Land to the east of Tilletts Lane,
Warnham

Flood Risk Assessment and Drainage Strategy

For

Broadbridge Heath Trust

motion

Document Control Sheet

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Warnham

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This document has been issued and amended as follows:

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1.0 Introduction

1.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been produced by Motion on behalf of Broadbridge Heath Trust. It supports the planning application for the construction of 59 residential dwellings at Land to the east of Tilletts Lane, Warnham.

1.2 The site currently consists of open fields. It is proposed to construct 59 residential units, associated roads, parking and landscaping. A copy of the proposed plans can be found in **Appendix A** and the site location plan can be found in **Appendix B**.

1.3 The site is located within Flood Zone 1 according to the Environment Agency (EA) Flood Map for Planning (**Appendix C**).

1.4 With reference to the Risk of Flooding from Surface Water (RoFSW) Extent and Depth Maps shown in **Appendix D**, the site is predominantly located in the Very Low surface water flood risk category (less than 1 in 1000 chance of flooding each year). However, the surface water flood extent mapping indicates there are three Low and Medium risk of surface water flooding flow paths (i.e. between 1 in 1000 and 1 in 100 and between 1 in 100 and 1 in 30 chance of flooding in any given year respectively) that appear to originate onsite. The maximum extent of the surface water flood flow paths does not interact with the locations of proposed residential units, and the surface water flood depth mapping indicates that the yearly chance of 'Up to 20cm' flooding between 2040 and 2060 in the location of the flood flow paths is Very Low. These areas of Low and Medium risk of surface water flooding will be dealt with through the site's surface water drainage strategy.

1.5 This FRA and Drainage Strategy will discuss the risks to the proposed development from all sources of flooding. This report will also define how the site will manage surface water and foul sewage so that the development does not increase flood risk in the area or to neighbouring properties.

1.6 This drainage strategy follows the guidance set out in:

- National Planning Policy Framework (NPPF);
- Technical Guidance to the NPPF;
- CIRIA SuDS Manual 2015 (C753);
- Environment Agency Rainfall Runoff Management for Developments;
- Non-Statutory Technical Standards for SuDS (NSTS); and,
- West Sussex County Council's Planning Application Technical Response Template.

1.7 This drainage strategy report pertains only to the design of the drainage system for the built site. It does not provide details of how the site will be drained during the construction phase. This is considered to be temporary works and can only be prescribed and provided by the eventual appointed contractor.

1.8 Similarly, this report does not provide information on how the drainage infrastructure will be protected during the construction phase of the project. The provision of this information is, again, the responsibility of the appointed contractor.

2.0 Site Description

Table 2.1 – Site Summary

Site Name	Land to the east of Tilletts Lane,
Location	Warnham, RH12 3SN
Grid Reference	515599, 133896
Site Area	4.332 ha
Development Type	More Vulnerable
Flood Zone	Flood Zone 1
Surface Water Flood Risk	Low
Local Water Authority	Southern Water
Local Planning Authority	Horsham District Council (HDC)
Lead Local Flood Authority	West Sussex County Council (WSCC)

Site Location and Description

2.1 The development site is located at Knob Hill to the east of Tilletts Lane, Warnham. A location plan can be seen in **Appendix B**.

2.2 The site is currently open fields.

2.3 The proposed development is to provide 59 residential units, associated roads, parking and landscaping. A copy of the proposed plans can be found in **Appendix A**.

Topography

2.4 A detailed topographical survey has been undertaken for the site and can be seen in **Appendix E**.

2.5 Overall the main site falls from the northwest to the southeast with levels falling from around 81.00 metres above ordnance datum (m AOD) in the northwest of the site to a level of around 64.00m AOD in the southeast of the site.

2.6 The overall gradient of the site, from the northwest to southeast, is estimated to be 1 in 19.

Geology

2.7 The British Geological Survey (BGS) online 1:50,000 GeoIndex[1] mapping identifies that the bedrock geology is Weald Clay Formation – Mudstone. There is no listed superficial geology.

2.8 Defra's Magic Map website[2] lists the soil as being slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

2.9 The nearest borehole log in the BGS Geoindex website is from a location approximately 850m north northwest of the site. However, reference has been made to the Geo-Environmental Risk Assessment[3] available to view on the HDC planning portal for planning application DC/17/0566, which is only 130m

[1] https://www.bgs.ac.uk/map-viewers/geoindex-onshore/
[2] https://magic.defra.gov.uk/magicmap.aspx
[3] Aviron Associates Limited, Geo-Environmental Risk Assessment, Referenced 17-197.01, Dated July 2017

southeast of the site. The Geo-Environmental Risk Assessment states 'in general ground conditions comprise;

- TOPSOIL across the site to depths of between 0.20m bgl and 0.30m bgl.
- MADE GROUND beneath the topsoil locally in WS1 within the grounds of The Vicarage to a depth of 1.10m bgl.
- Locally soft, firm and stiff becoming very stiff high strength, becoming very high strength CLAY (Weald Clay Formation) across the site to the maximum termination depths of drilling and probing of between 3.50m and 4.00m bgl respectively.
- The strata are likely to have transitioned to very weak MUDSTONE at the base of window sample boreholes WS2 and WS3 at depths of 3.00m and 3.50m bgl where drilling refusal occurred (SPT N > 50), and in dynamic probe holes DP1-DP5 at depths of between 2.50m and 4.00m bgl.'

2.10 The Geo-Environmental Risk Assessment also states 'No groundwater was encountered during investigation works within any of the exploratory holes completed to a maximum depth of 4.0m bgl'.

Hydrogeology

2.11 Groundwater Source Protection Zones (SPZ's) are defined around groundwater abstraction sources such as wells, boreholes and springs that are used for public drinking water supply.

2.12 SPZ's show the risk of contamination to groundwater from any activities that might cause pollution in the area. The closer the activity to the source of abstraction, the greater the risk. The maps show three main zones; inner – Zone 1; outer – Zone 2; and total catchment – Zone 3.

2.13 Defra's Magic Map was reviewed to see where the site is in relation to the Groundwater SPZ's, and the site is not within any SPZ's. The solid geology is listed as a 'Unproductive Aquifer'.

2.14 The Groundwater Vulnerability Map (England) classification is 'Unproductive'.

Hydrology

2.15 The EA Statutory Main River Map[4] shows that the nearest statutory main river to the site is Boldings Brook which flows in a southerly direction approximately 950m east of the site.

Existing Drainage Regime

2.16 Surface water run-off from the existing site drains by a network of ditches, ordinary watercourses and culverts to Boldings Brook.

2.17 The Southern Water Wastewater Plan in **Appendix F** shows an existing network of adopted foul and surface water sewers in Warnham. A capacity check has been undertaken with Southern Water, who confirmed that there is adequate capacity in the foul sewer network to accommodate a foul flow of 0.54 l/s from the development at manhole reference TQ15338601 in Church Street.

Infiltration Potential

2.18 The desk-based geology information above indicates that infiltration will not be feasible at the site due to the clay-based geology (Weald Clay).

2.19 No site-specific information on ground conditions has been obtained, however reference has been made to the Geo-Environmental Risk Assessment[5] available to view on the HDC planning portal for planning

[4] https://www.arcgis.com/apps/webappviewer/index.html?id=17cd53dfc524433980cc333726a56386
[5] Aviron Associates Limited, Geo-Environmental Risk Assessment, Referenced 17-197.01, Dated July 2017

application DC/17/0566, which is only 130m southeast of the site. The Geo-Environmental Risk Assessment states 'Conventional soakaway drainage is unlikely to be feasible for the proposed development given the relatively impermeