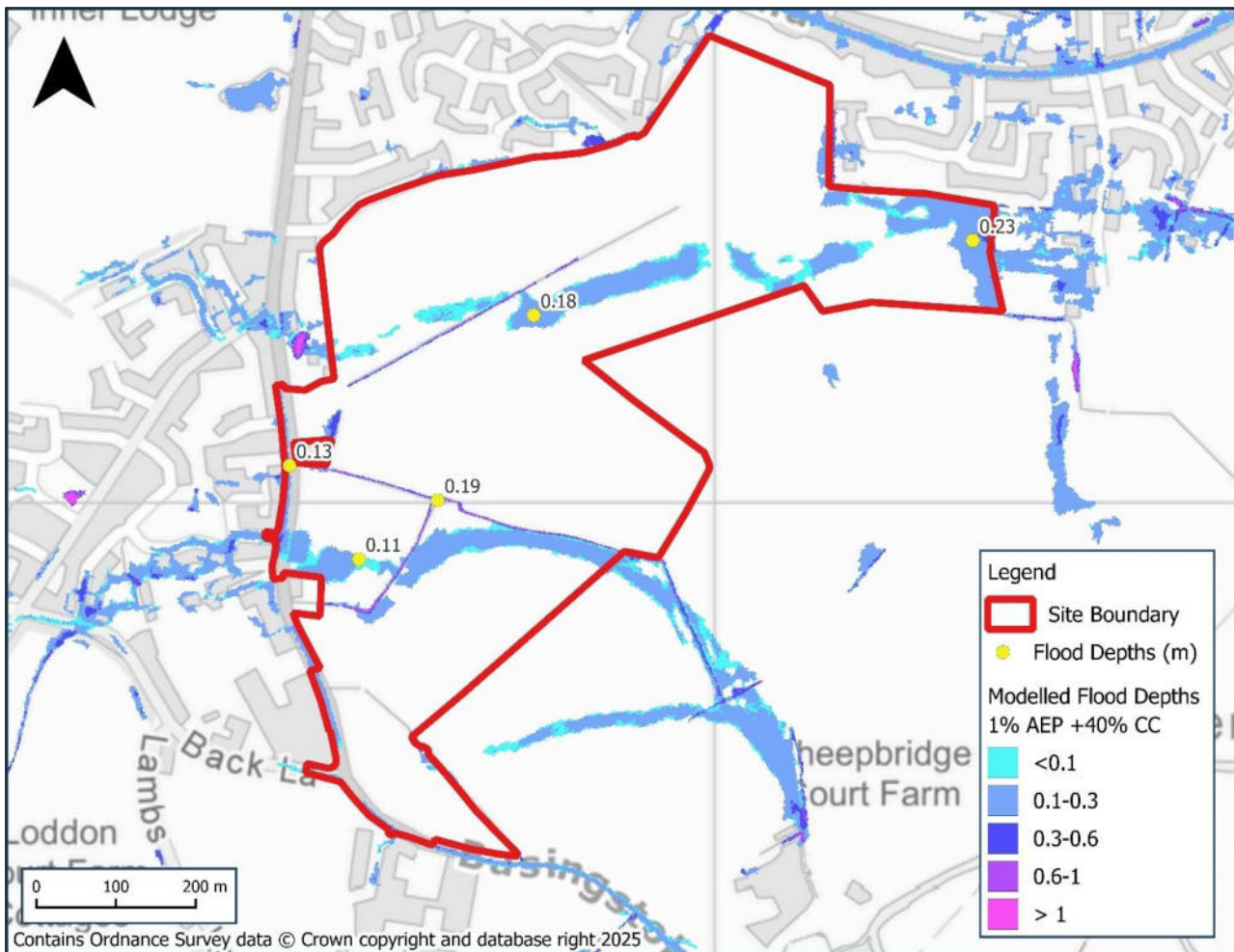


Figure 4-5 Modelled flood depths with 1% AEP +40CC flood event

Figure 4-5 shows that during the 1% AEP plus 40% climate change event in the baseline scenario, typical peak flood depths within the site are predicted to be 90-300mm. However, there are depths confined within the channel of the ordinary watercourses which reach 920mm. Overland flows are generally very shallow due to steep topography of the site.

4.3.1.2 Peak flood levels

Figure 4-6 shows the peak flood levels within the site boundary during the 1% AEP plus 40% climate change event for the baseline scenario.

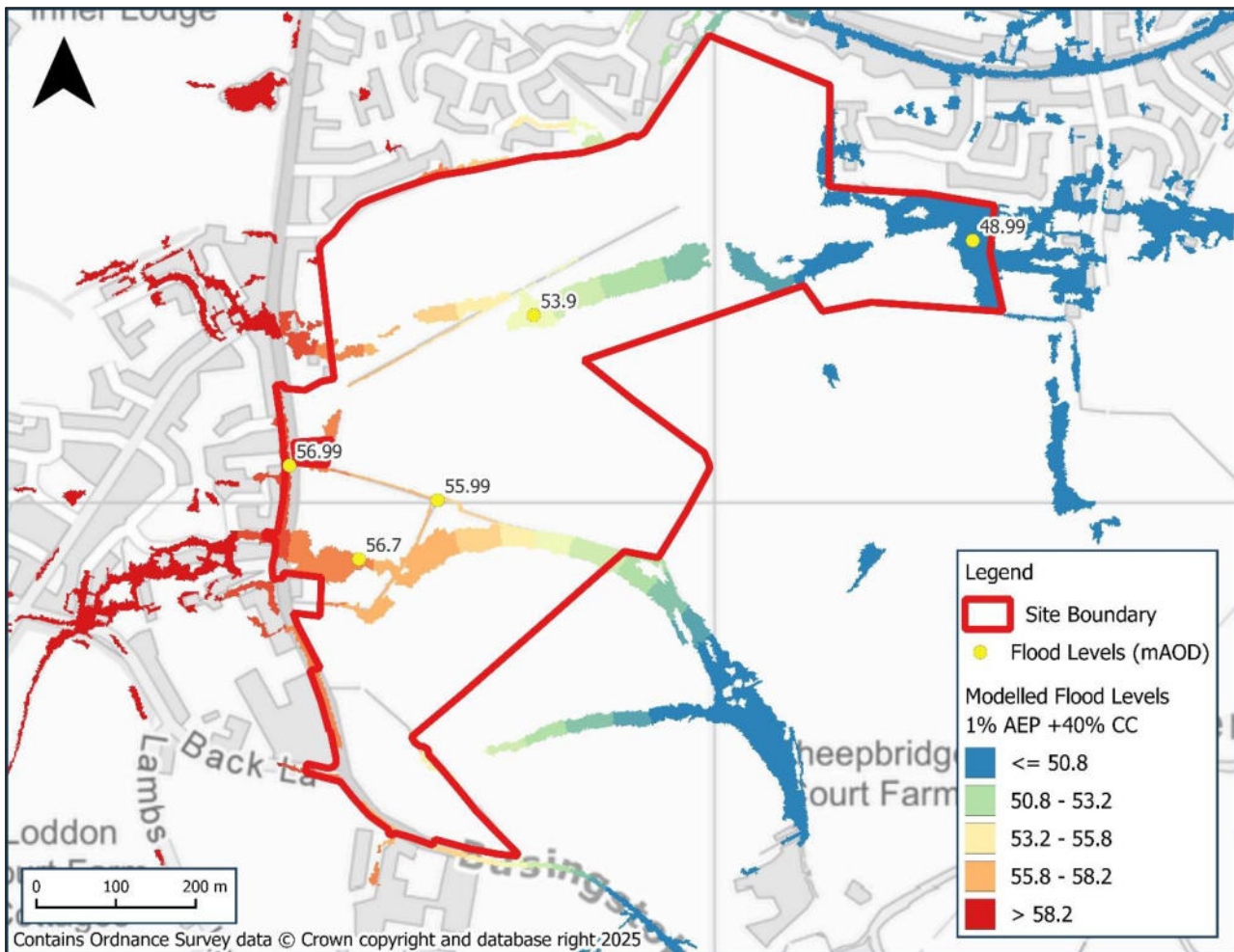


Figure 4-6 Modelled levels in 1% AEP +40% climate change flood event

Figure 4-6 shows that during the 1% AEP plus 40% climate change event in the baseline scenario, peak flood levels within the site range from 56.99m AOD down to 48.99m AOD. The range in peak design flood level is due to the steep topography of the site.

4.3.1.3 Post development

The baseline model was amended by applying the indicative development plateaus for each proposed development parcel to the 2D model domain to form a post-developed scenario as shown in Figure 4-7. The objective of this is to assess the impact on surface water flow of the obstruction caused by raised FFLs. As the level of detail of individual properties is not available, a conservative approach of raising whole development parcels was taken. To prevent increasing flood risk to third party land, shallow flow paths were maintained by keeping existing ground levels outside of the development parcels. The proposed development will be refined at a later date to include detail of individual properties, the model can then be updated to only raise ground levels within the footprint of proposed buildings, reinstating shallow water flow paths between buildings. A surface water drainage strategy which will serve the proposed development has not been represented

explicitly within the post-developed scenario, but rainfall to the development parcels has been removed to account for this.

The post-development scenario was simulated for the 1% AEP plus climate change event and the post-developed maximum depths are shown in Figure 4-8. The results were then compared with the baseline results to determine any flood risk impacts as a result of the proposed development, this impact assessment is shown in Figure 4-9.

Note that the post-development model scenario representation detailed above does not represent a final design and is conservative in many attributes. The post-development model acts to demonstrate that a development layout is viable that ensures that the development is safe from flooding for its lifetime and also does not adversely impact the flood risk of others.

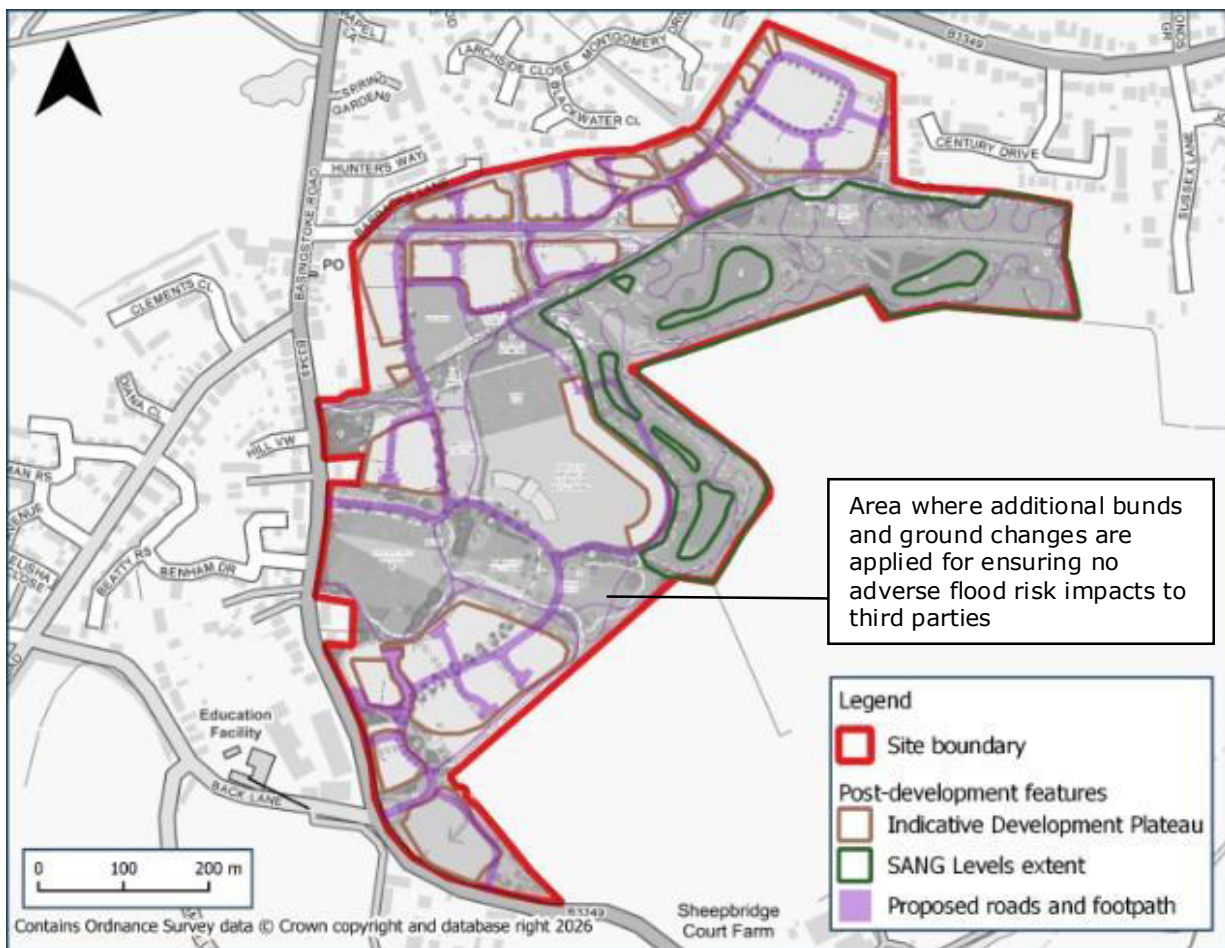


Figure 4-7 Post-development model scenario

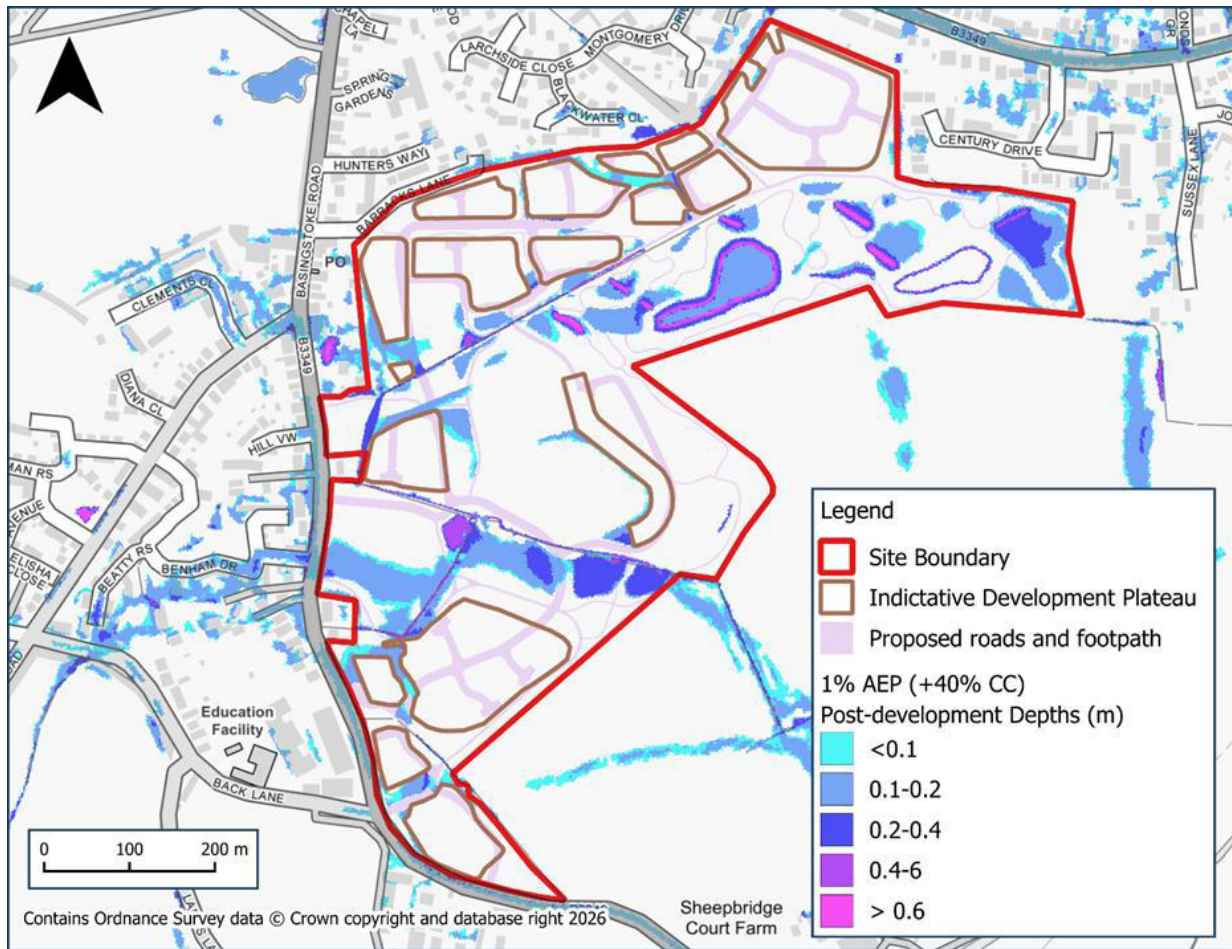


Figure 4-8 Post-developed flood depths for 1% AEP plus 40% climate change event

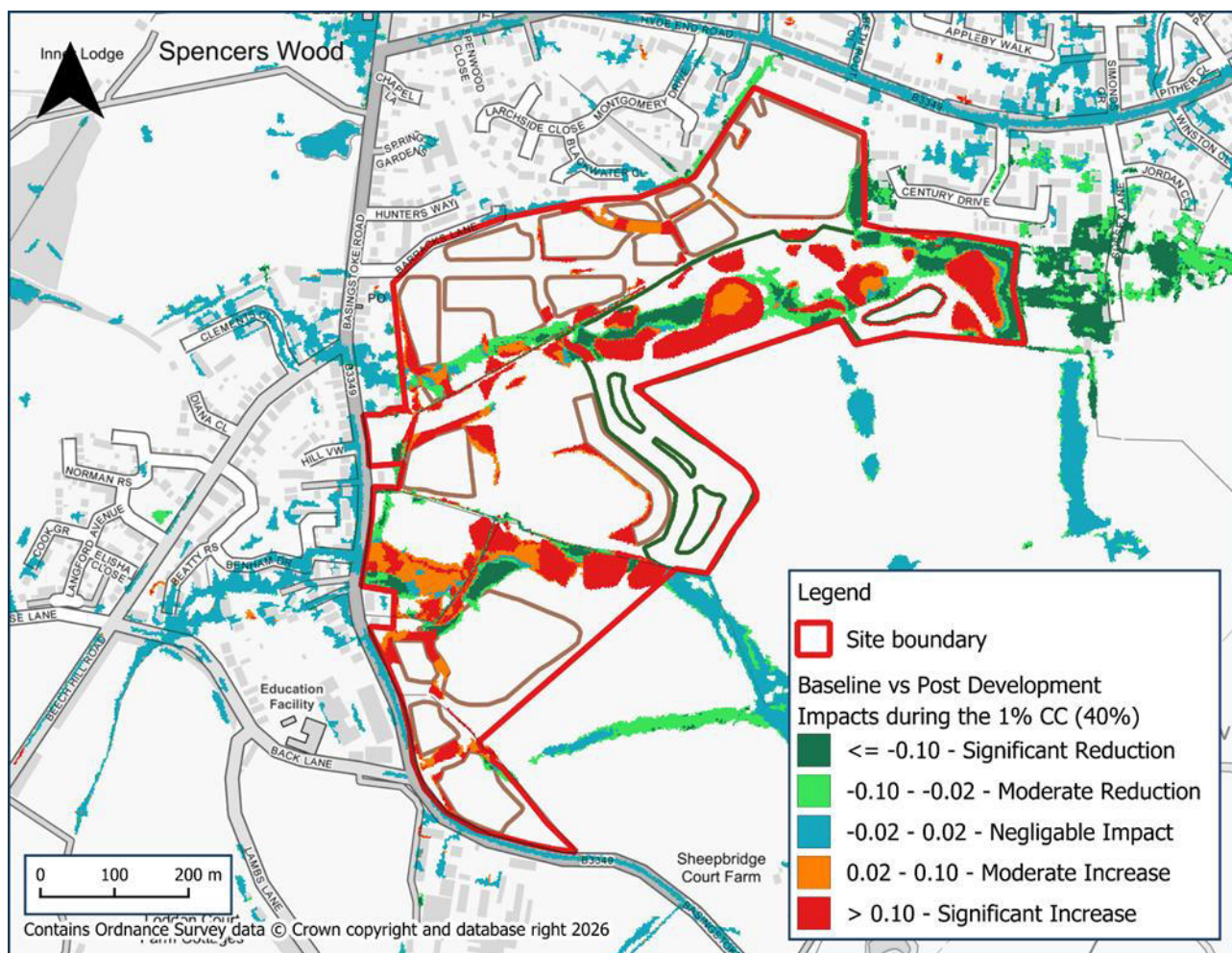


Figure 4-9 Post-developed depth comparison for 1% AEP plus 40% climate change event

Figure 4-9 shows there is no adverse flood risk impacts to third party land as a result of the proposed development. There is a reduction in flood depth to the east of the site and to the south of the site as a result of the proposed development. It is recommended that a further modelling scenario be carried out when the individual property footprint detail is known. However, the modelling provides a proof of concept that the development can be delivered without detriment to off-site flood risk.

The surface water hazard-to-people rating for the post-developed scenario during the 1% AEP plus 40% climate change flood scenario has been mapped using the formula as suggested in Defra's FD2321/TR2 "Flood Risk to People". The different hazard categories are shown in Table 4-1 and the hazard classification to the proposed option during the 1% AEP plus 40% climate change scenario is shown in Figure 4-10.

Table 4-1: Defra's FD2321/TR2 "Flood Risks to People" classifications

Flood hazard rating depth x (velocity+0.5) +DF	Level of Flood Hazard Description	Class label
<0.75	Low	Caution "Flood zone with shallow flowing water or deep standing water"
0.75 to 1.25	Moderate	Dangerous for some (i.e. Children) "Danger: flood zone with deep or fast flowing water"
1.25 to 2.00	Significant	Dangerous for most "Danger: flood zone with deep fast flowing water"
>2.00	Extreme	Dangerous for all "Extreme danger: flood zone with deep fast flowing water"

Using the hazard equation $HR = d \cdot (v + 0.5) + DF$
Where d = depth of flooding (m) v = velocity of floodwaters (m/sec) DF = debris factor

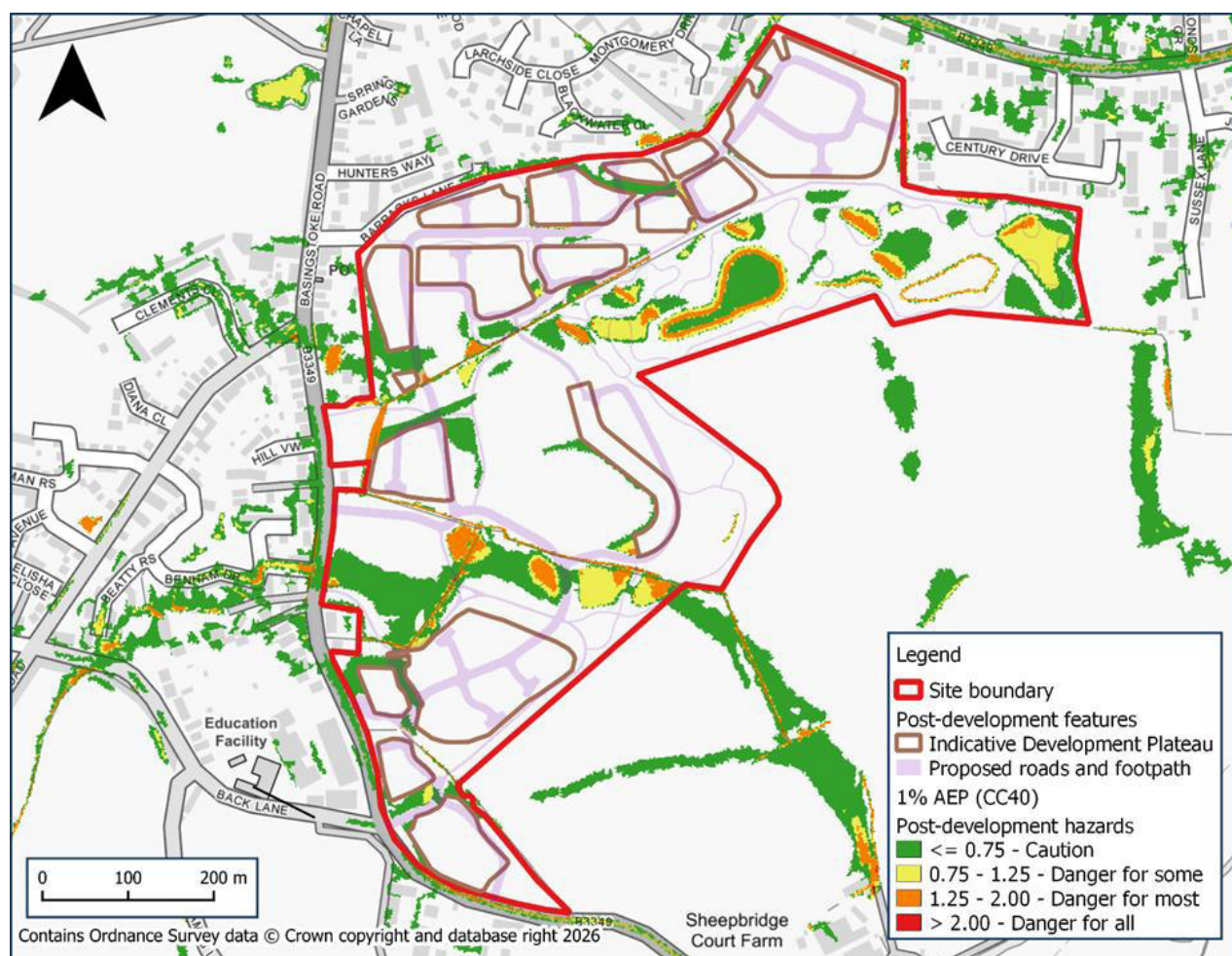


Figure 4-10 Proposed option modelled flood hazard in 1% AEP with (+40%) climate change event

Figure 4-10 shows that the modelled Hazard to People rating for the majority of the site falls within the 'caution' hazard category, with several isolated regions located centrally within

the site classified as 'danger for some' category. There are small areas classified as 'danger for most' within the centre of the site, however, these are minimal. The majority are contained within greenfield areas and those predicted to occur within access and egress routes are likely to be removed once the final level strategy has been implemented into the model.

The site-specific surface water modelling has demonstrated that there are surface water flow paths that cross the site from west to east. However, these flow paths are maintained within the proposed development layout and only pose a low hazard according to the DEFRA guidance. The modelling demonstrates that the flood risk impacts of the proposed development are mainly positive with a reduction in depth shown to the east of the site. The proposed development will be refined at a later date by adding more detail to the topography of the development parcels and representing the surface water drainage strategy to ensure there is no modelled adverse flood risk to any third-party land.

Safe access and egress to and from the site will be via Basingstoke Road situated west of the site. Although Basingstoke Road has isolated areas of flooding in the design flood event, the hazard rating of the modelling results show that these areas are of low hazard and therefore do not pose a risk to operational access.

Flood risk from surface water is therefore considered to be **medium** but can be managed within the development by taking a sequential approach to the proposed layout - locating the most vulnerable receptors in locations with the lowest risk, and by providing substantive corridors of open space to facilitate existing flow paths and ordinary watercourses.

4.4 Groundwater flood risk

Groundwater flooding can occur when the water table rises after prolonged rainfall and emerges above ground level. This is most likely to occur in low-lying areas that are underlain by permeable bedrock and superficial geology. According to Soilsclapes¹², the geological background of the site indicates that the underlying soils are loamy and clayey which are naturally wet.

The Wokingham Borough Council Level 1 SFRA¹³ states there have been 17 incidents of groundwater flooding in Wokingham Borough at the time the report was written (January 2020). A review of this SFRA shows none of these incidents are relevant to the site located in Spencers Wood.

Based on the above, the risk of flooding at the site from groundwater sources is considered to be **Low**.

4.5 Sewer flood risk

According to the Wokingham Borough Council SFRA, there has been no recorded incidents of flooding from sewers.

¹² Soilsclapes soil types viewer - Cranfield Environment Centre, Cranfield University (landis.org.uk)

¹³ <https://www.wokingham.gov.uk/sites/wokingham/files/2023-07/1.%20WBC%20SFRA%202020%20Report.pdf>

Based on the above, the risk of flooding at the site from sewers is considered to be **Low**.

4.6 Reservoir flood risk

Figure 4-11 shows the Environment Agency's Reservoir Failure Flood Extents. The mapping shows the site is not at risk of flooding if a reservoir were to fail during both a flood event (wet day) and when river levels are normal (dry day). Based on the above, the risk of flooding at the site as a result of a reservoir failure is considered to be **Low**.

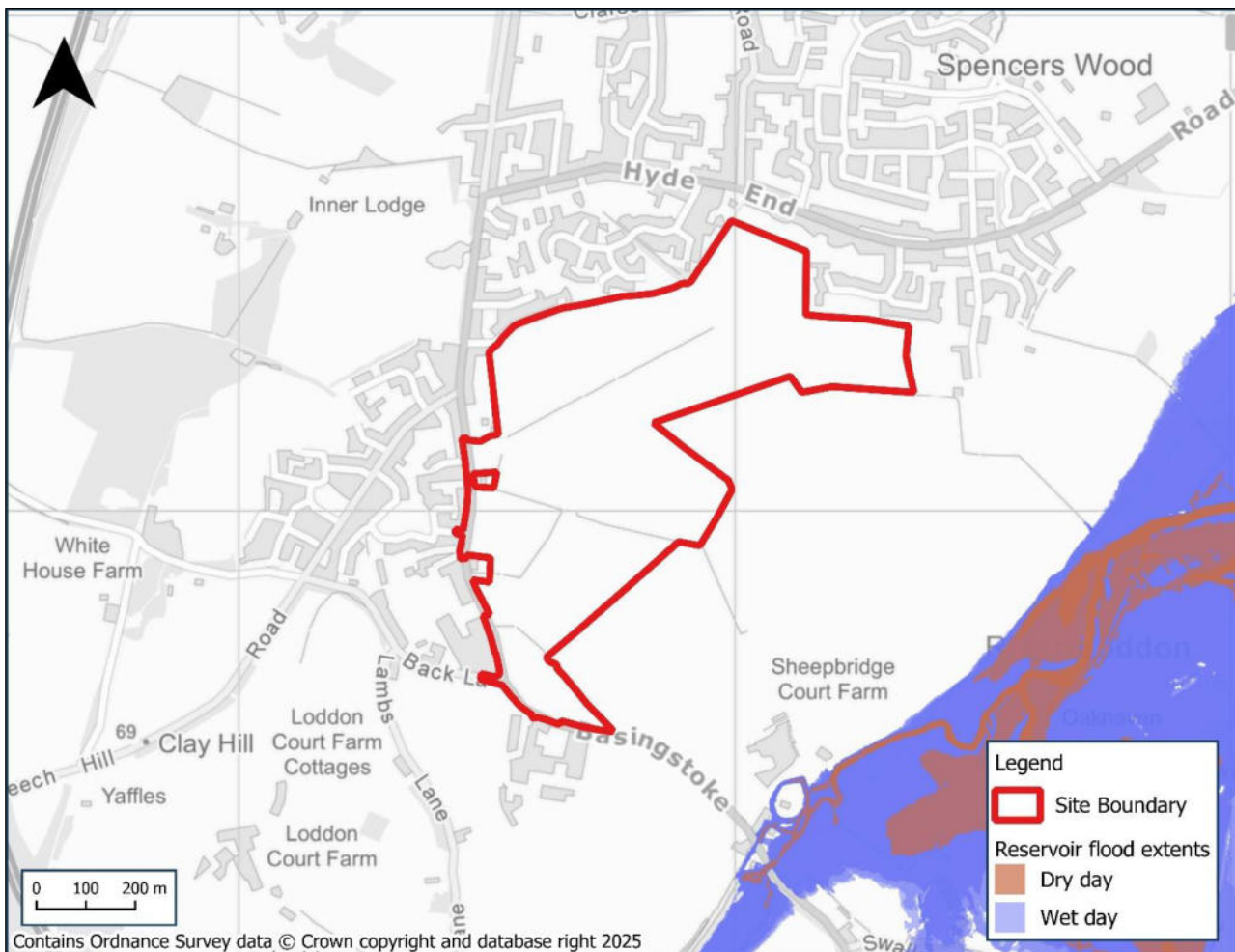


Figure 4-11 Environment Agency's Reservoir Flood Extents

5 Flood Mitigation Measures

In accordance with the NPPF and the associated PPG, it must be demonstrated that the proposed development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

5.1 Site layout

In line with best practice, the development layout has followed a sequential approach to avoid development in areas most at risk of flooding. The surface water flow routes across the site are respected and maintained within the masterplan.

5.2 Finished Floor Levels

The Finished Floor Levels (FFLs) of the proposed residential units should be set above the predicted flood level adjacent to each individual unit in the 1% AEP plus 40% climate change surface water flood event noting that across the site the design flood level ranges from 48.97m AOD to 56.99m AOD. Current Environment Agency guidance states that finished floor levels should be set 600mm above the Design Flood Level. The development plateau's will likely mean that FFLs are >600mm above the adjacent flood level.

A detailed site plan was not available at the time of this report and individual FFLs not able to be determined. However, a range of peak water levels for the Design Flood (surface water flood level) is provided in Table 5-1 based on the labels in Figure 5-1. This is provided to give an indication of the range of flood levels in the absence of detail of individual properties. It is recommended that when individual property footprints are known, the flood level adjacent to each property is used to inform its FFL.

Furthermore, in line with part H of the Building Regulations, FFLs and openings (e.g. air bricks) of the proposed buildings should also be set to a minimum of 150mm above the surrounding ground levels.

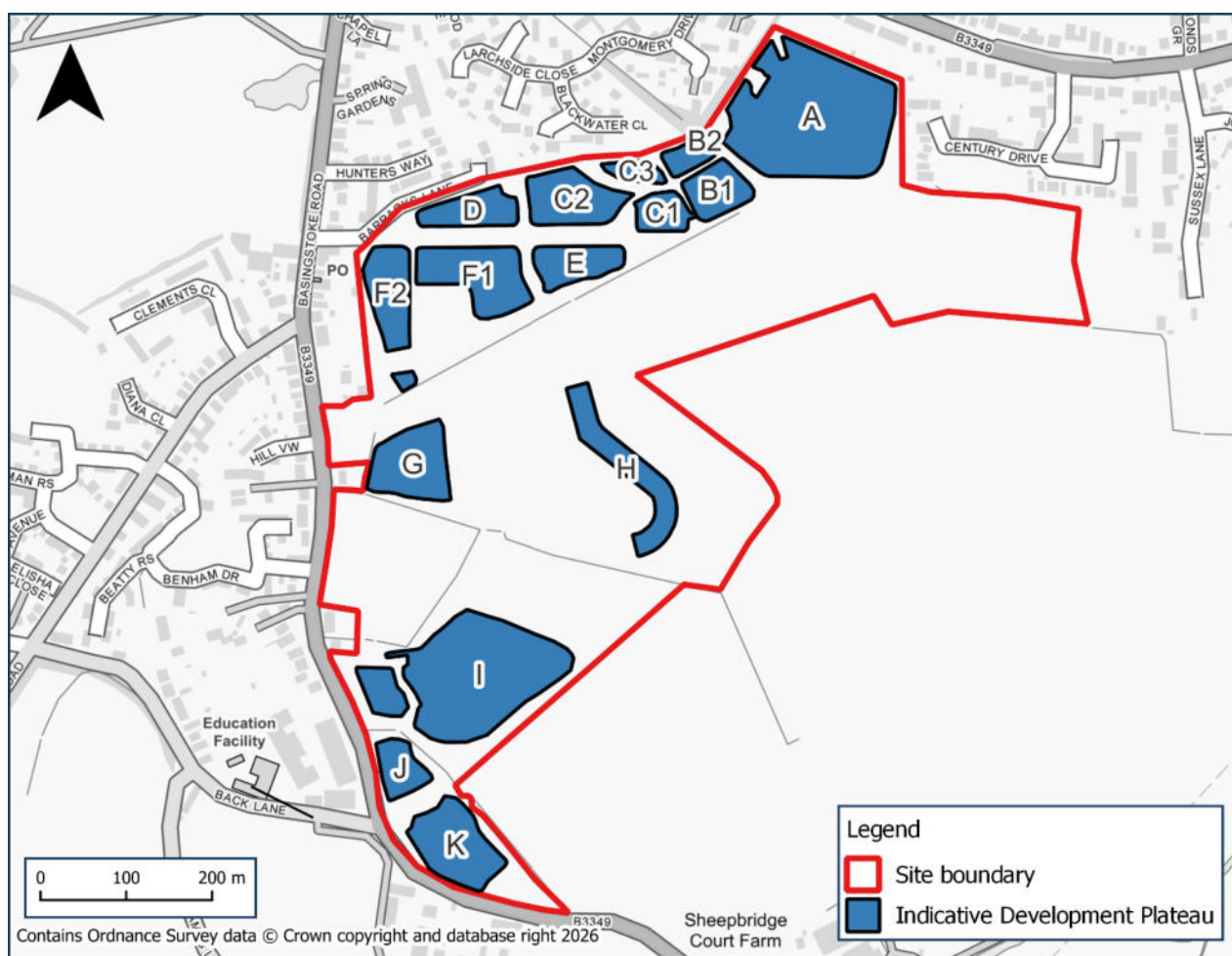


Figure 5-1: Development parcels

Table 5-1: Peak Design Flood level by development parcel

Development Parcel label	Minimum flood level (m AOD)	Maximum flood level (m AOD)
A	No modelled flooding	
B	53.57	53.90
C	53.57	55.65
D	No modelled flooding	
E	54.15	54.15
F	56.73	57.71
G	56.51	56.72
H	56.24	56.24
I	56.65	57.01
J	56.07	56.08
K	55.10	56.30

5.3 Surface water flood risk

Surface water runoff from the site will be managed as part of a surface water drainage strategy which will be carried out separately to this FRA. This will ensure that surface flows are managed so that there is no adverse flood risk impact to third parties as a result of increased impermeable surfaces on site.

5.4 Groundwater flood risk

Although groundwater flood risk to the site is assessed as being low, there have been 17 recorded incidents in Wokingham Borough. Therefore, the floors of all new buildings should be made of solid construction materials. Alternatively, the ground beneath suspended floors should be sealed to prevent ingress of groundwater should the water table levels increase directly beneath the site.

5.5 Safe access and egress

Safe access and egress to and from the site will be via Basingstoke Road situated west of the site. Although Basingstoke Road has isolated areas of flooding in the design flood event, the hazard rating of the modelling results show that these areas are of low hazard and therefore do not pose a risk to operational access.

Where a development or its main route of access is located within a flood risk area, the NPPF recommends that Flood Response Plans are put in place for managing the flood risk to the development and, if necessary, support the evacuation of the site. The site is not served by the Environment Agency's flood warning service, which focuses on fluvial flood risk.

6 Conclusions and Recommendations

6.1 Conclusions

- JBA Consulting was commissioned by Richborough Ltd to undertake a Flood Risk Assessment (FRA) for a mixed-use scheme at Spencers Wood, Wokingham. This FRA has been prepared in accordance with National Planning Policy Framework (NPPF).
- The 37.9ha site is currently greenfield land and falls from an elevation of 57.85m AOD along Basingstoke Road to the west to 48.62m AOD to the east. The River Loddon flows in a north-easterly direction approximately 400m to the south-east of the site. Three small ordinary watercourses flow through the centre of the site through a series of ditches.
- The Site is in Flood Zone 1 of the Environment Agency's Flood Map for Planning. More Vulnerable development, such as that propose is compatible with Flood Zone 1, without the need to apply the Exception Test.
- The site itself does not fall within the Environment Agency's historical flood outlines and is considered to be at a low risk of flooding from fluvial sources, groundwater, sewers or as a result of a reservoir failure.
- The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset shows significant overland flow paths to exist across the Site. However, the RoFSW mapping is informed by a generalised mapping approach. Therefore, a detailed rainfall-runoff model (1D-2D linked InfoWorks-ICM) has been developed to refine the flood risk shown within the RoFSW and to provide results suitable for a site-specific assessment of flood risk.
- Hydraulic model outputs from a surface water rainfall-runoff modelling study show that the overland flow routes across the Site are present but are more refined due to the more detailed representation of the site-topography.
- During the 1% AEP plus 40% climate change surface water event, typical peak flood depths within the site are predicted to be shallow at 90-300mm. Peak water levels range from 56.99m AOD down to 48.97m AOD due to the steep topography of the site.
- The baseline model was amended by applying the indicative development plateaus for each proposed development parcel to the 2D model domain to form a post-developed scenario. The post-development scenario was then simulated for the 1% AEP plus climate change event. There is no modelled increase in flood risk to third party land as a result of the proposed development. There is a reduction in flood depth to the east of the site and the south of the site as a result of the proposed development which can be defined as a betterment. The proposed development will be refined at a later date to ensure there is no adverse flood risk shown to any third-party land.
- Surface water runoff from the site will be managed as part of a surface water drainage strategy which will be carried out separately to this FRA.

- Safe access and egress are operational during all flood events considered via Basingstoke Road situated west of the site. Flood hazard ratings show the shallow flood depths to have a low hazard.
- This FRA report demonstrates that the proposed development may be designed in a sustainable and safe manner without adversely impacting the flood risk either at the Site or to any third-party land. The proposed development meets the requirements of the Sequential Test and Exception Test in line with the NPPF.

6.2 Recommendations

Following a review of all sources of flood risk on site, it is recommended to integrate the following mitigation measures as part of the proposal:

- The Finished Floor Levels (FFLs) of the proposed properties are to be set above the predicted flood level in the 1% AEP plus 40% climate change surface water flood event (53.57m AOD to 57.71m AOD adjacent to the development plateau's). Current Environment Agency guidance states that finished floor levels should be set 600mm above the Design Flood Level. FFLs to be 600mm above the immediately adjacent design flood level from the hydraulic model.
- The FFLs and openings (e.g. air bricks) of buildings are set to a minimum of 150mm above surrounding finished ground levels and wherever possible, levels around buildings will be designed so that water flows away from the building.
- The proposed development layout should be refined at a later date by adding more detail to the topography of the development parcels and individual building footprints. This updated masterplan should be used to run a final version of the model to confirm there is no adverse risk to third party land.
- The floors of all new buildings should be made of solid construction materials and the ground beneath suspended floors should be sealed to prevent ingress of groundwater should the water table levels increase directly beneath the site.

A Development Framework Plan



KEY

	SITE BOUNDARY		SECONDARY STREETS		NEW TREE PLANTING		POTENTIAL CONNECTIONS TO EXISTING MOVEMENT ROUTES
	RESIDENTIAL DEVELOPMENT		TERTIARY STREETS		COMMUNITY ORCHARD		COMMUNITY ART NATURE TRAIL
	SCHOOL SITE		PRIVATE LANES		PUBLIC OPEN SPACE		DOGGY TRIM TRAIL
	LOCAL CENTRE		SHARED SURFACE STREET/MEWS		MULTI-FUNCTIONAL OPEN SPACE AND PAVILION		INTERPRETATION BOARD
	EMPLOYMENT USES		EXISTING PUBLIC RIGHTS OF WAY		PROPOSED ECOLOGICAL AND WILDLIFE PONDS		EXOLUM PIPELINE
	SANG BOUNDARY		ACTIVE TRAVEL ROUTES		PROPOSED DOG PONDS		5M + 7M EXOLUM PIPELINE EASEMENT OFFSET
	CARE HOME FACILITY		KEY FOOTPATHS		AREAS OF PLAY		10M EXOLUM PIPELINE EASEMENT OFFSET
	ACCESS VIA BASINGSTOKE ROAD		SANG WALKING ROUTE		SUSTAINABLE DRAINAGE		
	PRIMARY AVENUE		PROPOSED PLANTING		PARKING		
	INDUSTRIAL ROAD		EXISTING VEGETATION		POTENTIAL HIGHWAYS UPGRADES		
	PROPOSED EMERGENCY						

KEY PRINCIPLES

1. PRIMARY ACCESS VIA BASINGSTOKE ROAD;
2. PRIMARY AVENUE THROUGH DEVELOPMENT;
3. SECONDARY STREETS;
4. TERTIARY STREETS;
5. FULLY CIRCULATORY CYCLE/ PEDESTRIAN ROUTES PROVIDING ACCESS TO ALL AREAS OF PUBLIC OPEN SPACE AND SURROUNDING INFRASTRUCTURE;
6. NEWLY CREATED SANG (GROVELAND COUNTRY PARK) PROVIDING A 2.3KM FULLY CIRCULATORY PEDESTRIAN ROUTE;
7. LANDSCAPED COMMONS AND GREENS PROVIDING RECREATIONAL SPACE FOR ALL AGES;
8. COMMUNITY SPACES IN THE FORM OF MULTI-FUNCTIONAL OPEN SPACES AND A COMMUNITY ORCHARD/ALLOTMENT;
9. LANDSCAPED GREENWAYS PROVIDING PUNCTUATION THROUGH DEVELOPMENT AND AREAS FOR ADDITIONAL PLANTING;
10. MAXIMUM RETENTION OF EXISTING VEGETATION;
11. POTENTIAL CYCLE/ PEDESTRIAN CONNECTIONS TO EXISTING MOVEMENT ROUTES;
12. POTENTIAL HIGHWAYS IMPROVEMENT TO EXISTING HIGHWAYS TO FACILITATE CYCLE AND PEDESTRIAN MOVEMENT;
13. SITE LOW POINTS UTILISED FOR SUSTAINABLE DRAINAGE;
14. NATURALISED WILDLIFE PONDS (FALLING WITHIN SANG BOUNDARY);
15. MAXIMUM OUTWARD FACING DEVELOPMENT FOR NATURAL SURVEILLANCE;
16. VIEWING CORRIDORS PROVIDING OPPORTUNITY TO ENJOY FAR-REACHING VIEWS OVER RIVER LODDON AND LOCAL COUNTRYSIDE; AND
17. LANDSCAPE BUFFER MINIMUM 5M.

B Hydraulic modelling report

Hydraulic Modelling Study at Spencers Wood, Wokingham

Final Report

March 2026

**Prepared for:
Richborough Ltd**

www.jbaconsulting.com



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Contract

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JBA Project Code 2024s0133

This report describes work commissioned by Stuart Nelmes, on behalf of Richborough Ltd by an email dated 25 January 2024. Harry Wightman and Daniel Bloomfield of JBA Consulting carried out this work.

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Table 5-1: Defra’s FD2320/TR2 “Flood Risks to People” classifications

Abbreviations

1D	One Dimensional
2D	Two Dimensional
AEP	Annual Exceedance Probability
CC	Climate Change
DTM	Digital Terrain Model
EA	Environment Agency
FEH	Flood Estimation Handbook
FFL	Finished Floor Levels
FRC	Fixed Runoff Coefficient
Ha	Hectares
ICM	Integrated Catchment Modelling
JBA	Jeremy Benn Associates
LIDAR	Light Detection and Ranging
m AOD	Metres Above Ordnance Datum
NGR	National Grid Reference
OS	Ordnance Survey
ReFH	Revitalised Flood Hydrograph
RoFSW	Risk of Flooding from Surface Water

Definitions

Term	Definition
Annual Exceedance Probability	The probability of an event size (often described in terms of peak flow rate) being equalled or exceeded in any one year
Flood risk	A combination of the statistical probability of a flood event occurring and the scale of the consequences if it does. So high risk can include circumstances that might not occur very frequently but have very substantial consequences, and also circumstances that occur relatively frequently and have more moderate consequences, causing relatively frequent but less severe harm
Manning's n	This is a roughness coefficient first introduced by Irish Engineer Robert Manning in 1889, which represents the roughness or friction affecting the flow of water by the surface (e.g. channel) over which the water flows. The rougher the surface the greater the effect of friction on the flow.

Executive Summary

JBA Consulting were commissioned by Richborough Ltd to undertake a detailed hydraulic modelling study in relation to a site located off Basingstoke Road in Spencers Wood, Wokingham, RG7 1PW.

The purpose of the study is to refine and accurately assess the pluvial flood risk to the site. To achieve this, a hydrological assessment was carried out to derive rainfall hyetographs and a 1D-2D InfoWorks-ICM direct runoff hydraulic model was produced to allow the detailed representation of flood depths, velocity and hazard within the site boundary.

The model was simulated for the following Annual Exceedance Probability (AEP) events: 3.3%, 3.3% with (+35%) climate change, 1%, 1% with (+40%) climate change, and 0.1% storm, for the 60-minute critical (summer) storm duration.

The baseline model results indicate that:

- Flooding is predicted to occur within the site during all modelled design events.
- Flooding is predicted to occur within the site during the 3.3% AEP with (+35%) climate change and 1% AEP with (+40%) climate change events.
- Peak modelled flood depths of up to 0.31m are predicted to occur within the site during the 100-year (1% AEP) plus climate change event.
- Peak modelled flood levels are predicted to range between 57.3m AOD to the west and 48.93m AOD towards the eastern boundary of the site during the 100-year (1% AEP) plus climate change event.
- Hazard classification areas of 'caution' extend across the site, with areas of 'moderate' to 'extreme' located within the confines of the drainage ditches.
- Sensitivity testing of the model found that within the site boundary the model results are insensitive to changes in modelled roughness, and slightly sensitive to changes in the fixed runoff coefficient (runoff percentage) value.

The post-development model results indicate that:

- Raising the indicative development area above design flood levels, stamping in proposed road levels, modelling proposed crossings as open channel and blocking off rainfall directly to the site during the 1% AEP with (+40%) climate change event largely had no adverse impact on modelled flood depths or hazard outside of the site boundary.

Recommendations

The results of the hydraulic modelling can be used to inform the Flood Risk Assessment for the site. However, it is recommended that the hydraulic modelling is reviewed and validated by the Lead Local Flood Authority, ideally before developing a masterplan or submitting a planning application.

It is recommended that the post-development scenario of the model is re-run once a final layout has been agreed at detailed design stage. It is recommended that the final levels be re-simulated in the hydraulic model to understand the impact on flood levels and flood hazard within and outside of the site, along with the incorporation of a site surface water drainage strategy.

The model results have been prepared for the purpose of quantifying surface water flood risk at the site and surrounding area. If the results are intended to be used for surface water flood risk mapping of the wider catchment, further model refinement is recommended. Additionally, if further data is made available it is recommended that the model is updated to improve the representation of surface water flood risk parameters.

1 Introduction

1.1 Terms of Reference

JBA Consulting were commissioned by Richborough Ltd to undertake a detailed hydraulic modelling study in relation to a site located off Basingstoke Road in Spencers Wood, Wokingham, RG7 1PW (hereafter referred to as 'the site').

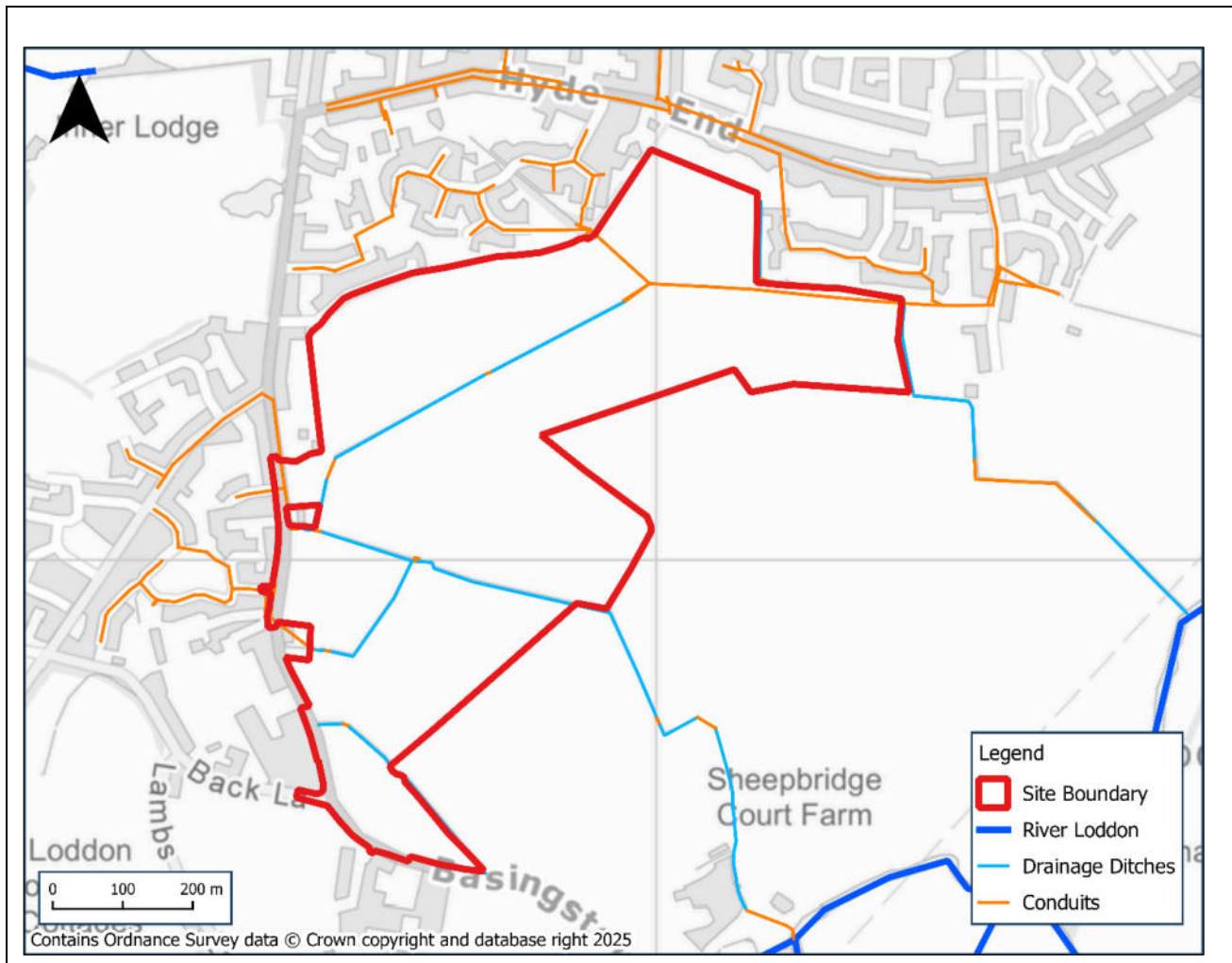
The purpose of the study is to refine and accurately assess the pluvial flood risk to the site. To achieve this, a 1D-2D InfoWorks-ICM direct runoff hydraulic model was produced to allow the detailed representation of flood depths, velocity and hazard within and around the site boundary.

A sustainable Drainage Strategy has been prepared by RACE and submitted separately to inform the planning application. However, a representation of the proposed drainage strategy has been accounted for in the post-development hydraulic modelling.

1.2 Site details

Table 1-1: Site details

Site address	Basingstoke Road, Spencers Wood, Wokingham, RG7 1PW
Site area	37.8 ha
Existing land-use	Greenfield
OS NGR	SU 71589 66027
County	Wokingham
Country	England



1.3 Site description

The site is located east of Basingstoke Road, Spencers Wood, Wokingham. Most of the surrounding land-use to the east and north of the site is urban, while agricultural land-uses make up for most of the neighbouring land to the east and south of the site. The catchment itself is mostly rural. Analysis of LiDAR elevation data shows the topography of the location slopes from the west to the east. There are a number of drainage ditches and presumed culverts in the vicinity of the site as shown in Figure 1-1. All drainage ditches are presumed to be draining into the River Loddon, Environment Agency (EA) Main River, approximately 500m south-east of the site.

Analysis of existing surface water risk mapping, OS mapping and LIDAR elevation data indicates that the site topography slopes south-easterly towards the floodplain of the River Loddon as shown in Figure 1-1.

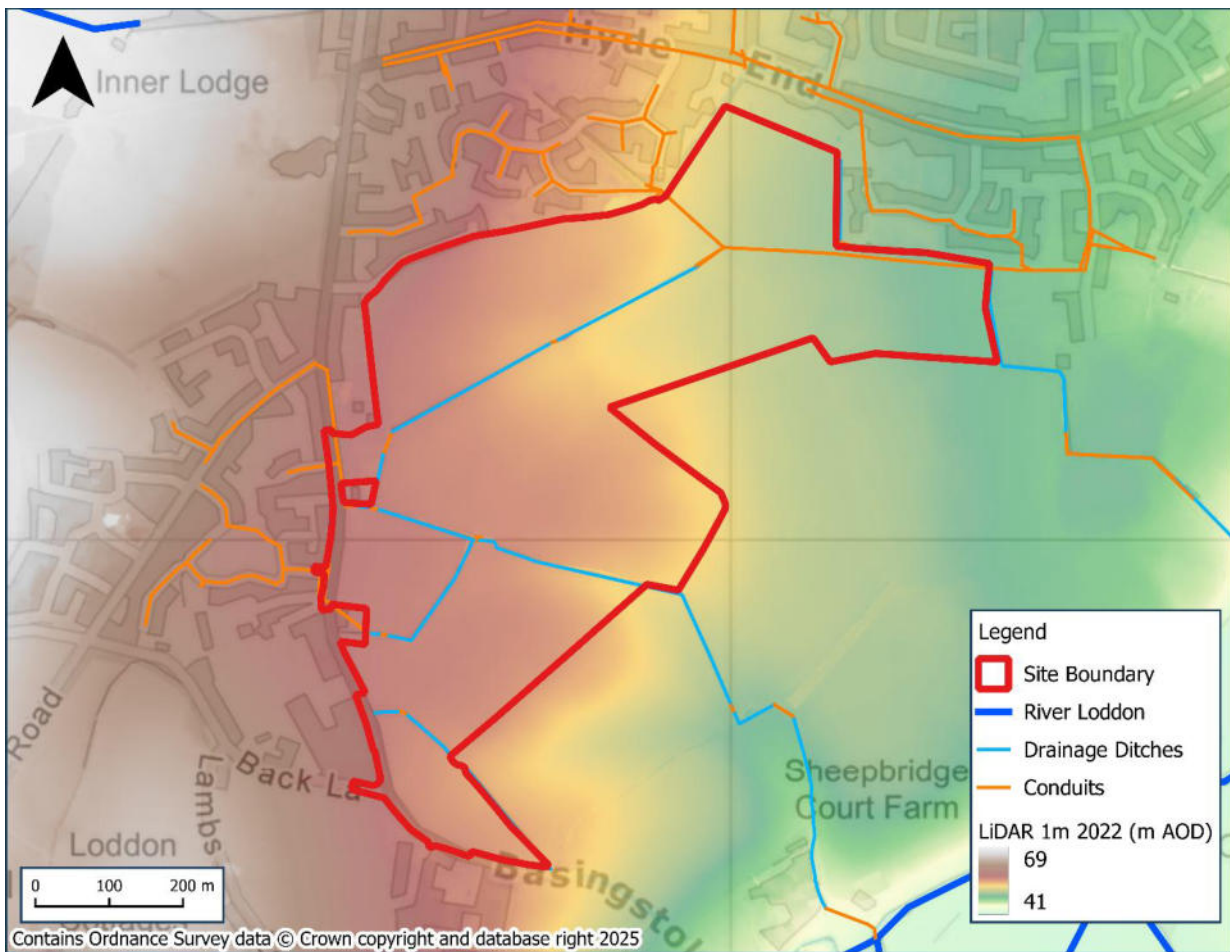


Figure 1-1: Site Topography

1.4 Existing flood data

The EA's NaFRA 2 Risk of Flooding from Surface Water (RoFSW) mapping for the site is shown in Figure 1-2.

The mapping indicates that the site is at risk from pluvial flooding in the 3.3% AEP, 1% AEP and 0.1% AEP events. The main cause of flooding is suggested to be flow routes originating from the raised land north-west of the site and entering the site via the western boundary. However, these maps originate from broad-scale modelling techniques whereby the capacity public sewers, channel and the structures crossing it is approximated. Key structures including the upstream surface water public sewer network, and surface water features which may allow water to drain away in lower return period events, (such as culverts, drains, gullies, kerbs, ect) are unlikely to be explicitly represented.

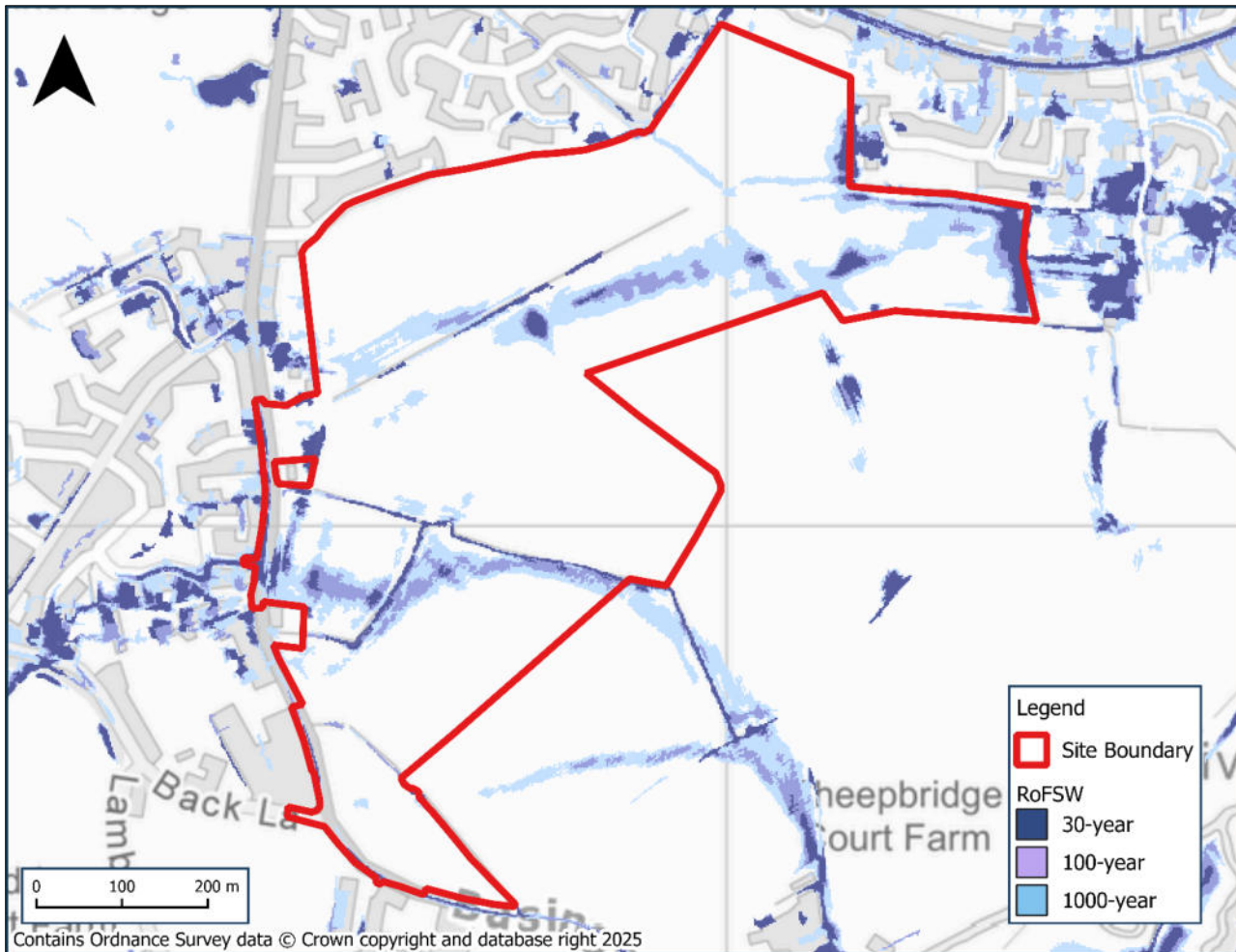


Figure 1-2: Environment Agency's NaFRA2 Risk of Flooding from Surface Water Mapping

1.5 General modelling approach

A direct rainfall-runoff model was developed to refine the understanding of surface water flood risk at the site, incorporating local surface water drainage information and topographic data to improve upon the EA's Risk of Flooding from Surface Water mapping.

A 1D-2D model was developed in InfoWorks ICM covering the study catchment draining towards the site. Rainfall hyetographs were derived for the following storm events:

- 3.3% AEP and 3.3% AEP with (+35%) climate change uplift.
- 1% AEP and 1% AEP with (+40%) climate change uplift.
- 0.1% AEP.

The rainfall hyetographs were applied directly to the model surface to provide baseline model results, including flood depths, velocity and hazard in the vicinity of the site.

The hydraulic model sensitivity to roughness values and the fixed runoff coefficient was tested to improve confidence in the model results.

2 Available data

2.1 Data availability

Grantham Coates Surveys Ltd were commissioned to undertake a culvert information survey report within the vicinity of the site in March 2024 (see Appendix A). The survey consisted of a total of 17 culverts identified within the vicinity of the site. Sewer maps covering the area around the site were obtained from Thames Water (see Appendix C) and used to inform the representation of the public sewer network, to the north and west of the site.

Topographic survey of the site was collected in December 2023 by Greenhatch group and was available for use in this study (See Appendix B). The 2023 topographic survey was used within the modelling to represent levels throughout the site. Environment Agency LiDAR data was obtained from the Open Data website and used within the modelling to represent ground levels within the wider catchment. The LiDAR data used has a grid resolution of 1m and flown in 2019.

Ordnance Survey (OS) ZoomStack mapping was used to inform land use information in the study catchment.

3 Hydraulic Model Build

The flood modelling approach was based on the "direct rainfall" concept where rainfall is applied to each mesh element in the hydraulic model and routed across the mesh surface, identifying flooding pathways and areas where ponding will occur. A 1D-2D direct rainfall model has been built to refine the EA's RoFSW mapping by representing the local drainage network using the available information. The model was built using InfoWorks ICM v2024.5.

3.1 2D domain

3.1.1 Model extent and topography

The hydraulic model extent encompasses the topographic catchment for the site and that of nearby surface water flow paths identified on the EA's RoFSW mapping. It also includes the sewer catchment for the surface water sewer that discharges into the watercourse near the site. The model extent is shown in Figure 3-1.

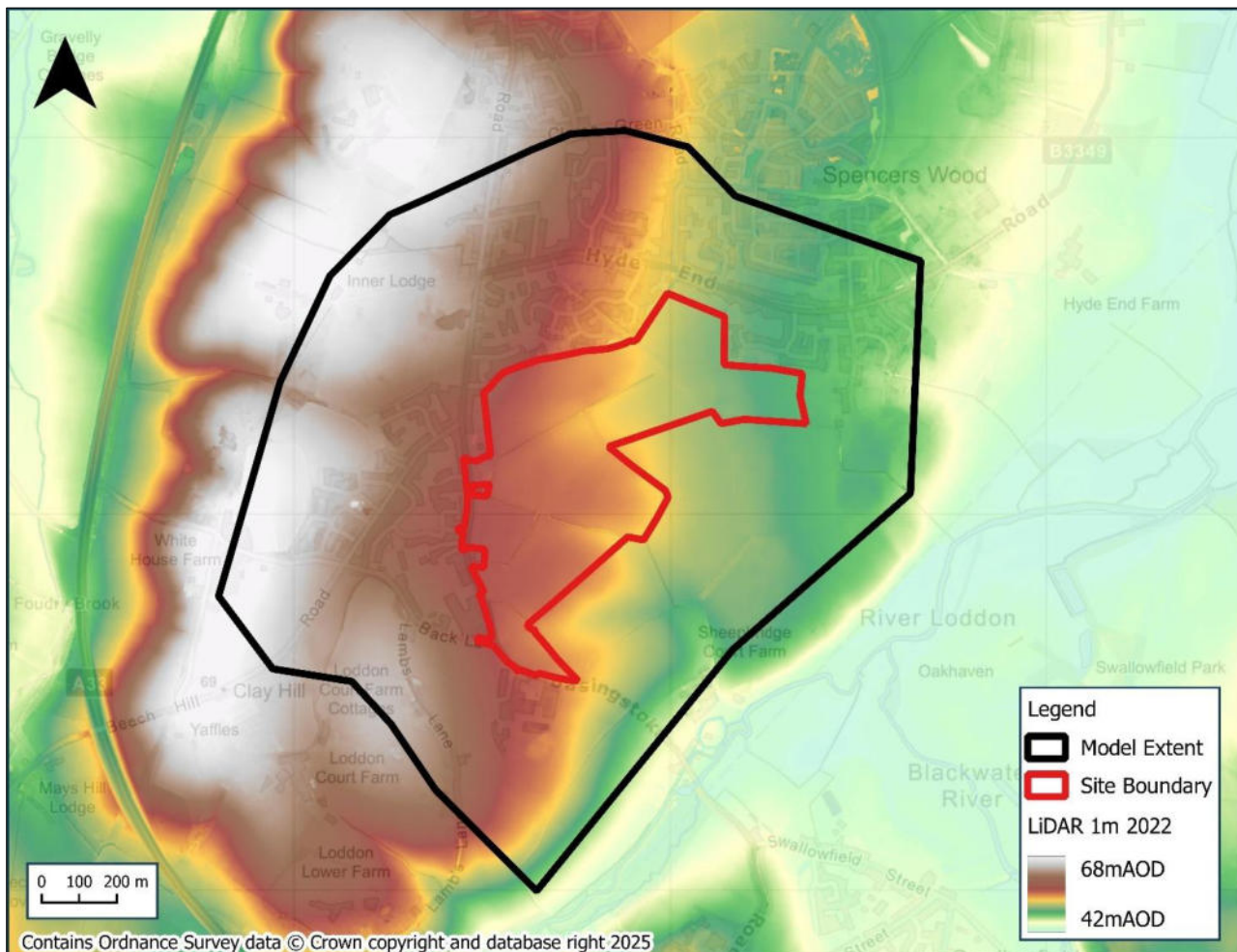


Figure 3-1: Model extent

The 1m Environment Agency 2019 LiDAR has been used to derive the topography throughout the model domain. A maximum triangle size of 10m² has been applied to the 2D zone, with terrain sensitive meshing used to increase the resolution in areas of steep topography and improve the representation of changes in the topography. A summary of the key 2D Zone parameters relating to model topography is shown in Table 3-1.

Table 3-1: 2D Zone parameters summary

	Value
Maximum triangle area (m ²)	10
Minimum element area (m ²)	2
Terrain-sensitive meshing	True
Maximum height variation (m)	0.25
Minimum angle (degrees)	25

3.1.2 Model roughness parameters

Manning's n roughness values were used to represent the model roughness in the hydraulic model's 2D domain based on land uses across the model extent. Land uses were defined using Ordnance Survey (OS) ZoomStack mapping (see Figure 3-2). Table 3-2 details the range of Manning's n values applied to the 2D domain.

Table 3-2: Manning's n values within the hydraulic model 2D domain

Land use	Manning's n
General Surface	0.050
Dense woodland	0.100
Roads	0.025
Buildings	0.300
Inland water	0.040

3.1.3 2D features

Mesh zones were used to represent buildings within the 2D domain and raise the mesh to a level 0.125m above the ground level to represent an assumed building threshold. This approach allows buildings threshold levels to be raised above the 2D mesh to account for their impact on overland flows. modifications

Mesh zones were also used to represent roads, enforce kerb lines, and to represent watercourses. Levels were taken from LIDAR with no made.

The 2D features are shown in the 2D model schematic in Figure 3-2.

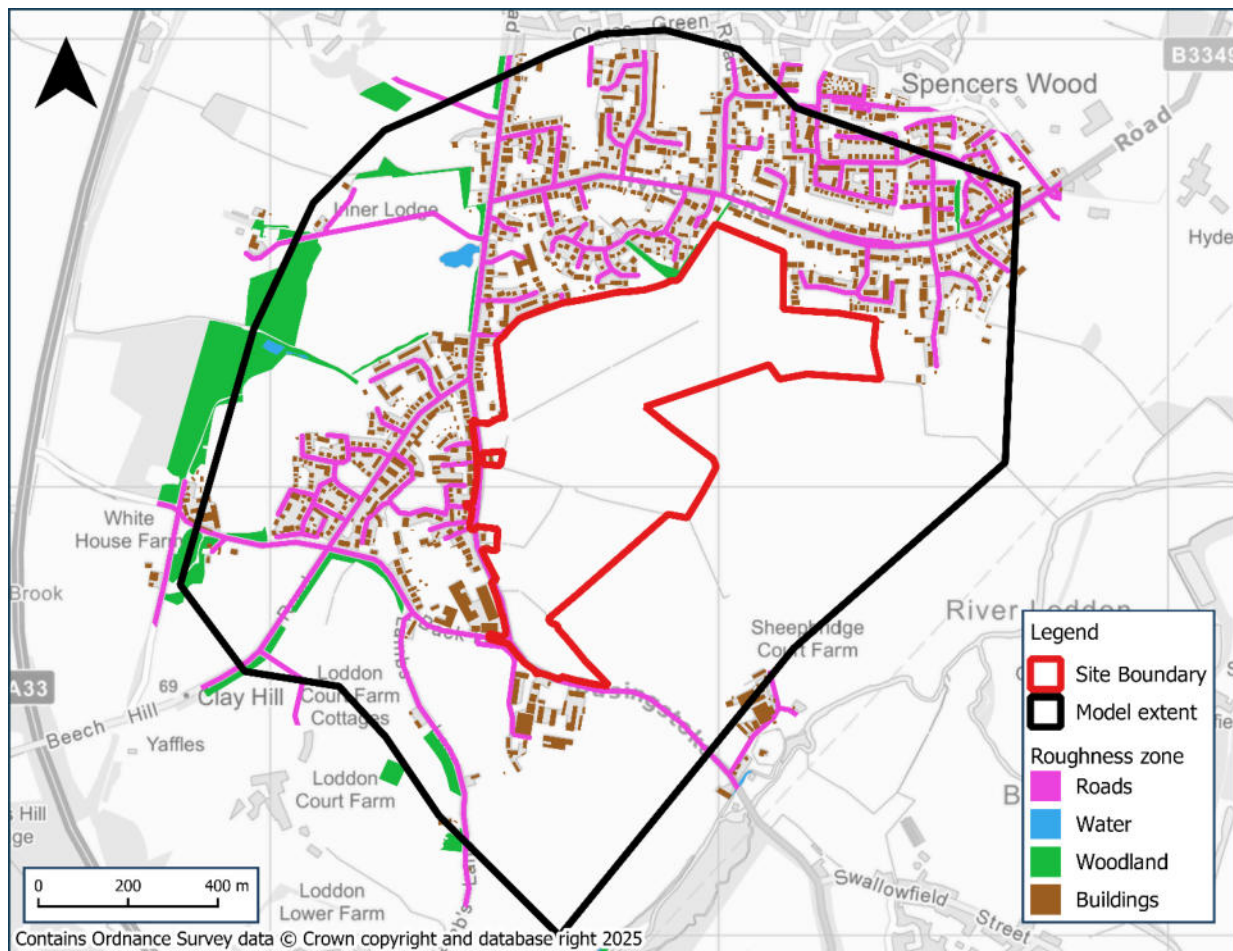


Figure 3-2: 2D model schematic

3.2 1D domain

3.2.1 Representation of sewers

The public surface water sewer network covering the area to the north and west of the site draining into the modelled drainage ditches via culvert has been represented in the 1D domain with conduits and manholes based on information from the Thames Water sewer maps (see Appendix 0).

It was necessary to make some assumptions about data taken from Thames Water sewer mapping including the following:

- Missing pipe dimensions were assumed based on standard pipe sizes and upstream and downstream connections.
- Manholes have been set to have a 2D flood type with those on or close to the highway which uses the weir equation to determine flow between the 1D and 2D domains.
- Ground levels were assumed to be equal to the cover level.

- Manholes were assumed to be unsealed and allowed to surcharge.
- Manholes with unknown dimensions are modelled using the default calculation InfoWorks ICM uses for Chamber plan area: $A = \frac{\pi}{4} \times (\text{Width of incoming pipe} + 0.762)^2$

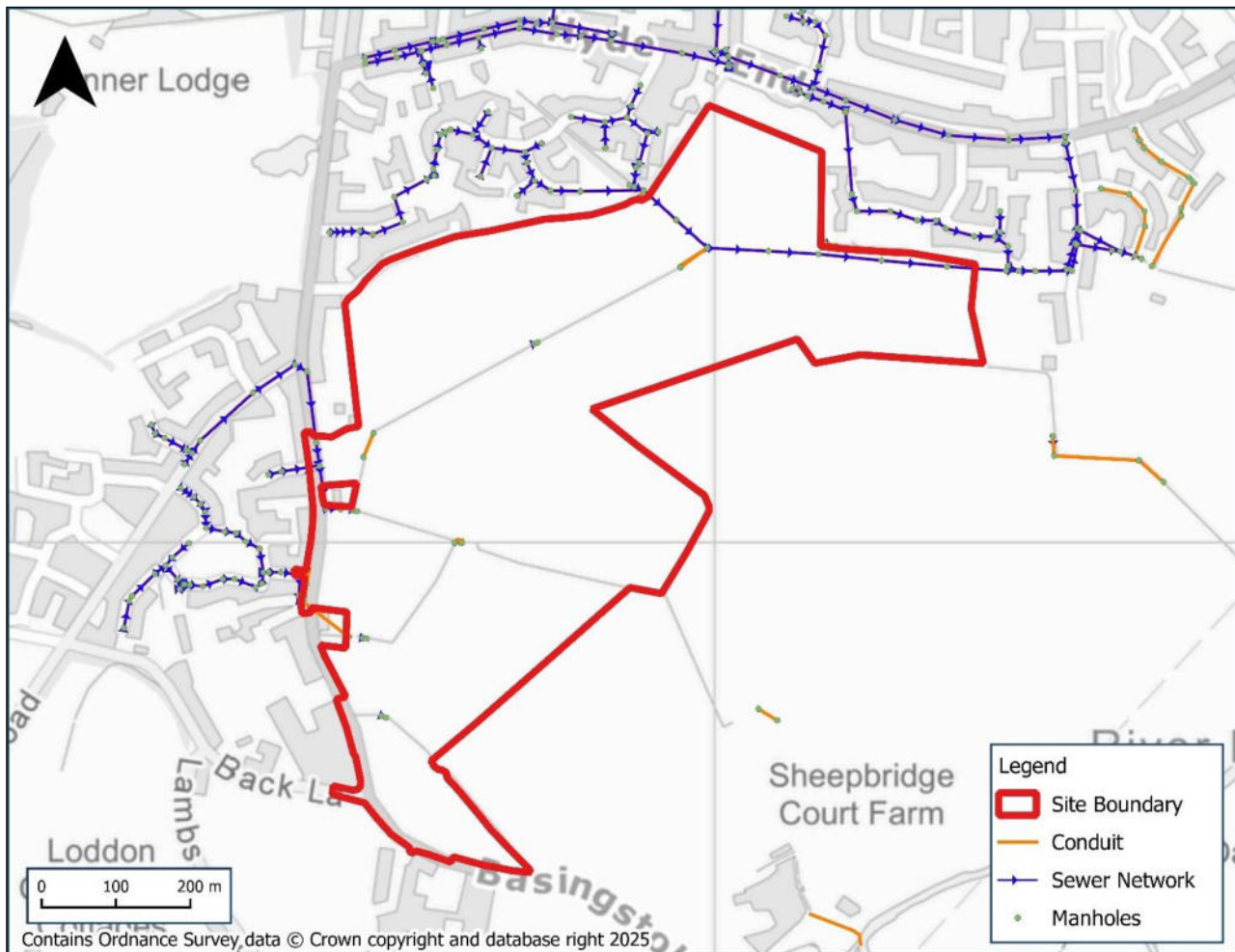


Figure 3-3: 1D model schematic

3.3 Application of hydrology

Rainfall hyetographs were applied directly to the ground model across the catchment using the ReFH2 rainfall generator in InfoWorks-ICM. InfoWorks-ICM allows hyetographs to be automatically generated within the software using catchment rainfall parameters from the FEH service. FEH22 rainfall descriptors were used to generate the rainfall events. An evapotranspiration value of 3mm/day was applied to summer storms to represent summer conditions and an evapotranspiration value of 1mm/day was applied to winter storms.

Rainfall hyetographs were calculated for the 3.3% AEP (1 in 30-year), 1% AEP (1 in 100-year), and 0.1% AEP (1 in 1000-year) storm events. Storm durations of 0.5-hour, 1-hour, 3-hours and 6-hours were simulated for each return period with the maximum extent generated for each event determined as the critical storm duration. Winter and summer

rainfall were also compared. The results showed that the maximum flood extents at the site occur during the 3-hour storm duration and summer rainfall profile, in all return periods. This event was taken forward as the critical storm duration for all return periods.

The effect of climate change was assessed by increasing the peak rainfall by 35% for the 3.3% AEP event and 40% for the 1% AEP event (upper end allowance for the 2080's epoch from the Loddon and tributaries management catchment).

Rainfall was applied directly to the whole of the 2D model surface, with overland flow routed by surface topography and surface features, such as buildings and roads. Buildings within 50m of the sewer network were represented with subcatchments to route flow into the 1D sewer network, accounting for the drainage of buildings directly into the sewers. Drainage from roads into the sewers was represented using manholes where sewers have been modelled and so were not represented with subcatchments.

Infiltration zones were used to control the volume of rainfall allowed to flow onto the 2D mesh and were also used to account for losses from the 2D domain (e.g. water flowing into the sewer network through subcatchments or water lost through infiltration).

Infiltration surfaces represented in the model are shown in Figure 3-4. Roads and buildings have been given separate infiltration surfaces dependant on whether they have been modelled with a connection to the 1D sewer network or not. If the sewer network draining roads or buildings has not been represented in the model, they have been given a 12mm/hour loss to account for drainage to the sewer network.

In order to prevent any double counting of inflows to the model (by application of rainfall to the 2D mesh and the 1D sewer system using subcatchments) runoff coefficients used to route flows to the sewer system through subcatchments have been reduced based on the 2D runoff coefficient. The fixed runoff coefficients used are shown in Table 3-3.

Table 3-3: Fixed runoff coefficients

Land Use	1D runoff coefficient	2D runoff coefficient	Infiltration surfaces loss (mm/hr)
Roads (No sewer network represented)	-	0.9	12
Buildings (No sewer network represented)	-	1.0	12
Buildings (With sewer network represented)	0.8	0.2	-
Green space	-	0.43	-

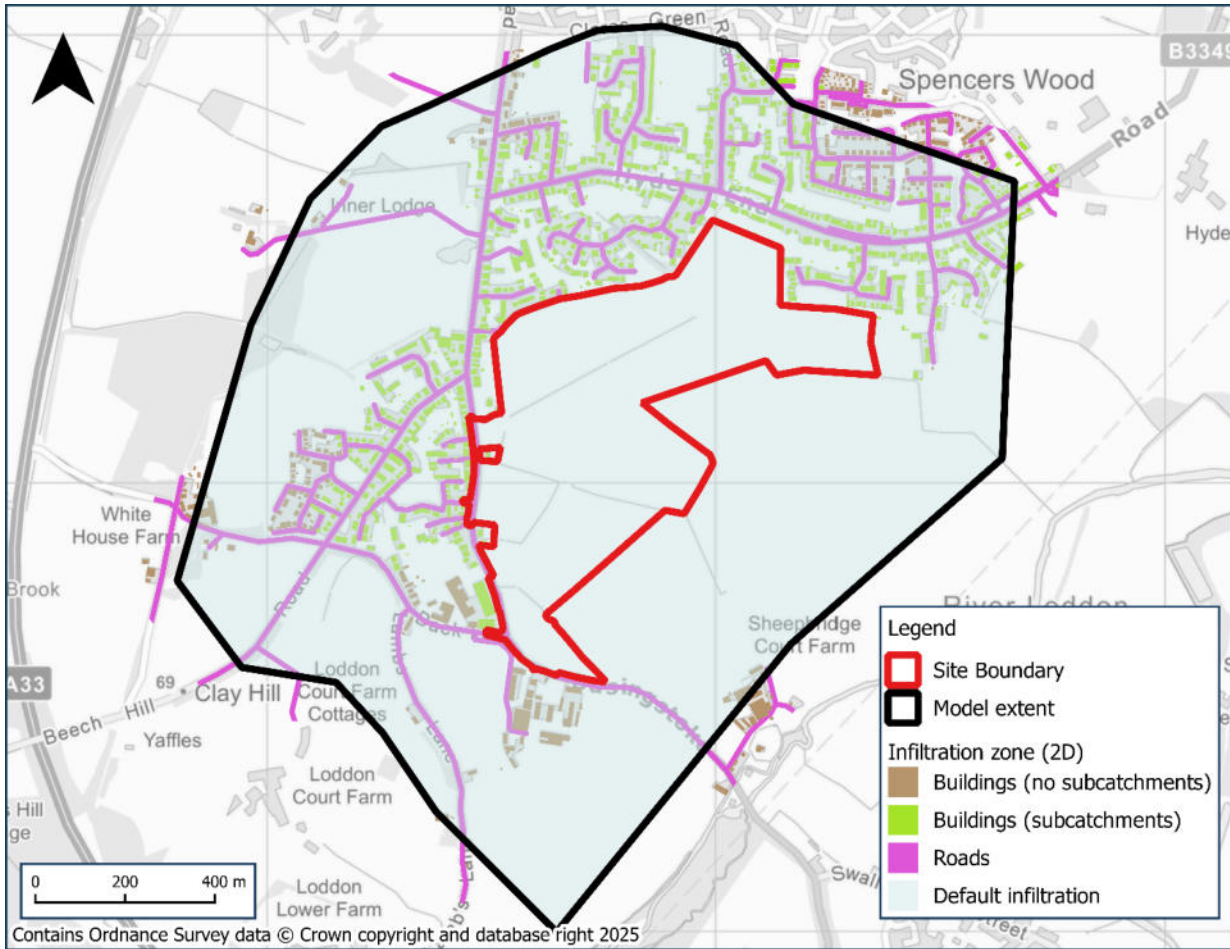


Figure 3-4: Infiltration surfaces

3.4 Calibration

No specific recorded flood levels or flow data were available for the study area. As a result, the model has not been calibrated. Instead, a model validation has been carried out through comparison with the EA's RoFSW mapping (see Section 4).

3.5 Model Runs

The following scenarios were simulated within the model:

Scenario	Return period	Description
Baseline scenario	3.3% AEP (30-year)	Existing condition scenario
Baseline scenario	3.3% AEP (30-year) with (+35%) climate change	Existing condition scenario
Baseline scenario	1% AEP (100-year)	Existing condition scenario
Baseline scenario	1% AEP (100-year) with (+40%) climate change	Existing condition scenario
Baseline scenario	0.1% AEP (1,000-year)	Existing condition scenario
Sensitivity analysis	1% AEP (100-year)	20% increase in roughness
Sensitivity analysis	1% AEP (100-year)	20% decrease in roughness
Sensitivity analysis	1% AEP (100-year)	20% increase in fixed runoff coefficient
Sensitivity analysis	1% AEP (100-year)	20% decrease in fixed runoff coefficient
Post-developed	Baseline scenario	Proposed levels represented

3.6 Sensitivity analysis

The model's sensitivity to changes in roughness and fixed runoff coefficient were assessed. Further detail on the sensitivity testing is provided in Appendix D.

Sensitivity testing of the model found that within the site boundary the model results are insensitive to changes in modelled roughness, and slightly sensitive to changes in the fixed runoff coefficient (runoff percentage) value.

4 Model validation

To assess the validity of the model results, the surface water modelling results were compared with the EA's Risk of Flooding from Surface Water (RoFSW) maps for two return periods.

4.1 Comparison with the EA 1 in 100-year surface water flood map

Figure 4-1 shows the EA's 1% AEP RoFSW extent compared to the 1% AEP surface water extent modelled as part of this study. The flood extents within the site for the modelled 1% AEP event are predicted to be smaller compared to that of the 1% AEP RoFSW. The predicted decrease in flooded area within the site can be attributed to the representation of the sewer network, inclusion of site-specific topography and improving the resolution of the modelling.

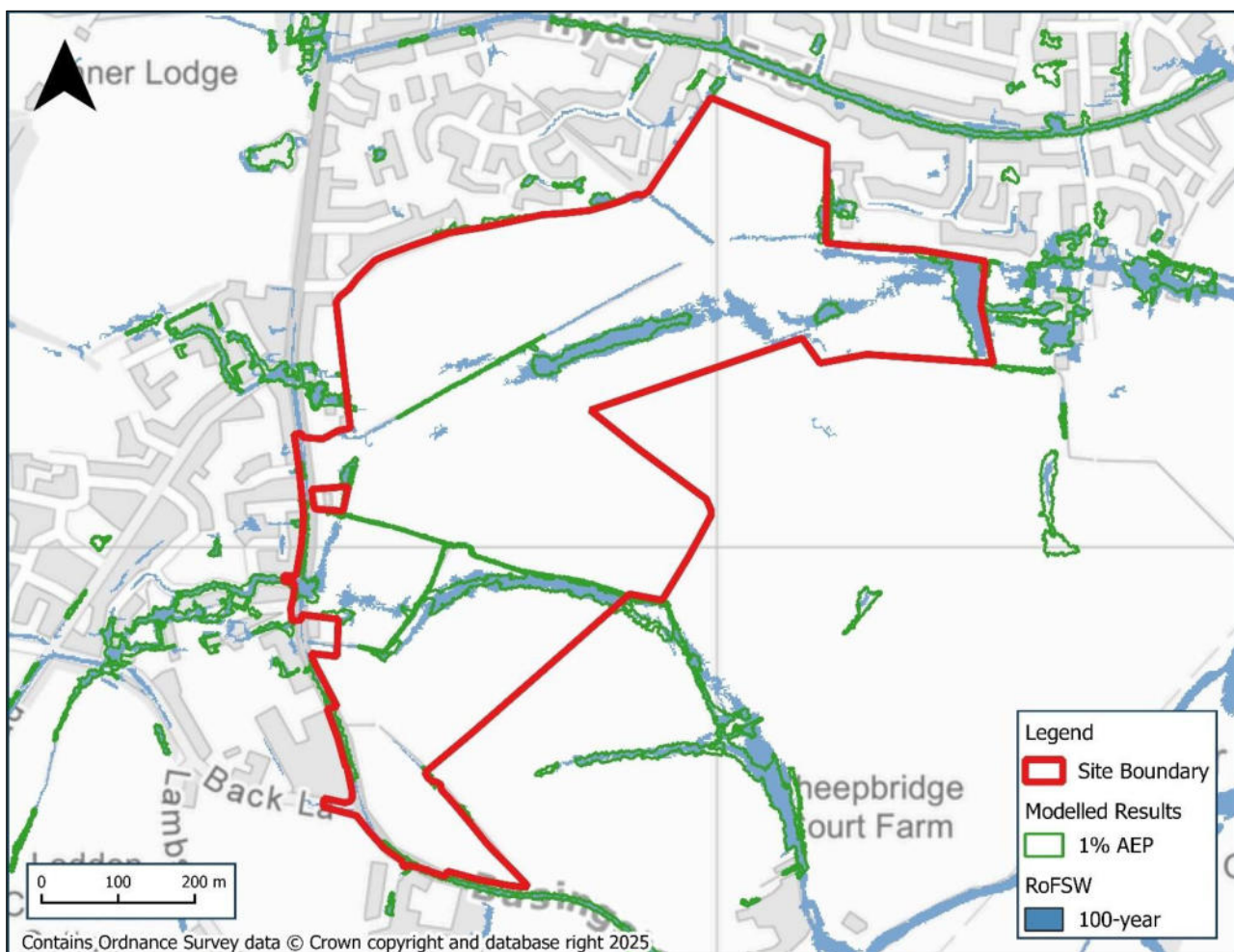


Figure 4-1: 1% AEP comparison with RoFSW

5 Hydraulic model results

5.1 Processing of hydraulic model results

The following processing steps, aligned with those taken from the EA's National Scale Surface Water Flood Mapping Methodology¹, have been applied to the outputs of all hydraulic modelling results:

- Filtered to remove areas where peak depths are less than 0.075
- Filled areas with an area less than 50m²
- Removal of polygons with an area less than 100m².

Only 2D model results are included in these figures.

5.2 Existing conditions/baseline scenarios

5.2.1 Peak flood extents

Flood extents for the 3.33% AEP, 1% AEP and 0.1% AEP flood events are shown in Figure 5-1, with mapping for the 3.33% AEP with (+35%) climate change and 1% AEP with (+40%) climate change events shown in Figure 5-2.

Figure 5-1 indicates that flooding is predicted to occur within the site during all modelled events.

Figure 5-2 indicates that flooding is also predicted to occurring within the site during the 3.3% AEP with (+35%) climate change and 1% AEP with (+40%) climate change events.

¹ Risk of Flooding from Surface Water Map. Report version 2.0., Environment Agency (2019)

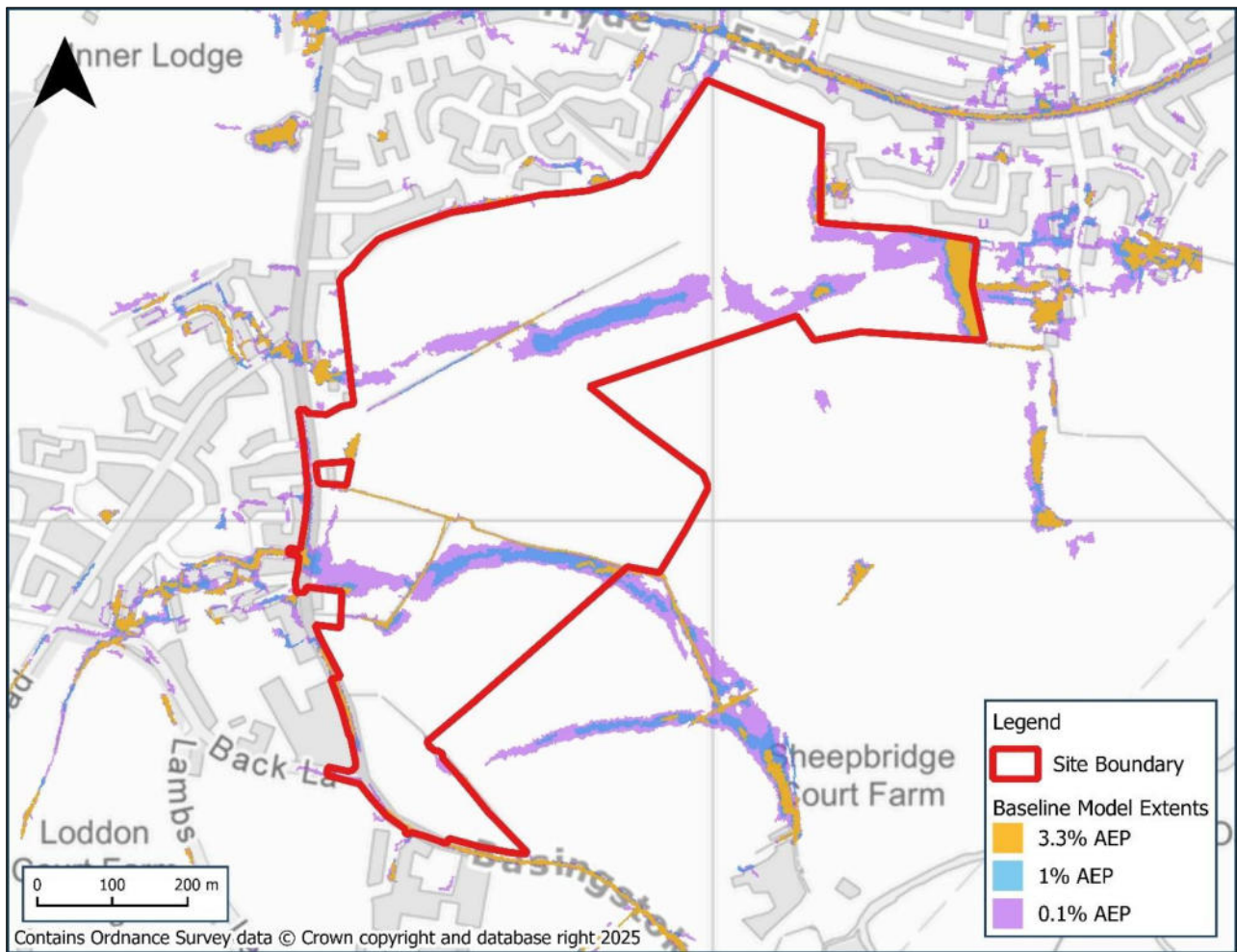


Figure 5-1: Baseline scenario peak flood extents

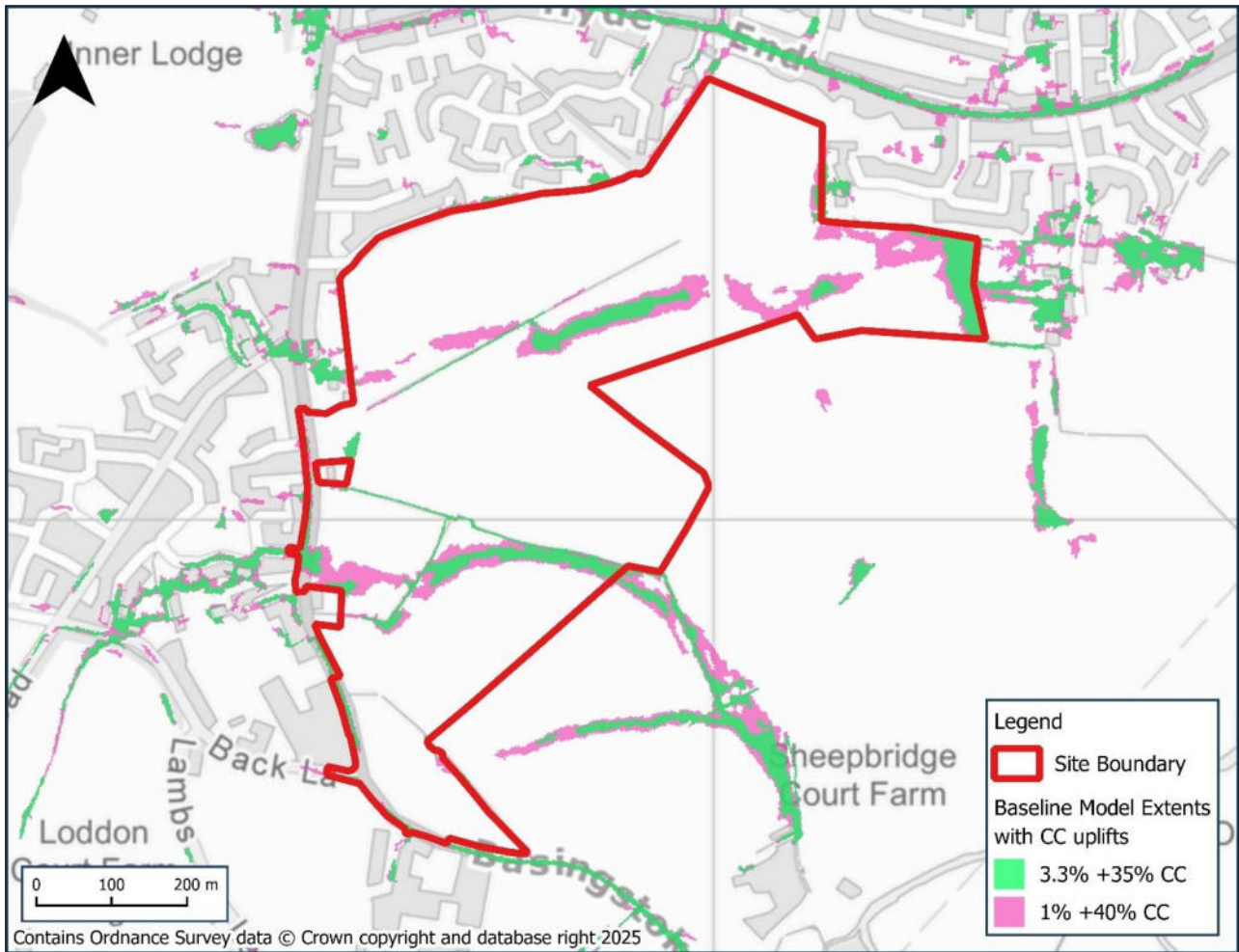


Figure 5-2: Baseline scenario climate change peak flood extents

5.2.2 Peak flood depths

Figure 5-3 shows the peak flood depths within the site boundary during the 1% AEP with (+40%) climate change event for the baseline scenario. Peak modelled flood depths of up to 0.31m are predicted to occur within the site during the 100-year (1% AEP) plus climate change event.

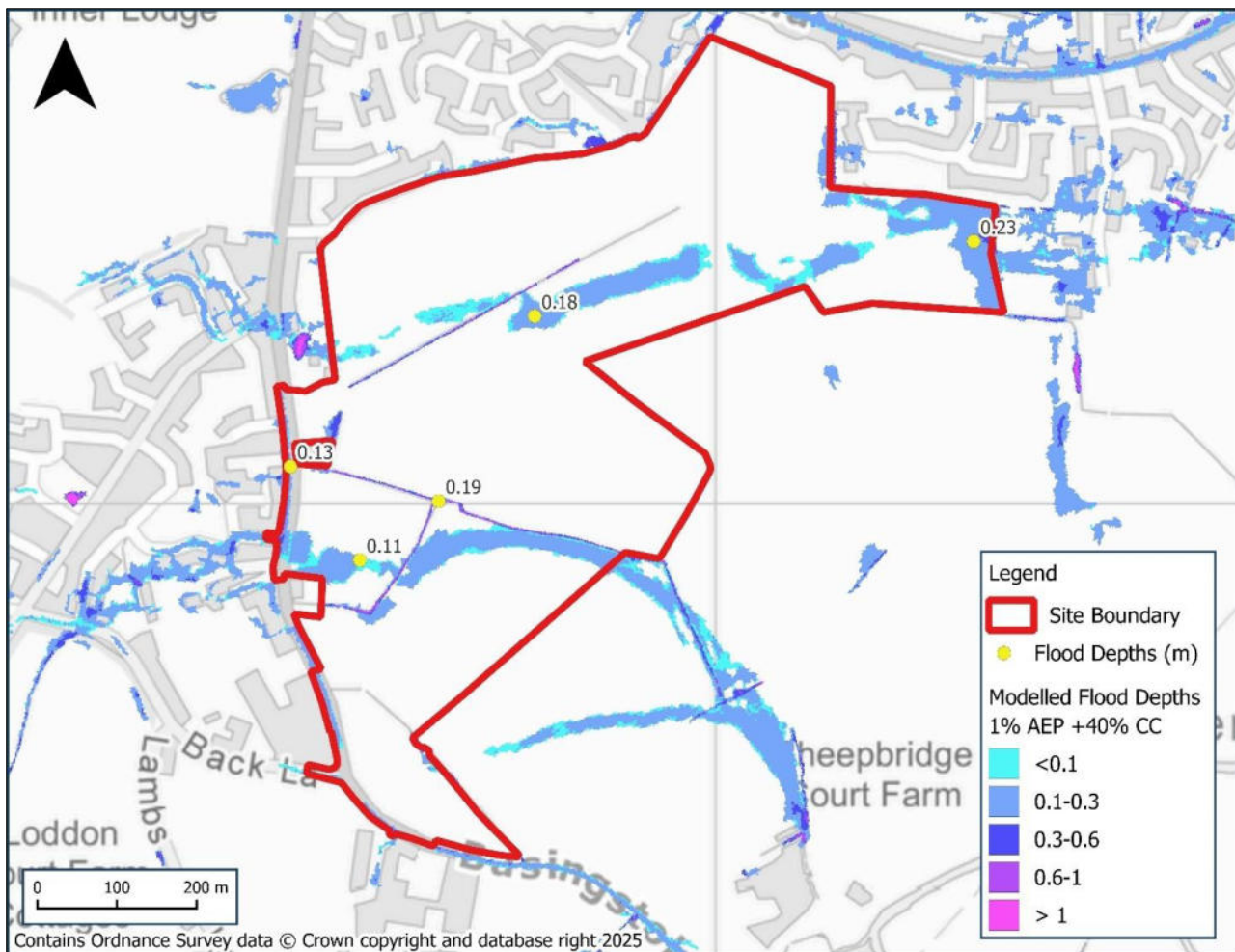


Figure 5-3: Modelled depths in 1% AEP with (+40%) climate change flood event

5.2.3 Peak flood levels

Figure 5-4 shows the peak flood levels within the site boundary during the 1% AEP with (+40%) climate change event for the baseline scenario. Peak modelled flood levels are predicted to range between 57.3m AOD to the west and 48.93m AOD towards the eastern boundary of the site during the 100-year (1% AEP) plus climate change event.

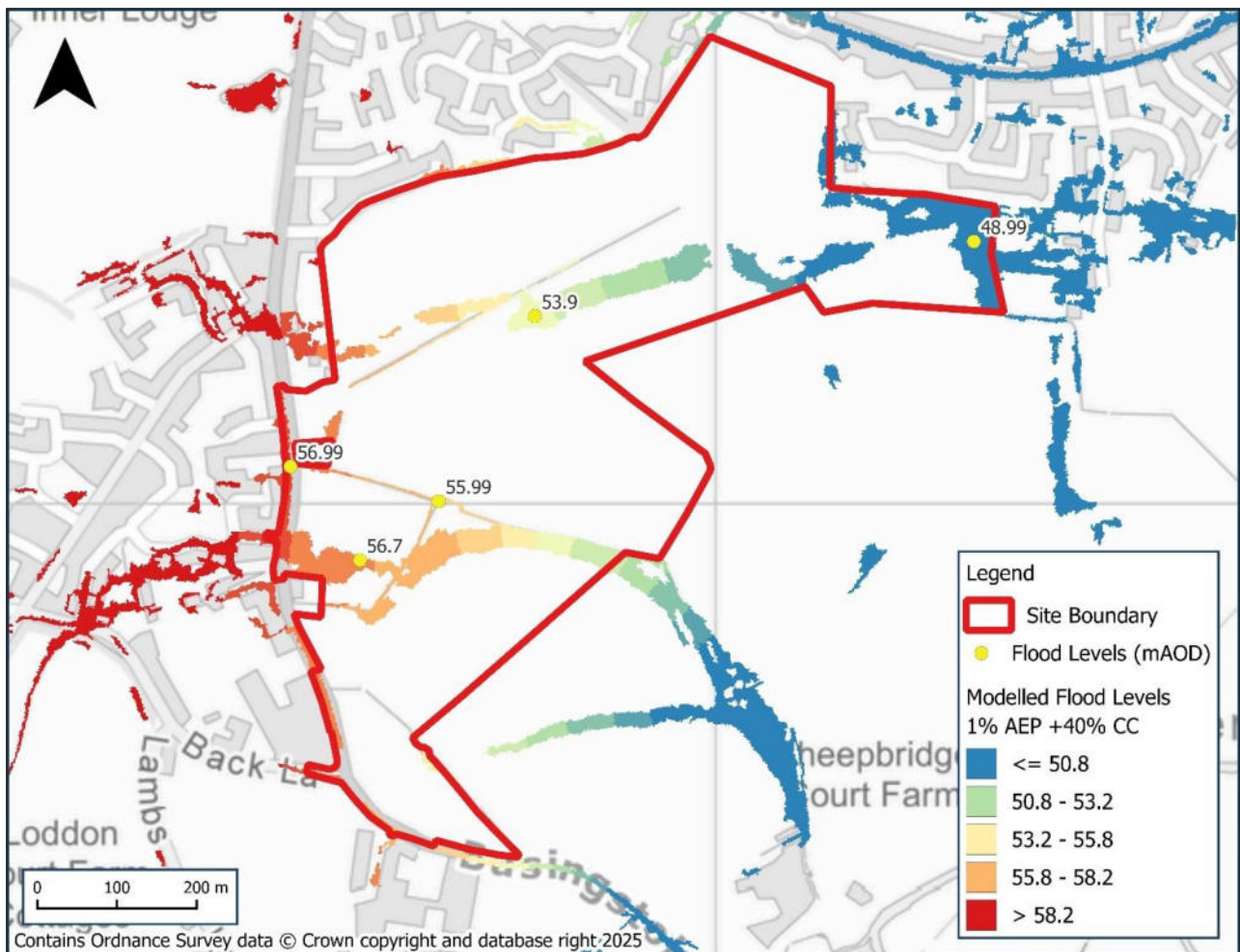


Figure 5-4: Modelled levels in the 1% AEP with (+40) climate change flood event

5.2.4 Hazard to people

The hazard-to-people rating has been mapped using the formula as specified in Defra's FD2320/TR2 "Flood Risk to People". The different hazard categories are shown in Table 5-1 and the hazard classification to the site during the 100-year (1% AEP) plus 40% climate change event is shown in Figure 5-5.

Table 5-1: Defra's FD2320/TR2 "Flood Risks to People" classifications

Flood hazard rating	Degree of Flood Hazard	Description
<0.75	Caution	Caution <i>"Flood zone with shallow flowing water or deep standing water"</i>
0.75 to 1.25	Moderate	Dangerous for some (i.e. Children) <i>"Danger: flood zone with deep or fast flowing water"</i>
1.25 to 2.00	Significant	Dangerous for most <i>"Danger: flood zone with deep fast flowing water"</i>
>2.00	Extreme	Dangerous for all <i>"Extreme danger: flood zone with deep fast flowing water"</i>
Using the hazard equation $HR = d \cdot (v + 0.5) + DF$ Where d = depth of flooding (m) v = velocity of floodwaters (m/sec) DF = debris factor		

Figure 5-5 shows that during the 100-year (1% AEP) plus 40% climate change event, hazard classification areas of 'caution' extend across the site, with areas of 'moderate' to 'extreme' located within the confines of the drainage ditches.

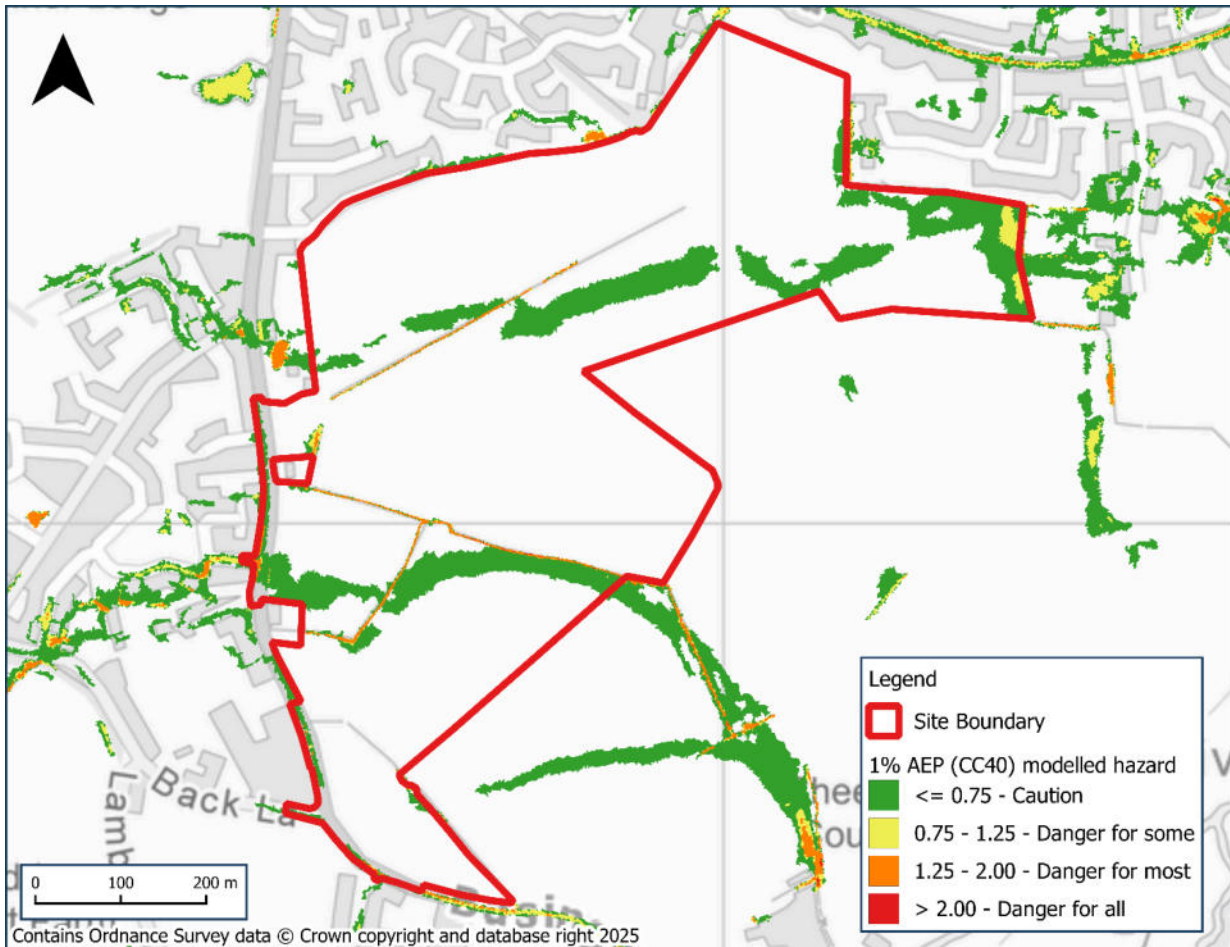


Figure 5-5: Baseline scenario peak flood hazard – 1% AEP plus 40% climate change

5.3 Post-development modelling

A post-development model scenario was developed and was tested for the 1% AEP with (+40%) climate change event. The post-development model scenario is shown in Figure 5-6.

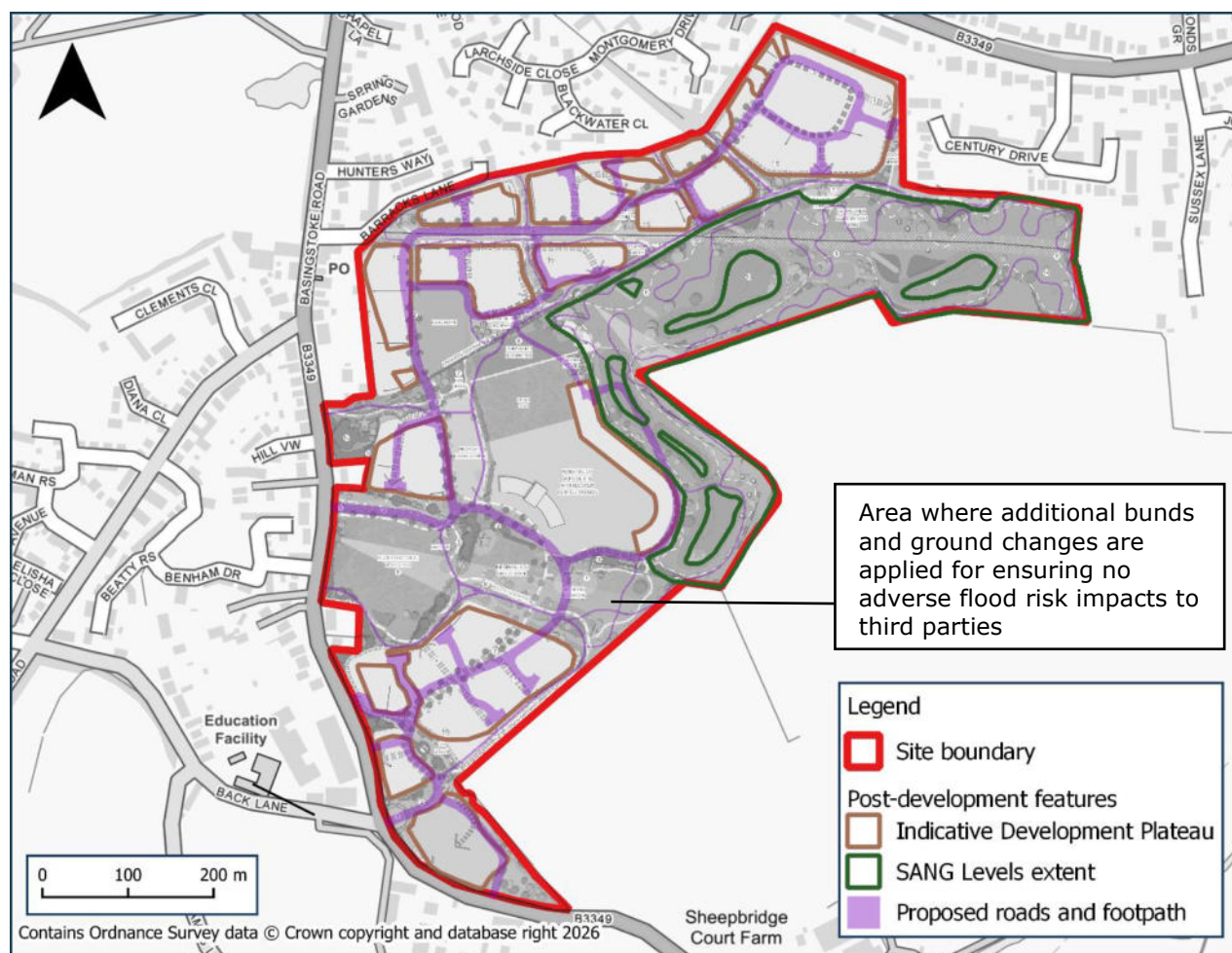


Figure 5-6: Post-Development model scenario

This post-development model scenario included the following model adjustments:

- Stamping in proposed levels – These have been extracted from the file provided by RACE (ref: *SW - PRELIM ENG - PROPOSED LEVELS 4-2-25 (to Prelim Eng Rev D).dwg*).
- Stamping in additional subtle bunds and ground alterations within the proposed levels to ensure no adverse flood risk impacts outside of the site boundary.
- Applying Suitable Alternative Natural Greenspace (SANG) levels (extent defined by Ecological Planning & Research Ltd) as provided by Race (ref: *PDS PROPOSED GM SANG 23_01_26_NO_PDS_DESIGN.dwg*)
- Raising the indicative development parcels above maximum flood levels – This was done to represent the FFLs being set above the design flood levels.

As the site layout has not yet reached detailed design stage, this approach has been applied to the whole of the development parcels. To prevent increasing flood risk to third party land, shallow flow paths were maintained by keeping existing ground levels outside of the development parcels. The development plateau approach to the model representation results in overestimating the degree of obstruction caused by proposed buildings and should be re-run once the detailed design is available. The proposed development will be refined at a later date to include detail of individual properties, the model can then be updated to only raise ground levels within the footprint of proposed buildings, reinstating shallow water flow paths between buildings

- Modelling proposed crossings as open channel – This is to represent all proposed crossings being clear span of the channel and set above the design flood level
- Blocking off rainfall directly to the site – It is assumed that rainfall on site will be managed by a site-specific surface water drainage strategy which is not explicitly represented within the model.

Note that the post-development model scenario representation detailed above does not represent a final design and is conservative in many attributes. The post-development model acts to demonstrate that a development layout is viable that ensures that the development is safe from flooding for its lifetime and also does not adversely impact the flood risk of others.

5.3.1 Post-development flood depths

The results of the post-development modelling for the 1% AEP with (+40%) climate change event shows that maximum flood depths within the site are typically <400mm (Figure 5-7).

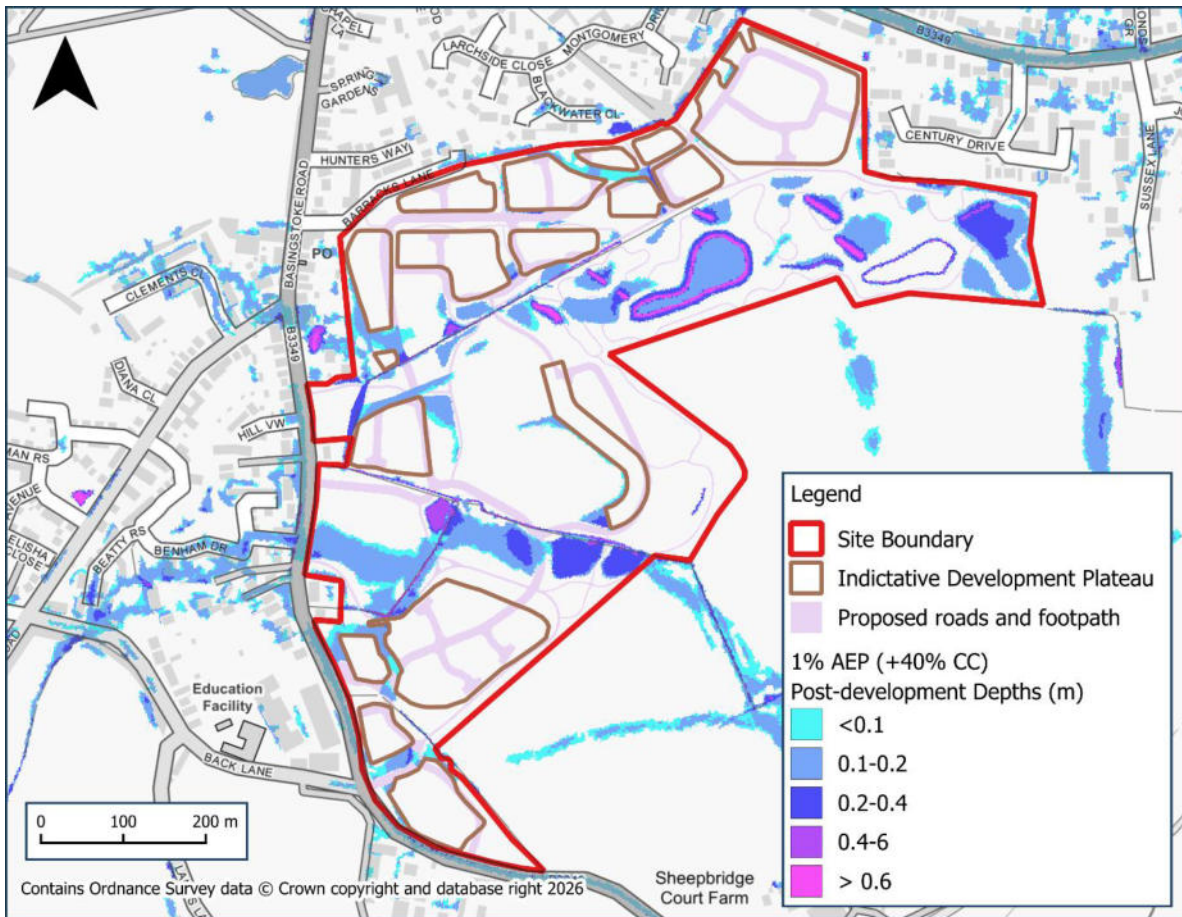


Figure 5-7: Post-development flood depths in the 1% AEP with (+40%) climate change event

5.3.2 Post-development flood levels

Maximum modelled flood levels within the site boundary during the post-development scenario for the 1% AEP with (+40%) climate change event ranged from 48.69m AOD east of the site to 57.2m AOD to the west of the site (Figure 5-8).

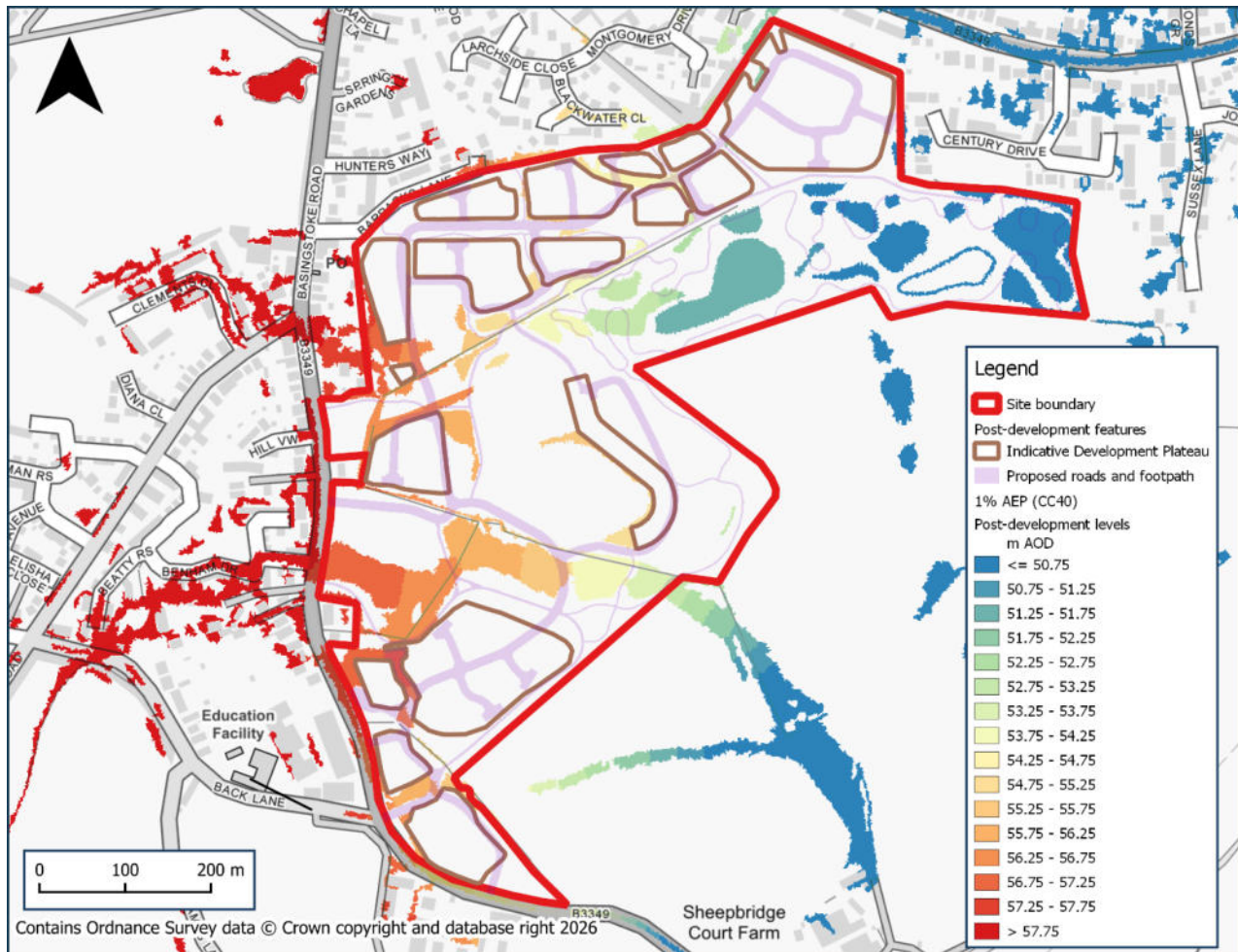


Figure 5-8: Post-development flood levels in the 1% AEP with (+40%) climate change event

5.3.3 Impact of post-development scenario on flood depth

The impact of the post-development model scenario on maximum flood depths has been assessed for the 1% AEP with (+40%) climate change event. The difference between baseline and the post-development maximum flood depths is shown in Figure 5-9.

Overall, there is no adverse flood risk impacts to third party land as a result of the proposed development. There is a reduction in flood depth to the east of the site and to the south of the site as a result of the proposed development. It is recommended that a further modelling scenario be carried out when the individual property footprint detail is known. However, the modelling provides a proof of concept that the development can be delivered without detriment to off-site flood risk.

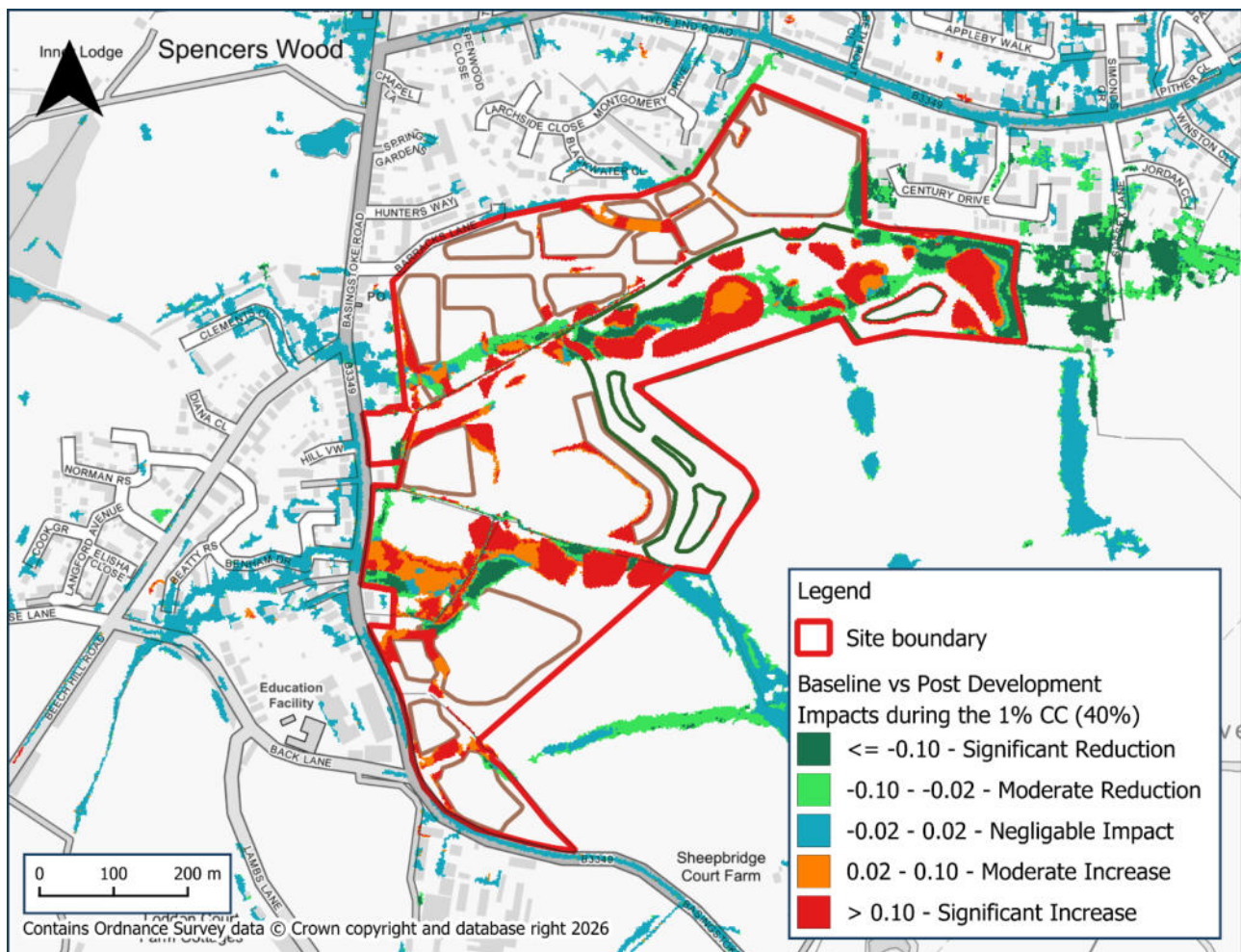


Figure 5-9: Depth comparison between baseline and post-development

5.3.4 Post-development flood hazard

The post-development scenario provides safe access and egress to the site during a 1% AEP with (+40%) climate change event (Figure 5-10).

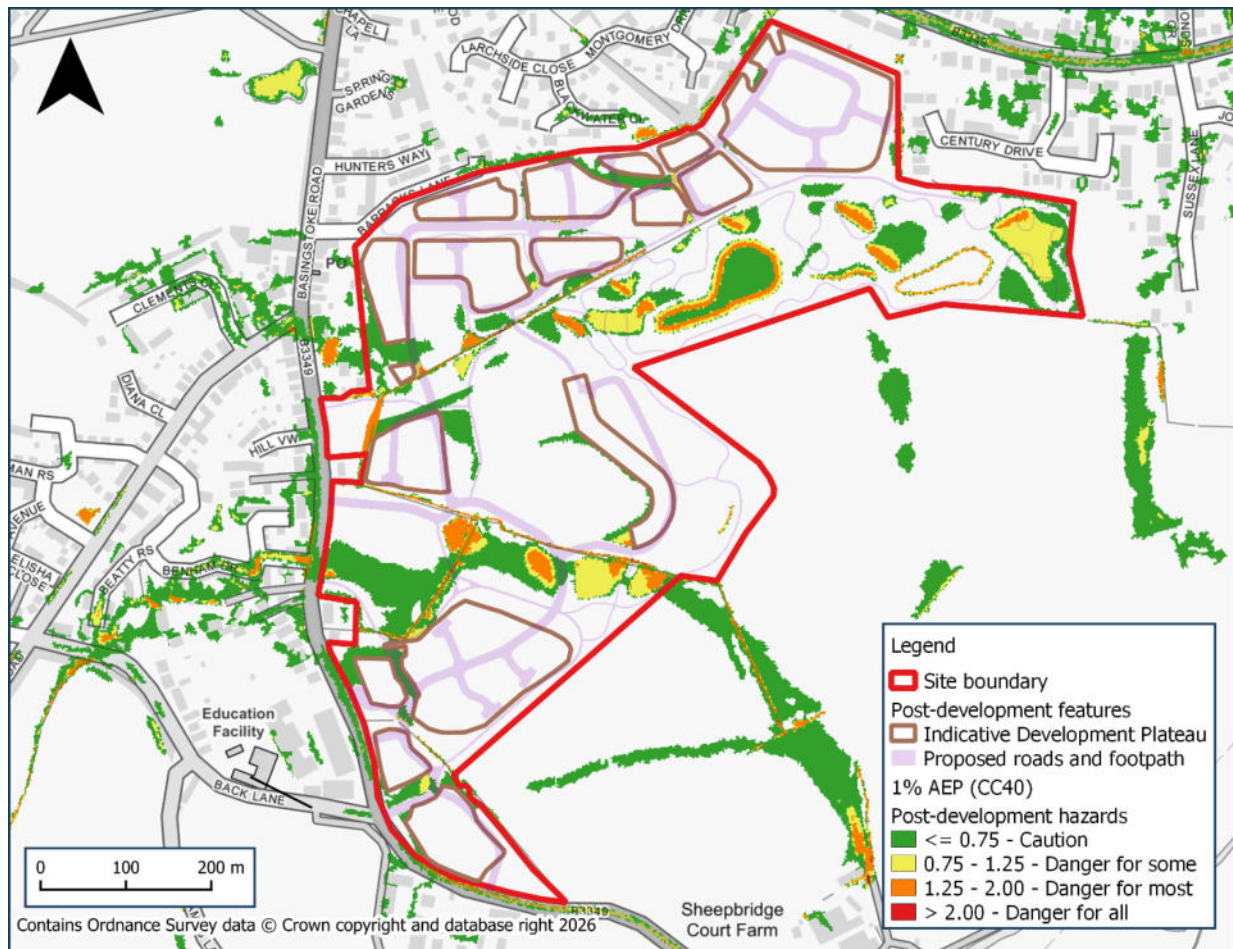


Figure 5-10: Post-development peak flood hazard in the 1% AEP with (+40%) climate change event

5.3.5 Impact of post-development scenario on flood hazard

The impact of the post-development model scenario on maximum flood hazard has been assessed for the 1% AEP with (+40%) climate change event. The difference between baseline and the post-development maximum flood depths is shown in Figure 5-11. This shows that the proposed development does not result in any adverse change to flood hazard outside of the site boundary.

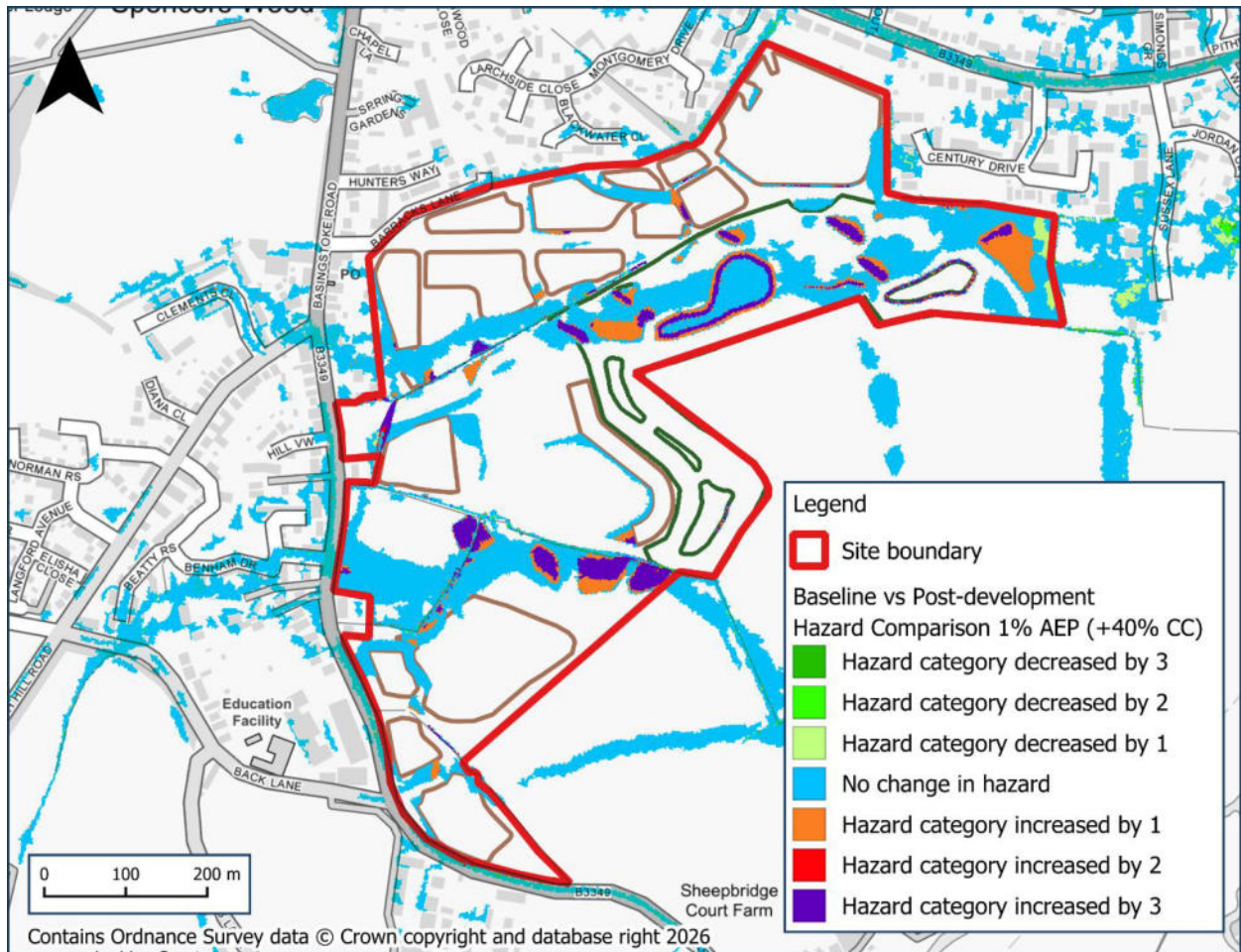


Figure 5-11: Hazard comparison between baseline and post-development

6 Model assumptions and uncertainties

6.1 General assumptions/uncertainties

The representation of any complex system by a model requires a number of assumptions to be made. In the case of the 1D elements of the model the following assumptions have been made:

- Model parameters used, such as roughness and structure coefficients, are representative of the general conditions.
- The units used to represent hydraulic structures within the model represent the situation accurately using the information available at the time of the study.
- A stable numerical solution can be achieved.
- The design hydrology accurately represents flows in the models given there was no flow / level data or historical flood data for the catchment available for calibration of flows in the surface water model.
- The watercourse and culverts around the site have been represented as un-silted using hard bed levels.

In terms of the 2D elements of the model the following assumptions have been made:

- The LIDAR and topographic survey are representative of the land surface and no errors have been introduced through filtering algorithms.
- Model parameters used, such as roughness, are representative of the general conditions.
- The losses applied to rainfall accurately represents the amount of runoff that is lost to infiltration and evaporation.

7 Summary and recommendations

7.1 Summary

- JBA Consulting were commissioned by Richborough Ltd to undertake a detailed hydraulic modelling study in relation to a site located off Basingstoke Road in Spencers Wood, Wokingham, RG7 1PW.
- The purpose of the study is to refine and accurately assess the pluvial flood risk to the site. To achieve this, a hydrological assessment was carried out to derive rainfall hyetographs and a 1D-2D InfoWorks-ICM direct runoff hydraulic model was produced to allow the detailed representation of flood depths, velocity and hazard within the site boundary.
- The model was simulated for the following Annual Exceedance Probability (AEP) events: 3.3%, 3.3% with (+35%) climate change, 1%, 1% with (+40%) climate change, and 0.1% storm, for the 60-minute critical (summer) storm duration.

The baseline model results indicate that:

- Flooding is predicted to occur within the site during all modelled design events.
- Flooding is predicted to occur within the site during the 3.3% AEP with (+35%) climate change and 1% AEP with (+40%) climate change events.
- Peak modelled flood depths of up to 0.31m are predicted to occur within the site during the 100-year (1% AEP) plus climate change event.
- Peak modelled flood levels are predicted to range between 57.3m AOD to the west and 48.93m AOD towards the eastern boundary of the site during the 100-year (1% AEP) plus climate change event.
- Hazard classification areas of 'caution' extend across the site, with areas of 'moderate' to 'extreme' located within the confines of the drainage ditches.
- Sensitivity testing of the model found that within the site boundary the model results are insensitive to changes in modelled roughness, and slightly sensitive to changes in the fixed runoff coefficient (runoff percentage) value.

The post-development model results indicate that:

- Raising the indicative development area above design flood levels, stamping in proposed road levels, modelling proposed crossings as open channel and blocking off rainfall directly to the site during the 1% AEP with (+40%) climate change event had no adverse impact on modelled flood depths and hazard outside of the site boundary.

7.2 Recommendations

The results of the hydraulic modelling can be used to inform the Flood Risk Assessment for the site. However, it is recommended that the hydraulic modelling is reviewed and validated by the Lead Local Flood Authority, ideally before developing a masterplan or submitting a planning application.

It is recommended that the post-development scenario of the model is re-run once a final layout has been agreed at detailed design stage. It is recommended that the final levels be re-simulated in the hydraulic model to understand the impact on flood levels and flood hazard within and outside of the site, along with the incorporation of a site surface water drainage strategy.

The model results have been prepared for the purpose of quantifying surface water flood risk at the site and surrounding area. If the results are intended to be used for surface water flood risk mapping of the wider catchment, further model refinement is recommended. Additionally, if further data is made available it is recommended that the model is updated to improve the representation of surface water flood risk parameters.

Appendices

A Culvert Survey

CULVERT INFORMATION SURVEY REPORT

SPENCERS WOOD

DATE: 13/03/2024

PREPARED BY: MARCIN SAWICKI

Contents

1. Survey Brief
2. Culvert Locations
3. Culvert Information

1 Survey Brief

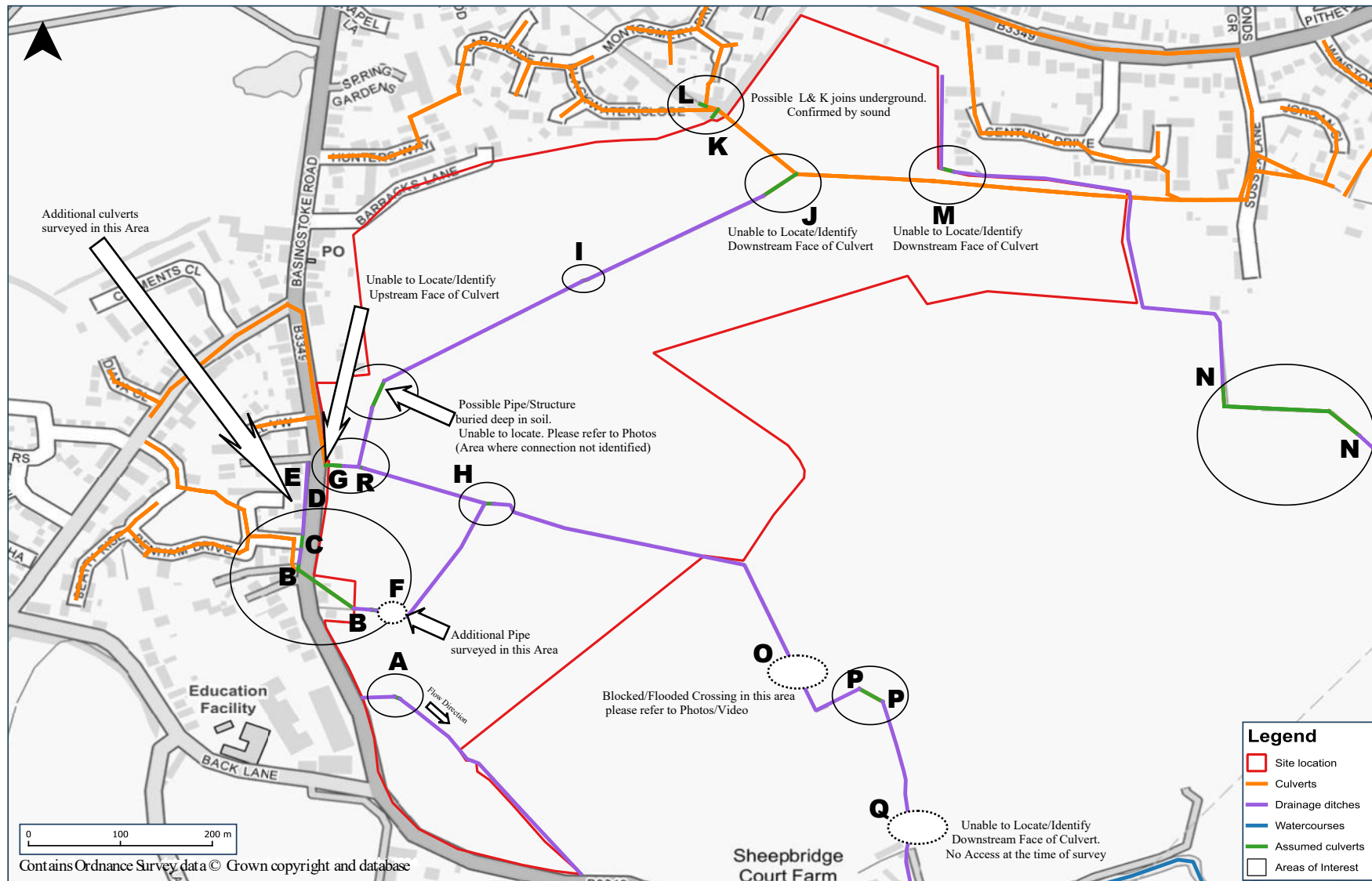
To survey at upstream and downstream ends of culverts

- Inverts
- Width/height
- Shape
- Where culverts are short, info can be limited to US end only with length
- Photos of Culvert (Multiple photos in each Culvert photo folder)
- Coordinates of I culvert locations/inverts supplied as XYZ file.

The survey was carried out between the 11^h and 12^h March 2024.

2 Culvert Locations

Land - Engineering - Building Surveyors



Culvert A



Culvert Length 5m.
Upstream Face Circular
Pipe dia.300mm
Soffit Level 55.97
Invert Level 55.67
Invert Position-
E471553.769, N165767.101

Downstream Face
Circular Pipe dia.300mm
Soffit Level 55.89
Invert Level 55.59
Invert Position-
E471558.388, N165765.305

Culvert B



Culvert Length Approx. 74m
Upstream Face Circular
Pipe dia.380mm
Soffit Level 57.09
Invert Level 56.69
Invert Position-
E471449.476, N165919.324



Downstream Face Circular
Pipe dia.450mm
Soffit Level 56.39
Invert Level 55.95
Invert Position-
E471507.790, N165873.420

Culvert C



Culvert Length 9m.
Upstream Face Circular
Pipe dia.450mm
Soffit Level 57.31
Invert Level 56.84
Invert Position-
E471450.257, N165930.538



Downstream Face Circular
Pipe dia.450mm
Soffit Level 57.23
Invert Level 56.78
Invert Position-
E471449.387, N165921.524

Culvert D



Culvert Length 18m.
Upstream Face Circular
Pipe dia.500mm
Soffit Level 57.16
Invert Level 56.64
Invert Position-
E471456.357, N165965.341



Downstream Face Circular
Pipe dia.500mm
Soffit Level 56.97
Invert Level 56.46
Invert Position-
E471452.774, N165947.366

Culvert E



Culvert 4m.
Upstream Face Circular
Pipe dia.approx.450mm
Soffit Level 57.12
Invert Level approx. 56.67
Invert Position-approx.
E471460.952, N166004.623



Downstream Face Circular
Pipe dia.approx.450mm
Soffit Level 57.14
Invert Level 56.69
Invert Position-
E471460.638, N166000.523

Culvert F



Culvert 4m.
Upstream Face Deformed
Pipe dia.600mm
Soffit Level 56.46
Invert Level 55.95
Invert Position-
E471528.458, N165871.900



Downstream Face Circular
Pipe dia.600mm
No further Information

Culvert G



Culvert Length Unknown
Upstream Face Circular
Pipe dia.520mm
Soffit Level 56.56
Invert Level 56.04
Invert Position-
E471493.720, N166046.767

Unable to locate Upstream Face of the Culvert

Culvert H



Culvert Length 5m.
Upstream Face Circular
Pipe dia.300mm
Soffit Level 55.26
Invert Level 54.95
Invert Position-
E471655.772, N166003.799



Downstream Face Circular
Pipe dia.300mm
No further Information

Culvert I



Culvert 4.4m.
Upstream Face Circular
Pipe dia.300mm
Soffit Level 53.48
Invert Level 53.21
Invert Position-
E471758.470, N166266.516



Downstream Face Circular
Pipe dia.300mm
No Further Information

Culvert J



Culvert Length Unknown
Upstream Face of
Stone Headwall
Soffit Level 51.30
Invert Level approx. 51.04
Pole refusal
Invert Position-
E471953.232, N166371.357
Uneven opening
in the Stone Headwall.
Dimensions: 254mm Wide
255mm Height
Unable to locate/identify
pipe within structure

Unable to locate/identify Downstream Face of structure.

Culvert K



Culvert Length Unknown.
Upstream Face Circular
Pipe approx. dia.500mm
Soffit Level N/A-no access
Invert Level 51.78
Invert Position-
E471899.977, N166466.283

Unable to locate/identify Downstream Face of structure. Pipe likely join with Pipe "L" underground.
Confirmed by Sound

Culvert L



Culvert Length Unknown.
Upstream Face Circular
Pipe dia.300mm
Soffit Level 52.72
Invert Level 52.41
Invert Position-
E471887.699, N166479.696

Unable to locate/identify Downstream Face of structure. Pipe likely join with Pipe "K" underground.
Confirmed by sound

Culvert M



Culvert Length Unknown.
Upstream Face Circular
Pipe dia.360mm
Soffit Level 49.42
Invert Level 49.04
Invert Position-
E472148.602, N166403.391

Culvert N



Culvert Length approx.190m.
Upstream Face Circular
Pipe dia.300mm
Soffit Level 47.57
Invert Level 47.25
Invert Position-
E472456.273, N166143.100



Downstream Face
Possible Pipe dia.300mm
(unable to Confirm
/Debris in channel)
Soffit Level 46.04
Invert Level approx.45.75
Invert Position-
E472624.666, N166059.696

Culvert 0



Crossing Length Approx. 6m.
Upstream Face
Completely Submerged
Unable to Identify Opening.
Bottom of the ditch 48.78
Approx. Position
E472001.015, N165776.662



Downstream Face
Damaged Headwall
Unable to Identify Pipe
Under Stone Level 48.91
Bottom of ditch 48.28
Approx. Position-
E472003.554, N165771.491

Culvert P



Culvert Length 28m.
Upstream Face Circular
Pipe dia.450mm
Soffit Level 48.40
Invert Level Approx. 47.95
Invert Position-
E472060.547, N165778.343



Downstream Face Circular
Pipe dia.approx.450mm
Soffit Level approx. 48.23
Invert Level approx. 47.78
Invert Position-approx.
E472084.580, N165764.263

Culvert Q



Culvert Length Unknown.
Upstream Face Circular
Pipe dia. 450mm
Soffit Level N/A
Invert Level N/A
Position- N/A

Unable to Locate Downstream Face of Culvert. No Access at the time of Survey.
Pipe dia. measured with tape on site

Culvert R



Culvert 5.5m.
Upstream Face Circular
Pipe dia.approx.450mm
Soffit Level approx 56.38
Invert Level 55.93
Invert Position-approx.
E471513.393, N166042.539



Downstream Face Circular
Pipe dia.approx.450mm
Soffit Level approx. 56.38
Invert Level 55.93
Invert Position-
E471518.830, N166042.181

B Topographic Survey

B.1 Topographic Survey data

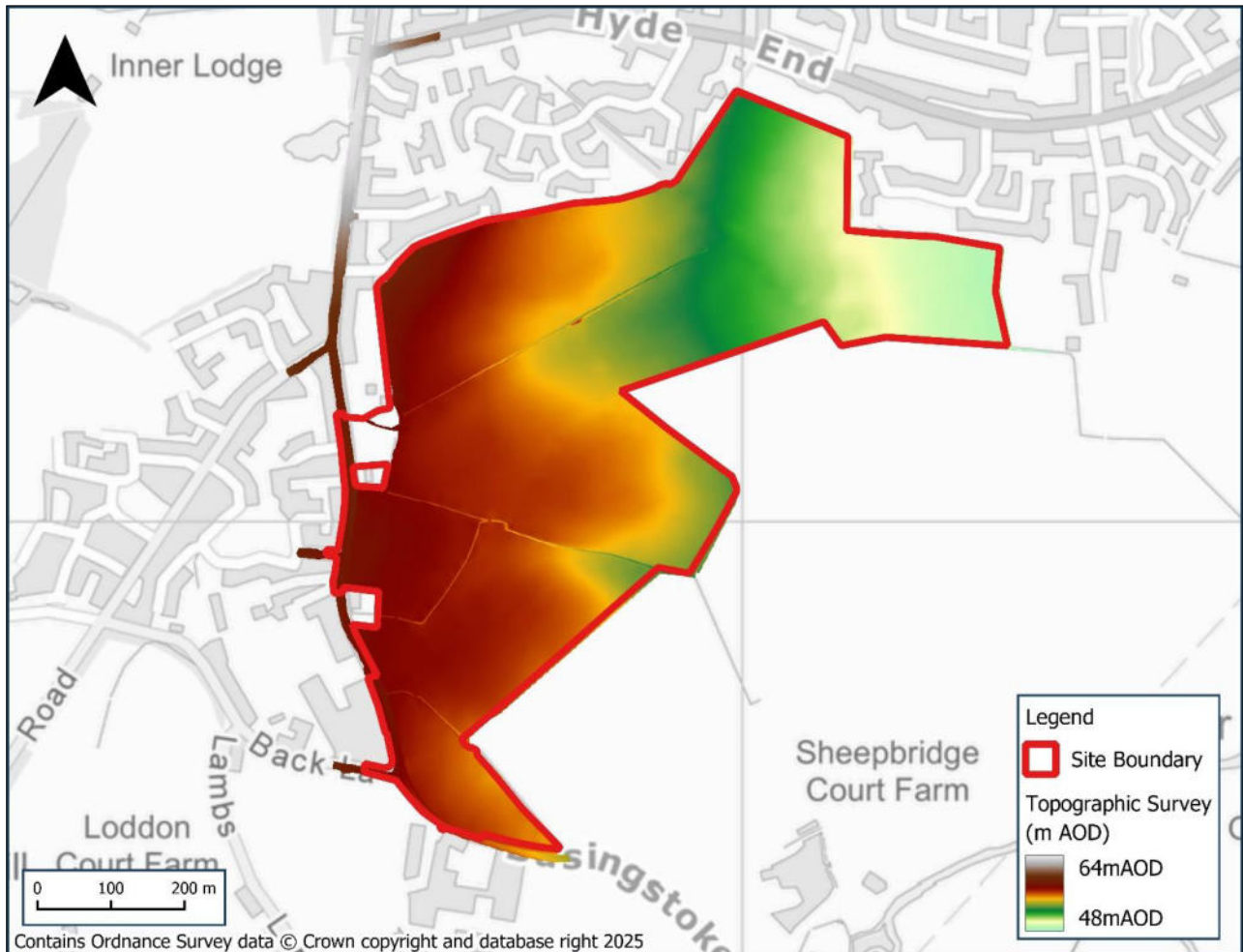


Figure B- 1: Topographic Survey

B.2 Quality assessment

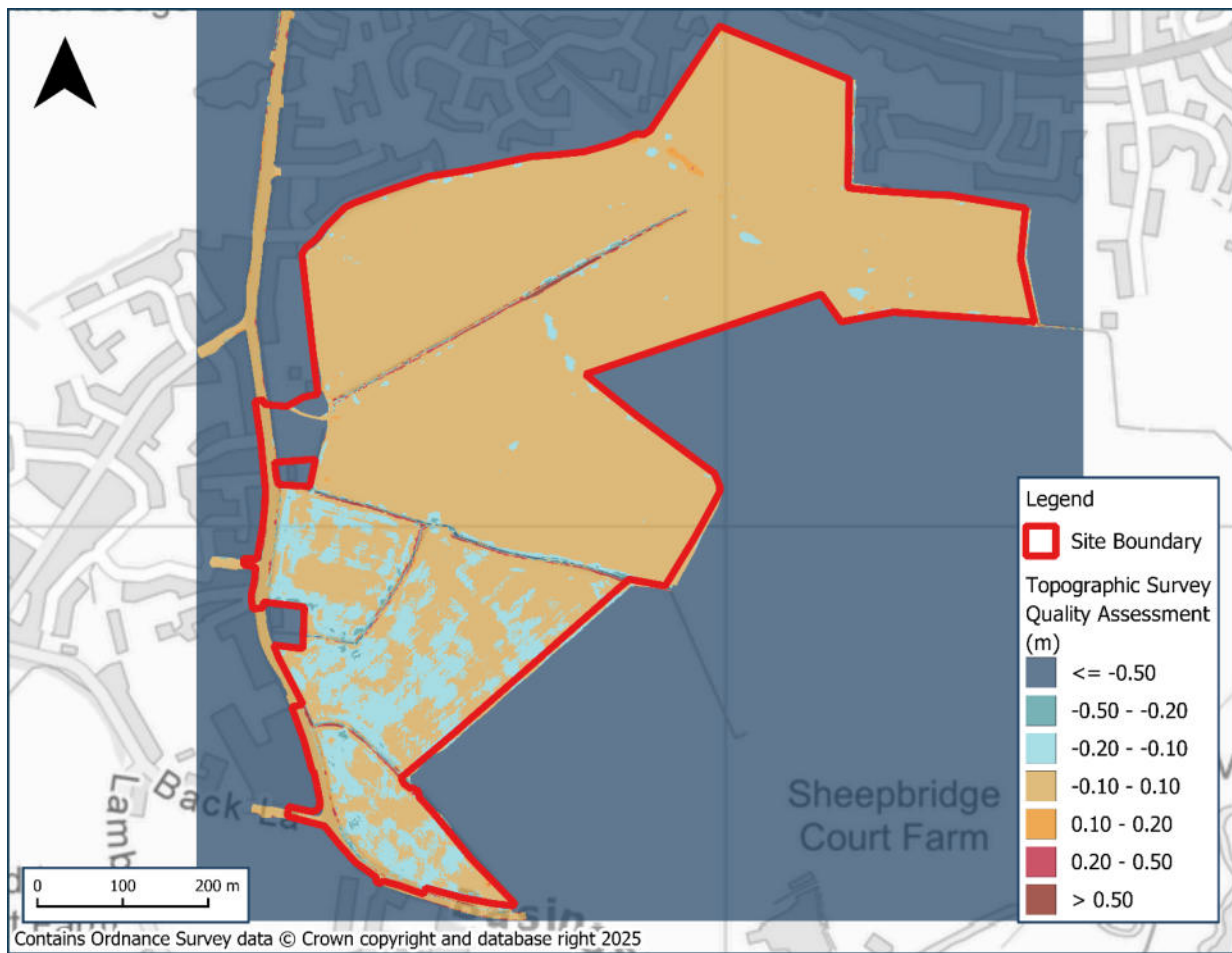


Figure B- 2: Topographic Survey Quality Assessment

C Thames Water sewer maps

Asset location search



Property Searches

Subtechnics Ltd
Technics House
Merrow Lane
GUILDFORD
GU4 7WA

Search address supplied

Land at
Basingstoke Road
Spencers Wood
Reading
Berkshire
RG7 1PR

Your reference

SP231602

Our reference

ALS/ALS Standard/2023_4898169

Search date

18 October 2023

Notification of Price Changes

From 1st April 2023 Thames water Property Searches will be increasing the prices of its CON29DW, CommercialDW Drainage & Water Enquiries and Asset Location Searches. Historically costs would rise in line with RPI but as this currently sits at 14.2%, we are capping it at 10%.

Customers will be emailed with the new prices by January 1st 2023.

Any orders received with a higher payment prior to the 1st April 2023 will be non-refundable. For further details on the price increase please visit our website at www.thameswater-propertysearches.co.uk



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



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



0800 009 4540

Search address supplied: Land at, Basingstoke Road, Spencers Wood, Reading, Berkshire, RG7 1PR

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 0800 009 4540, 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

Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have been printed as they fall within Thames' sewerage area:

SU7165NW
SU7166SW
SU7165NE
SU7166SE
SU7166NE
SU7266SW
SU7266NW

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.

The following quartiles have been printed as they fall within Thames' water area:

SU7165NW
SU7166SW
SU7165NE
SU7166SE
SU7166NE
SU7266SW
SU7266NW

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

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

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

Payment for this Search

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

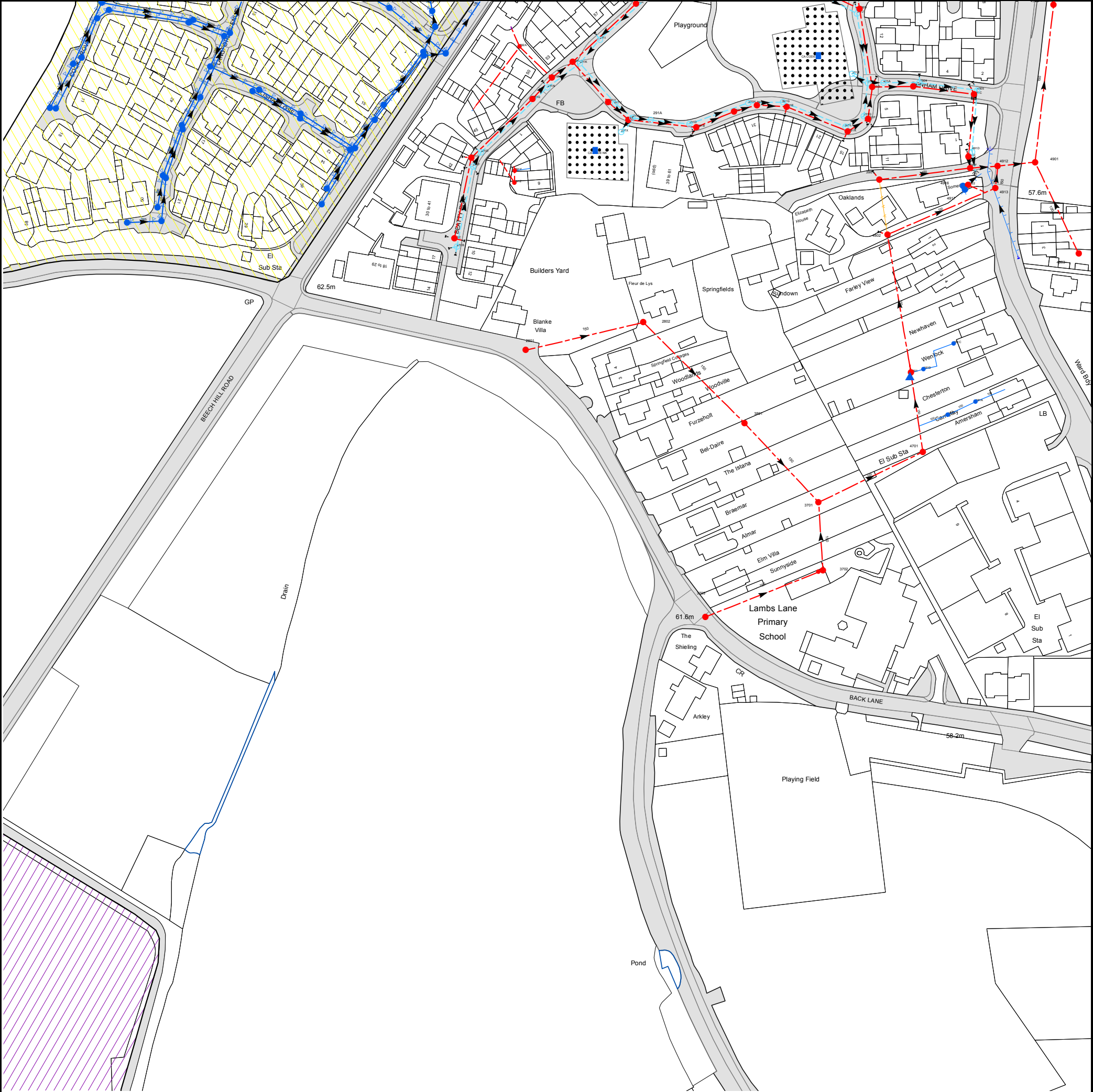
Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

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



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 471250,165750

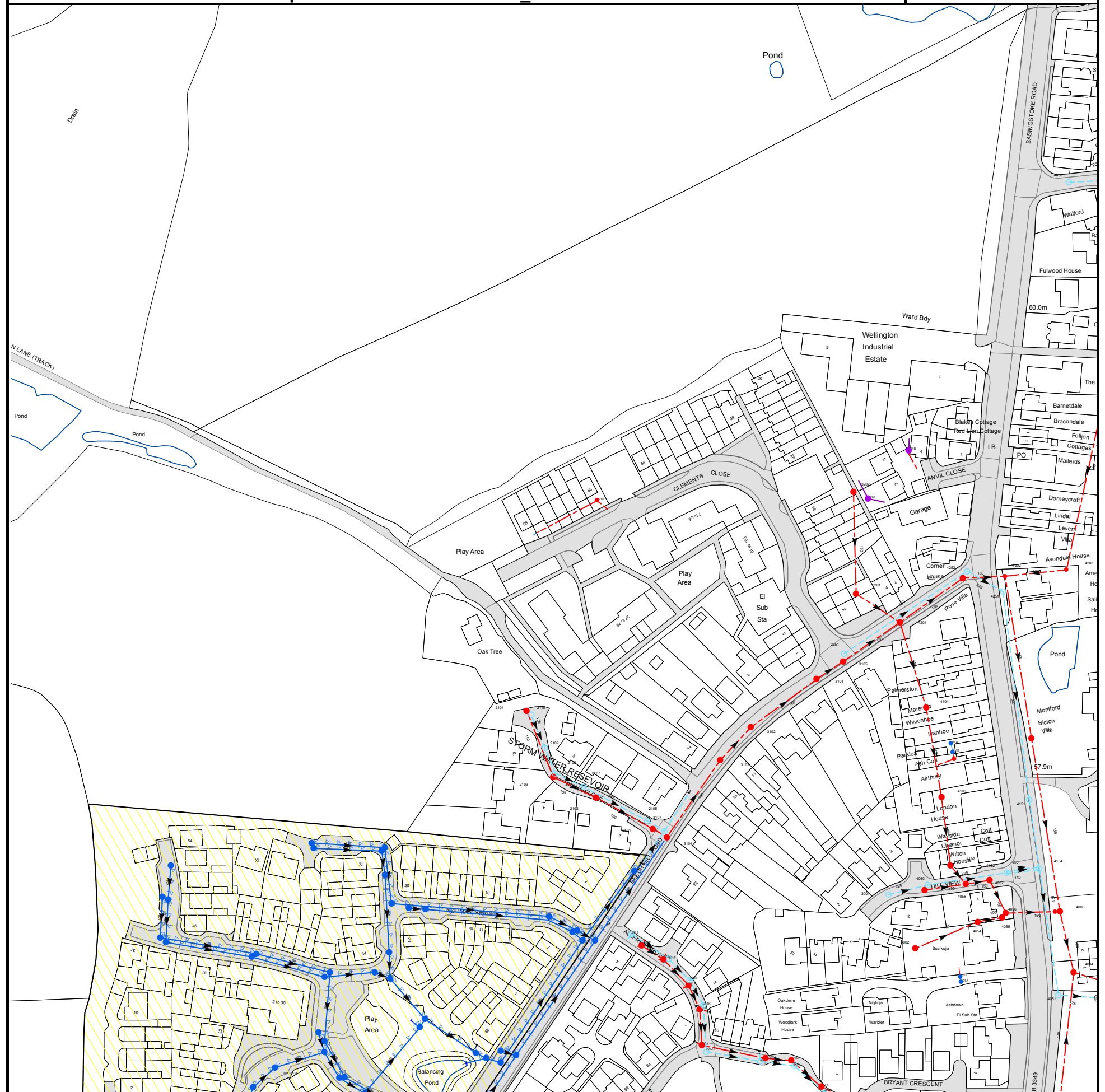
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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

[illegible]

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4916	57.8	57.11
4922	57.8	57.05
3901	58.11	55.98
491F	57.9	55.68
4912	57.619	55.629
4901	n/a	n/a
491E	57.84	55.94
491D	57.85	56.74
391K	58.1	56.64
391B	58.75	57.16
391L	58.13	57.14
391P	58.02	56.57
391Q	58.04	57.09
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.		



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 471250,166250

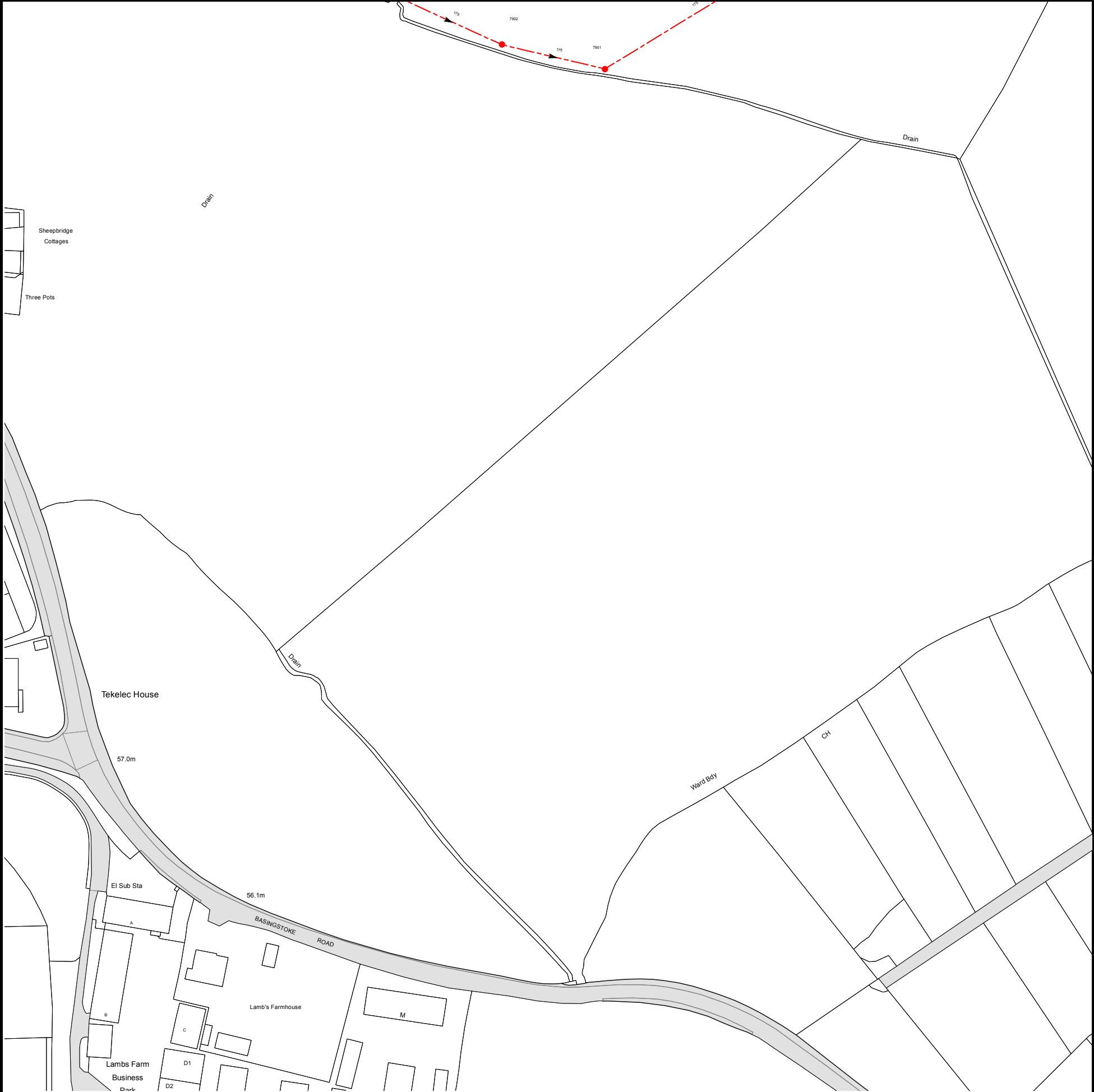
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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

[illegible]

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4051	58.09	56.08
401A	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
301M	59.68	58.13
301A	60.12	58.46
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.		



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 471750,165750

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.

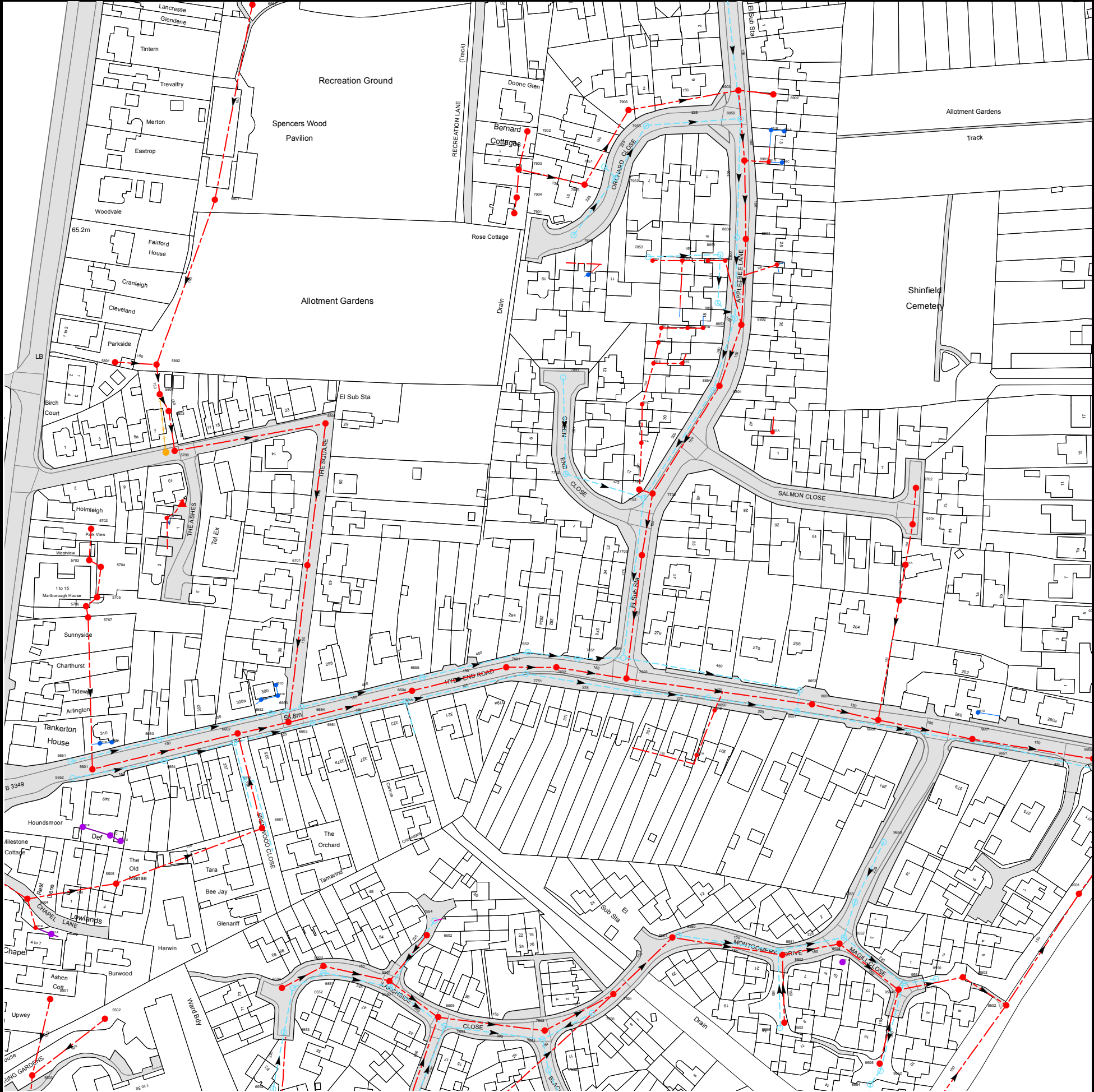
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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7901 7902	54.92 n/a	52.76 n/a
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
6453	n/a	n/a
641A	n/a	n/a
6405	56.76	55.07
6452	56.74	55.26
7401	55.75	54.33
6401	59.52	57.79
5452	58.99	58.18
6403	57.12	55.72
9453	n/a	n/a
6404	57.06	55.49
6402	57.78	56.01
5451	59.73	58.04
7450	55.19	53.59
7402	55.14	53.86
8453	54.34	52
7452	54.79	52.44
9451	52.82	50.97
8402	53.95	52.24
8401	54.36	52.93
7404	54.78	53.26
9401	53.15	51.75
8451	53.41	51.15
7451	54.98	52.62
7403	54.99	53.44
6451	n/a	n/a
5454	60	58.8
5402	60.19	58.71
5403	60.84	58.79
5404	60.73	58.83
5405	60.95	59
5301	58.3	57.11
5401	60	58.58
5453	59.53	58.51
6001	55.99	53.43
8001	n/a	n/a
5001	n/a	n/a
9001	53.33	50.97
9351	n/a	n/a
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.		



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 471750,166750

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.

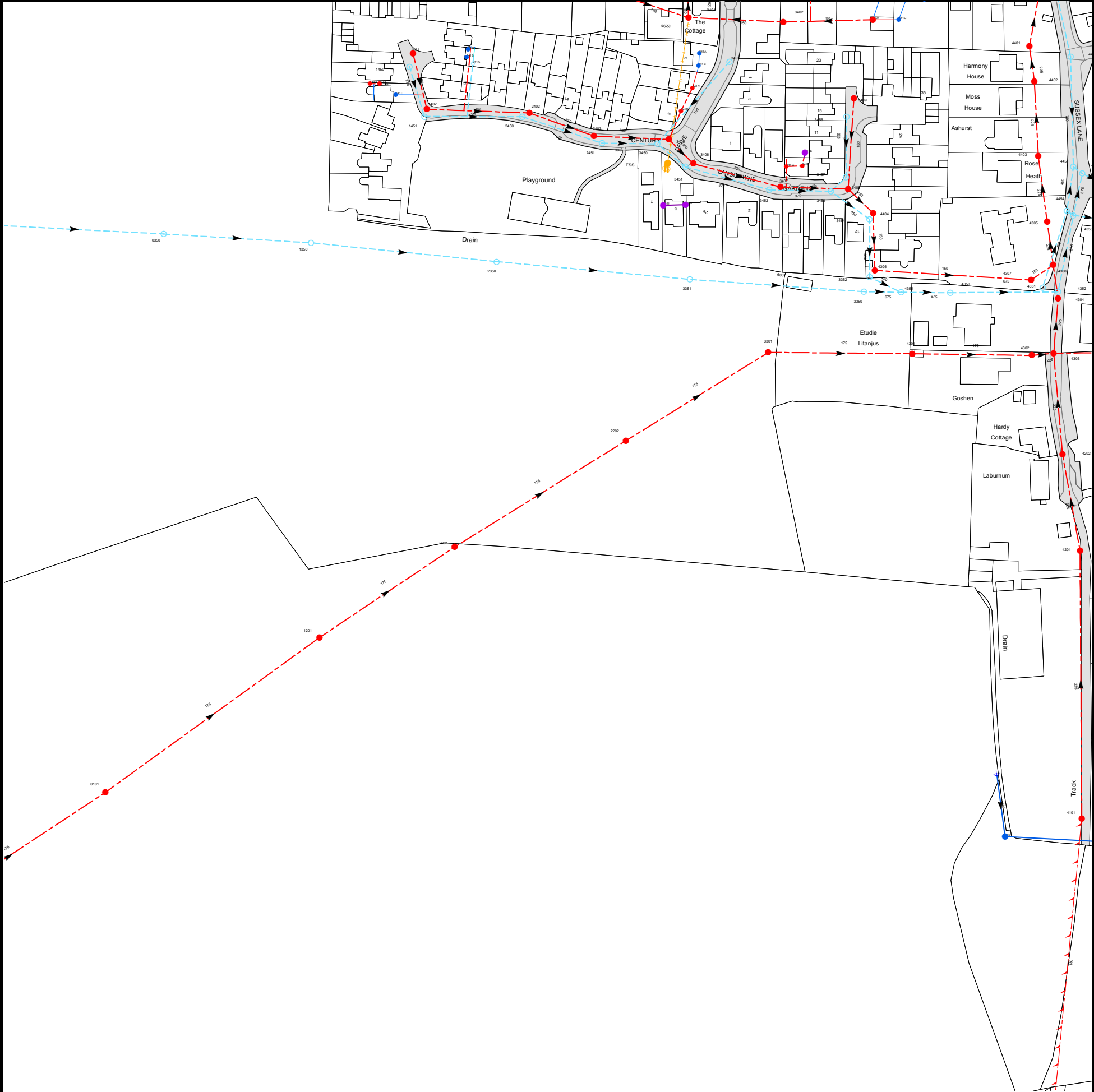
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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
5901	n/a	n/a
6901	64.47	63.31
7901	60.4	59.65
7904	60.61	59.5
7903	60.61	59.3
7902	60.67	59.73
7852	59.71	58.78
7905	59.93	58.67
781A	n/a	n/a
7951	59.57	58.64
7952	59.32	58.12
7906	59.44	57.84
7953	59.01	57.64
7853	58.65	57.71
7801	58.78	57.3
881G	n/a	n/a
881H	n/a	n/a
8851	57.9	57.14
8804	57.44	55.94
8850	57.43	56.61
8903	58.11	56.47
8950	57.99	57.05
8901	57.77	56.12
8803	57.44	55.8
891D	n/a	n/a
891B	n/a	n/a
8902	57.61	56.74
881I	n/a	n/a
891C	n/a	n/a
891A	n/a	n/a
5703	62.47	61.06
5702	62.57	61.32
5705	62.14	60.79
5704	62.27	60.94
5801	63.69	61.87
771A	n/a	n/a
7703	56.52	54.5
781C	n/a	n/a
7753	56.81	55.64
7702	56.7	54.77
781B	n/a	n/a
881F	n/a	n/a
881D	n/a	n/a
881E	n/a	n/a
881C	n/a	n/a
881B	n/a	n/a
8650	55.3	54.29
8854	56.9	56.13
861B	n/a	n/a
8852	57.76	56.74
8801	56.92	55.13
8853	57.14	56.33
8802	57.1	55.4
881A	n/a	n/a
8651	54.51	53.33
8652	54.46	53.65
8601	54.28	52.59
971B	n/a	n/a
971A	n/a	n/a
9701	54.06	52.71
9702	54.18	52.92
961A	n/a	n/a
5802	63.44	61.58
5804	n/a	61.41
571A	n/a	n/a
5803	n/a	61.23
5708	n/a	60.9
661F	n/a	n/a
6652	59.03	58
661D	n/a	n/a
661E	n/a	n/a
6653	58.89	57.96
6654	58.71	57.71
6701	59.81	58.26
6801	61.33	59.72
661A	n/a	n/a
6604	57.88	56.23
6655	58.03	56.93
7601	57.11	55.56
7652	56.87	55.8
7751	57.01	56.15
7602	56.53	54.88
7851	58.89	57.41
7752	57.95	56.41
7651	56.56	55.45
7654	56.04	54.97
7603	55.92	53.87
7653	55.84	54.78
7701	57.13	55.11
7552	55.39	53.04

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7550	55.51	53.94
7501	55.38	53.23
8501	55	52.8
8550	54.95	53.57
861A	n/a	n/a
8551	54.14	52.32
8555	53.94	52.62
8502	54.15	52.13
8503	53.89	52.59
8504	53.66	51.78
851A	n/a	n/a
8552	53.6	51.92
8553	53.52	51.96
8554	53.55	51.33
8602	53.75	52.08
9505	53.29	51.87
9552	53.4	51.39
9650	53.37	52.12
9504	53.27	51.26
9551	53.26	51.55
9550	53	51.83
9503	52.75	51.02
9601	52.97	51.39
9651	52.91	51.92
9502	52.29	50.82
9501	52.11	50.26
9602	n/a	n/a
5653	60.03	59.1
5654	59.98	59.34
661C	n/a	n/a
6602	59.22	57.46
661B	n/a	n/a
6601	59.38	57.78
6554	n/a	n/a
6504	58.61	56.74
6553	58.66	57.24
6603	58.78	57.07
6552	58.68	56.67
6651	58.64	57.76
6551	58.52	56.44
6503	58.5	56.45
6501	57.59	55.2
6550	57.57	55.73
6502	57.31	55.51
7554	57.07	55.93
6505	56.71	54.45
7553	56.62	55.03
7551	55.7	53.42
7502	55.75	53.9
5503	61.35	59.54
5502	n/a	n/a
5501	61.84	60.83
551A	n/a	n/a
551B	n/a	n/a
5504	61.85	60.41
5505	n/a	n/a
561D	n/a	n/a
561C	n/a	n/a
561E	n/a	n/a
5652	60.99	60.41
5601	60.9	59.29
5651	60.67	59.76
561B	n/a	n/a
561A	n/a	n/a
5707	61.62	60.58
5706	62.08	60.7

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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 472250,166250

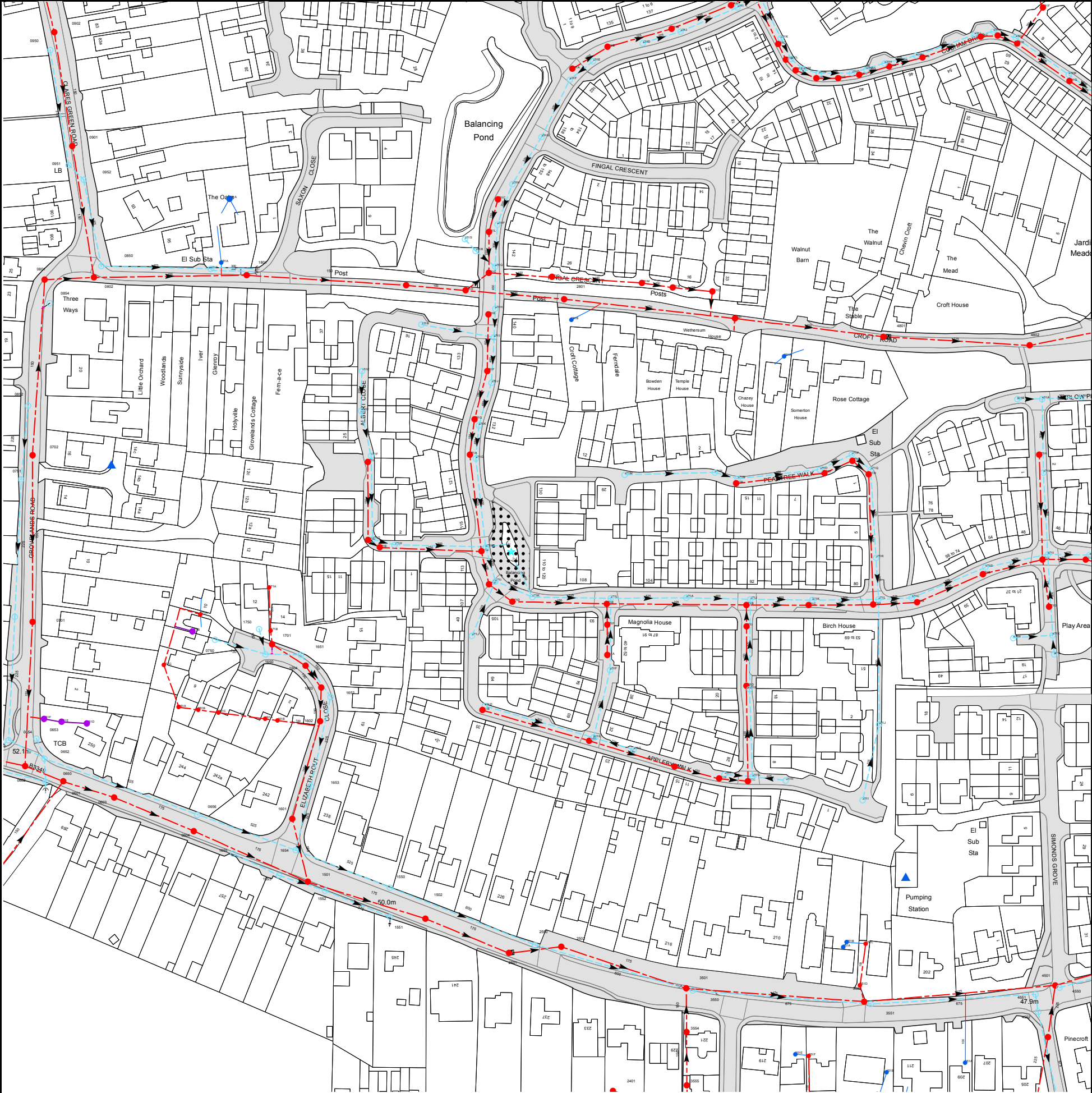
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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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
3409	n/a	n/a
3455	48.8	47.61
341A	n/a	n/a
3402	48.6	47.54
3401	48.71	47.86
441C	n/a	n/a
441B	n/a	n/a
1402	49.84	48.78
341C	n/a	n/a
341B	n/a	n/a
241A	n/a	n/a
241B	n/a	n/a
241C	n/a	n/a
3404	49.32	47.25
4403	48.17	46.19
4402	48.24	46.04
4452	n/a	n/a
4401	48.3	45.93
441A	n/a	n/a
3301	48.83	47.48
3452	n/a	37.22
3407	48.59	47.62
341G	n/a	n/a
341F	n/a	n/a
341E	n/a	n/a
3453	48.41	47.13
3457	n/a	n/a
3456	n/a	n/a
3408	48.41	47.44
3350	48.35	46.85
3454	48.5	47.01
3352	n/a	46.6
4404	48.41	47.34
4306	48.5	47.16
4355	48.31	46.81
1451	49.84	48.22
2201	50.03	48.69
2350	n/a	n/a
2450	49.23	47.9
2402	49.23	48.48
2403	49.29	48.26
2451	n/a	47.7
2202	n/a	n/a
3450	49.27	47.5
341I	n/a	n/a
3405	49.25	47.99
341D	n/a	n/a
3451	49.26	37.38
341J	n/a	n/a
3351	n/a	n/a
3406	49.26	47.9
0101	n/a	n/a
1201	50.86	49.25
1350	n/a	n/a
0350	n/a	n/a
141C	n/a	n/a
141B	n/a	n/a
141A	n/a	n/a
1450	49.9	48.33
1401	49.92	48.94
4151	48.73	46.77
4101	49.13	47.92
4201	48.53	47.31
4202	48.29	46.96
4302	48.52	46.71
4301	48.39	n/a
4303	48.2	46.65
4304	48.09	46.53
4350	48.29	46.59
4352	48.09	46.23
4351	47.98	47
4307	48.2	46.6
4308	48.1	46.57
4305	48.04	46.3
4353	47.95	46.09
4454	47.98	46.41
4450	48.02	45.77
4451	48.04	45.84

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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 472250,166750

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.

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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
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
4802	47.666	46.126
4801	48.198	46.528
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
0752	52.44	51.65
0751	52.41	51.57
0852	52.51	51.71
0702	52.23	51.02
0701	52.25	50.46
0854	52.45	51.49
071A	n/a	n/a
171A	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
1802	50.12	48.62
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
281C	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
281D	n/a	n/a
2801	49.44	47.89
281B	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
3801	48.71	46.99
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
381A	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
061F	n/a	n/a
061G	n/a	n/a
061A	n/a	n/a
061B	n/a	n/a
0750	51.48	50.46
061C	n/a	n/a
1750	n/a	n/a
161A	n/a	n/a
1650	50.77	50.17
171B	n/a	n/a
1701	50.8	50.35

Manhole Reference	Manhole Cover Level	Manhole Invert Level
161B	n/a	n/a
1651	50.79	49.96
1604	50.79	50.07
1603	50.74	49.91
1652	50.76	49.77
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
451B	n/a	n/a
351F	n/a	n/a
351E	n/a	n/a
3551	48.56	46.92
3502	48.59	46.33
351D	n/a	n/a
351A	n/a	n/a
351C	n/a	n/a
351B	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
2401	49.18	48.13
3555	n/a	n/a
3554	n/a	n/a
3550	48.96	47.26
3501	48.99	46.97
2501	49.46	47.69
2502	49.38	47.54
2550	49.5	47.9
1502	49.84	48.16
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
451A	n/a	n/a
4556	n/a	n/a
4552	48.22	46.52
4551	48.19	46.52
4550	48.11	47.11
4501	48.43	45.59
1551	n/a	n/a
1552	50.45	49.54
1550	50.12	48.59
1501	50.56	48.7
1553	50.61	49.82
1655	50.82	50.04
1654	50.49	49.14
0604	50.98	49.2
1601	50.61	49.08
0656	51.11	49.54
0603	51.41	49.58
1653	50.7	49.35
0601	51.74	49.77
0650	51.8	50.92
0602	51.94	49.94
0652	51.89	50.46
0654	52.11	50.83
0653	52.08	50.98
061D	n/a	n/a
061E	n/a	n/a
1602	50.78	49.68
0801	52.32	50.34
0950	53.03	52.12
0902	53.04	51.58
0951	52.48	51.78
0901	52.49	50.84
0952	52.36	51.41
0802	51.86	49.7
0850	52.21	51.33
081A	n/a	n/a
181A	n/a	n/a
191A	n/a	n/a
1801	51.03	49.44
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Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

	Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
	Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	Storm Sewer
	Sludge Sewer
	Foul Trunk Sewer
	Surface Trunk Sewer
	Combined Trunk Sewer
	Foul Rising Main
	Surface Water Rising Main
	Combined Rising Main
	Vacuum
	Thames Water Proposed
	Vent Pipe
	Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

	Sewer
	Culverted Watercourse
	Proposed
	Decommissioned Sewer
	Content of this drainage network is currently unknown
	Ownership of this drainage network is currently unknown

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plan are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

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		Meter
	Dam Chase		Vent
	Fitting		

Operational Controls

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

	Ancillary		Drop Pipe
	Control Valve		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.

	Inlet		Outfall
	Undefined End		

Other Symbols

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

	Change of Characteristic Indicator		Public / Private Pumping Station
	Invert Level		Summit

Areas

Lines denoting areas of underground surveys, etc.

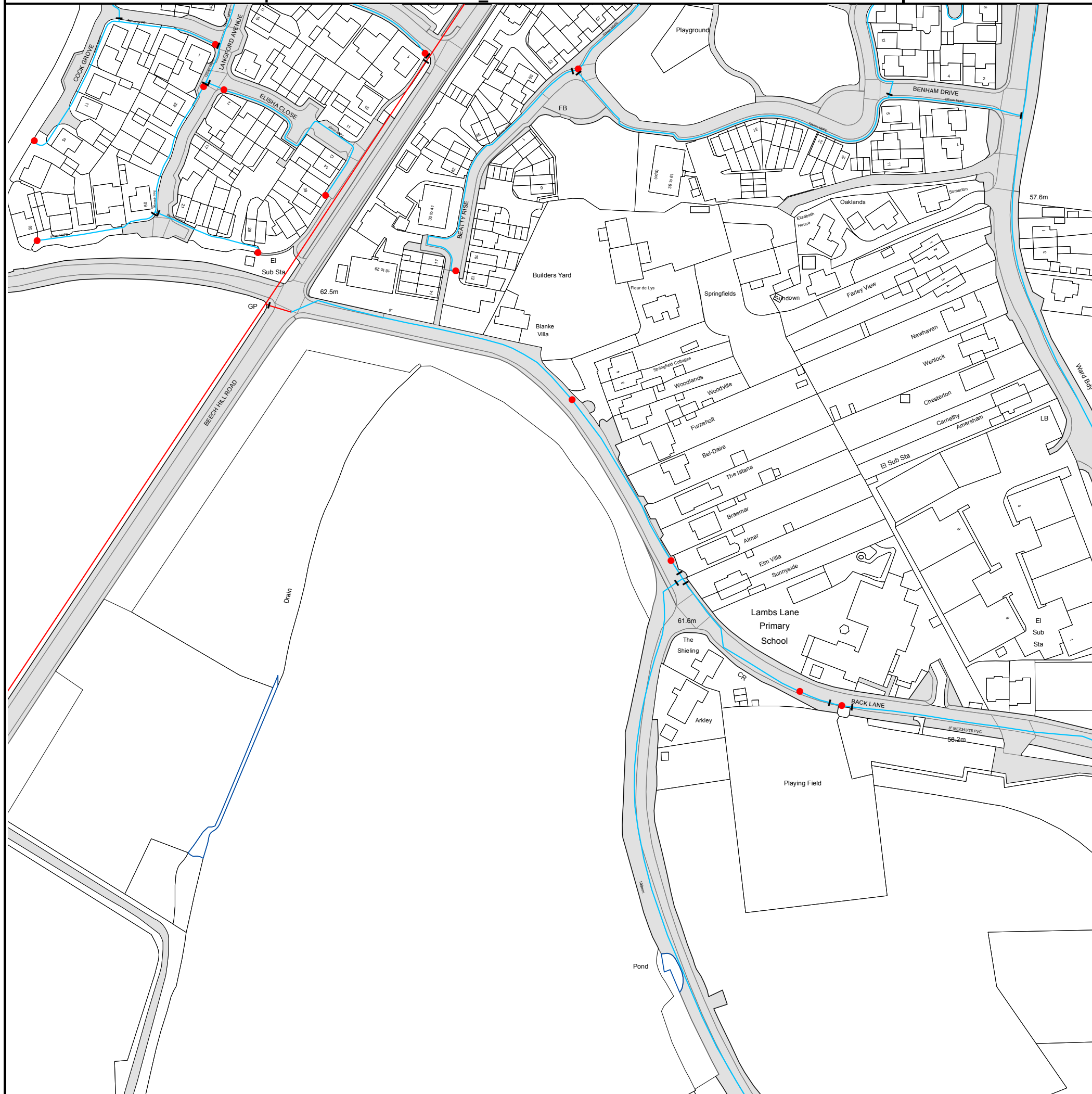
	Agreement
	Chamber
	Operational Site

Ducts or Crossings

	Casement	Ducts may contain high voltage cables. Please check with Thames Water.
	Conduit Bridge	
	Subway	
	Tunnel	

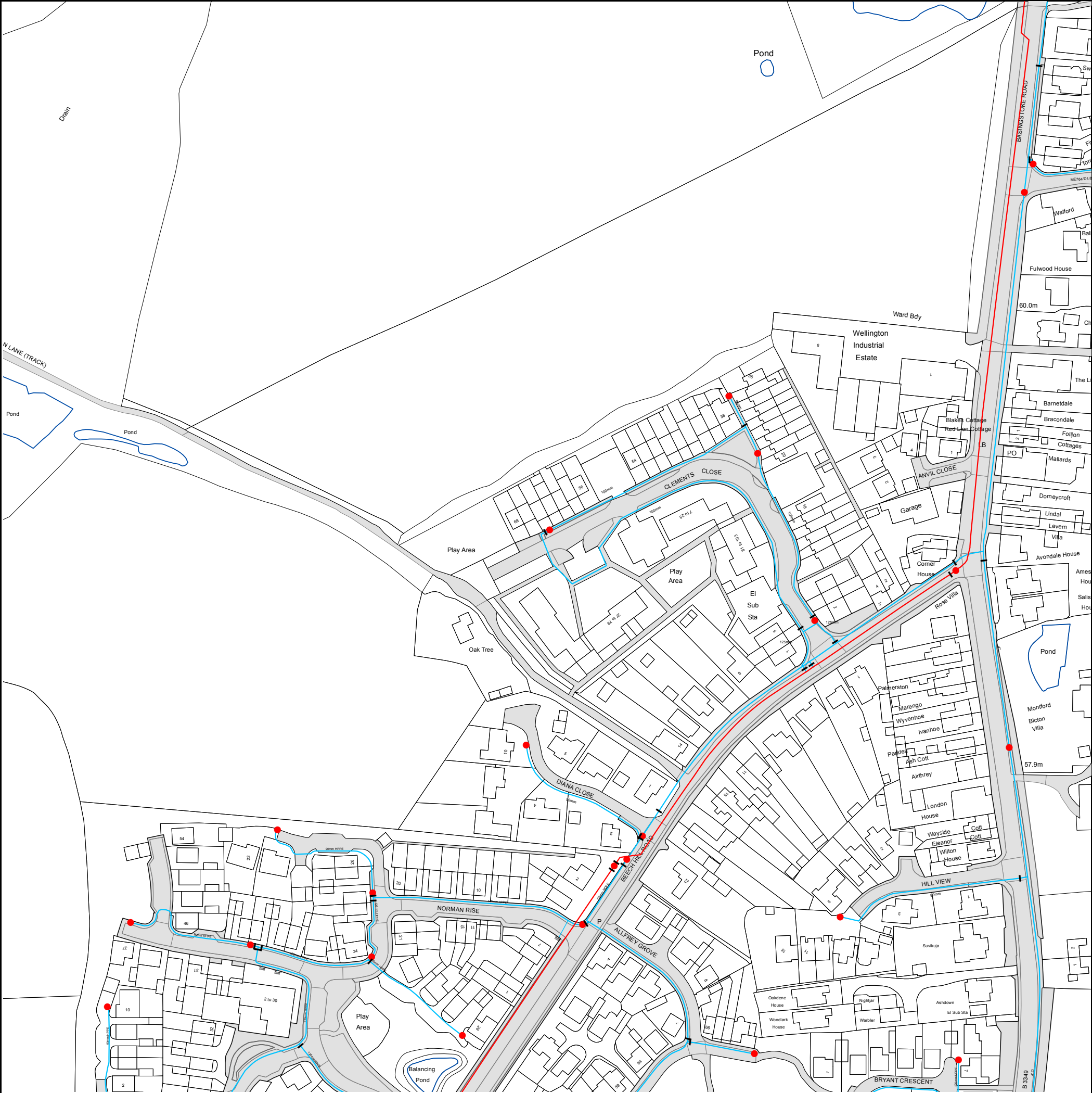
5) 'na' or '0' on a manhole indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. 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, please contact Property Searches on 0800 009 4540.



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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 471250,166250

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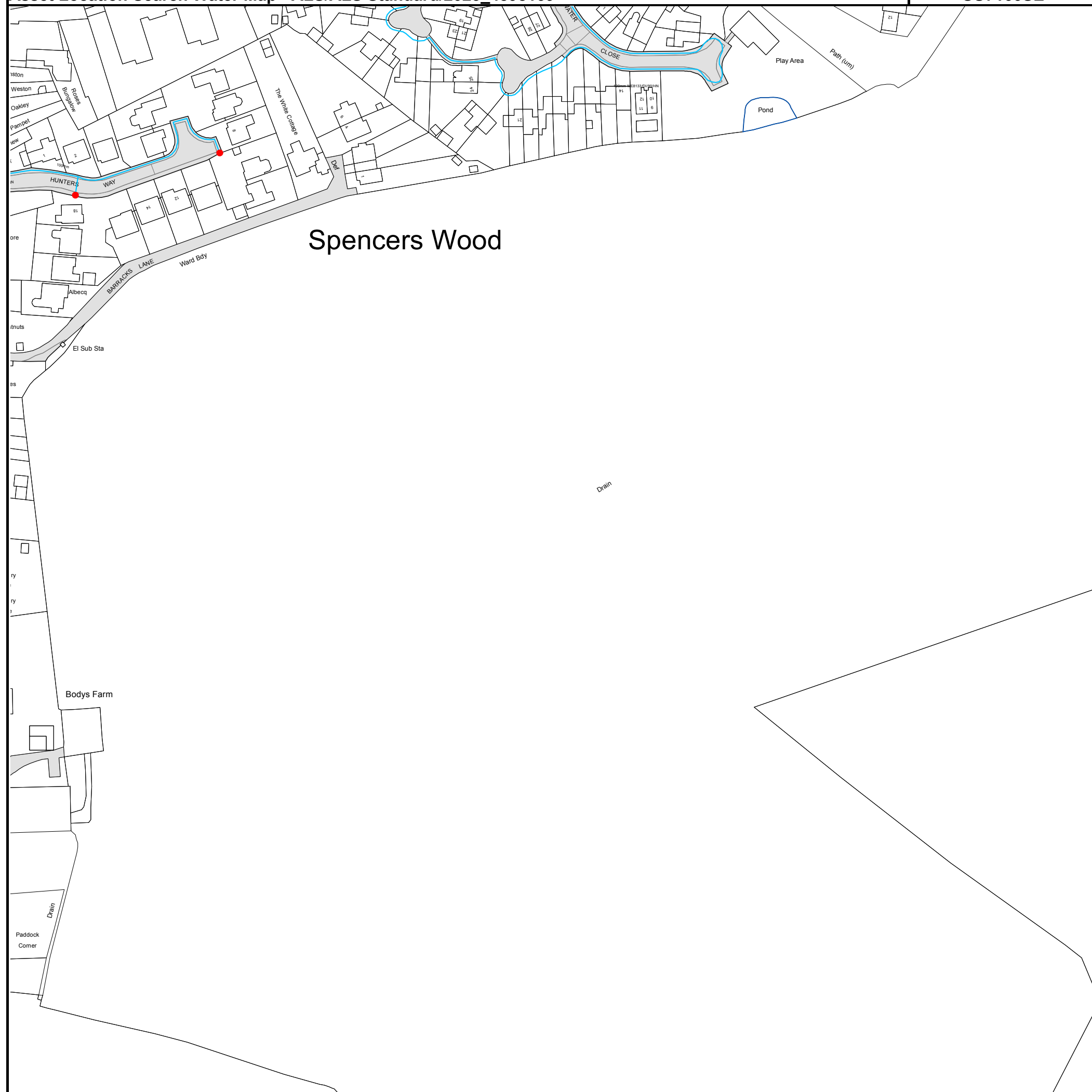
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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 471750,165750

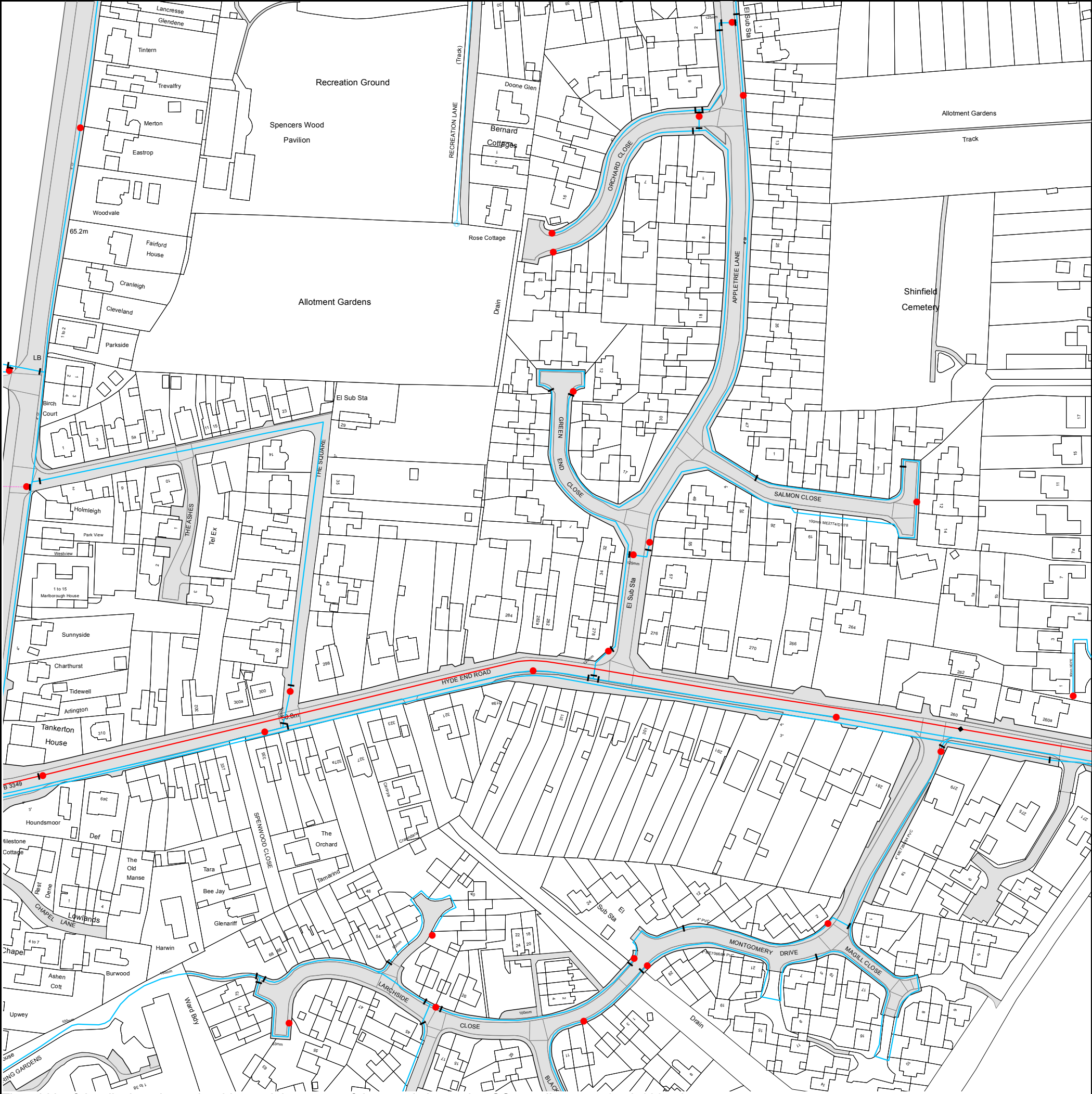
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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 472250,166750

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Asset Location Search - Water Key

Water Pipes (Operated & Maintained by Thames Water)

-

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

- Data Logger
- Casement: Ducts may contain high voltage cables. Please check with Thames Water.

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

- Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.
- Private Main: Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

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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 within 14 days of the 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. 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'.
5. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
6. 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).

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If you are unhappy with our service, you can speak to your original goods or customer service provider. If you are still not satisfied with the outcome provided, we will refer the matter to a Senior Manager for resolution who will provide you with a response.

If you are still dissatisfied with our final response, and in certain circumstances such as you are buying a residential property or commercial property within certain parameters, The Property Ombudsman will investigate your case and give an independent view. The Ombudsman can award compensation of up to £25,000 to you if he finds that you have suffered actual financial loss and/or aggravation, distress, or inconvenience because of your search not keeping to the Code. Further information can be obtained by visiting www.tpos.co.uk or by sending an email to admin@tpos.co.uk.

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 0300 034 2222 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
Please Call 0800 009 4540 quoting your invoice number starting CBA or ADS	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

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D Sensitivity Analysis

D.1 Sensitivity to roughness

Figure D- 1 shows the impact on flood extents within the site when the Manning's 'n' roughness values are increased and decreased by 20%. The model results indicate a slight increase in flood extent within the site when the roughness was decreased by 20%, while a 20% increase in roughness indicate a slight decrease in flood extent within the site. It shows that within the development site, the model is not sensitive to roughness changes.

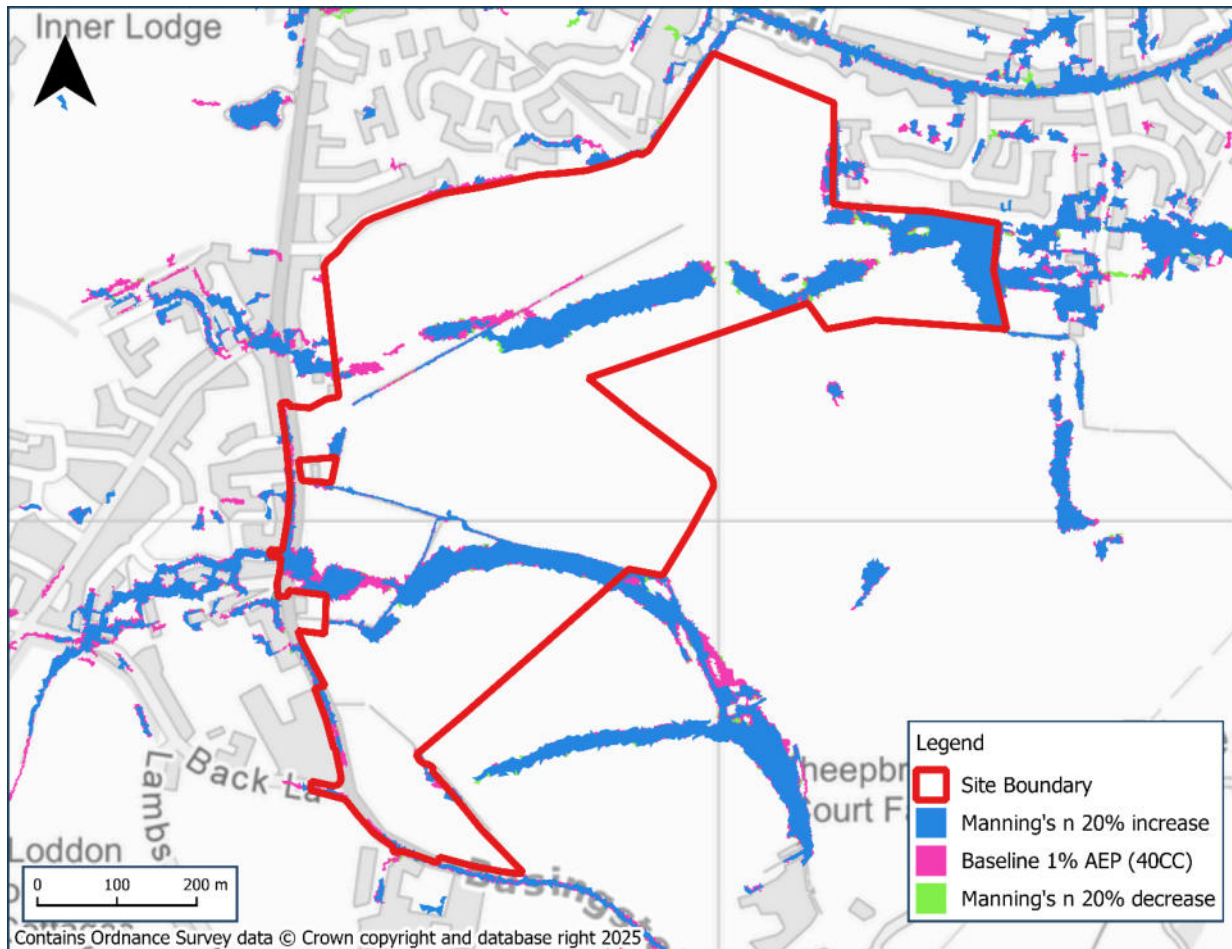


Figure D- 1: Sensitivity to changes in roughness coefficients

D.2 Sensitivity to fixed runoff coefficient (FRC)

Figure D- 2 shows the impact on flood extents within the site when the fixed runoff coefficient values are increased and decreased by 20%. The model results indicate an increase in flood extent within the site when the fixed runoff coefficient was increased by 20%, while a 20% reduction in the fixed runoff coefficient is predicted to result in a corresponding reduction in flood extent. This suggests that the model is sensitive to changes in fixed runoff coefficient values in this location.

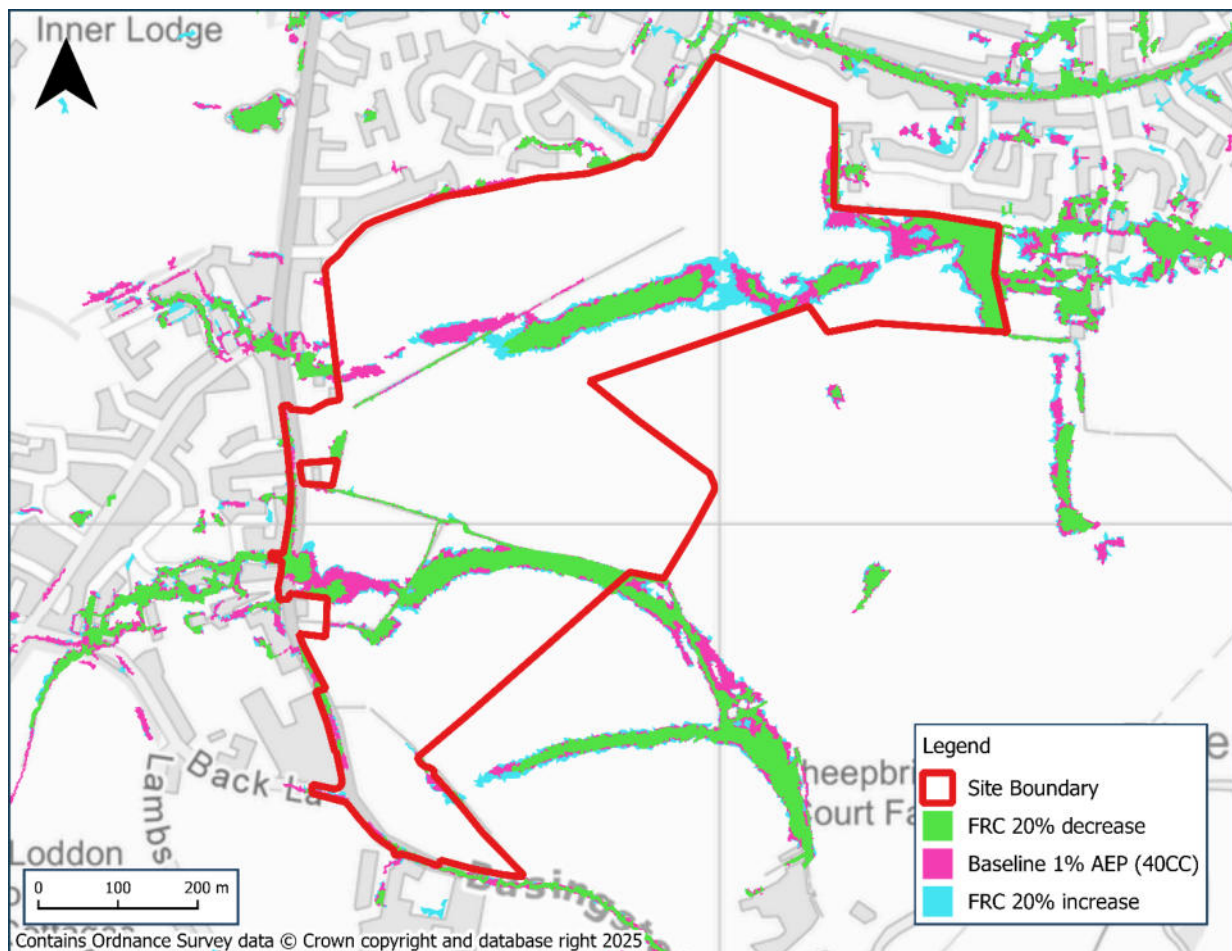


Figure D- 2: Sensitivity to changes in fixed runoff coefficient (FRC)

Offices at

Bristol
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Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Leeds
Limerick
Newcastle upon Tyne
Newport
Peterborough
Portsmouth
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

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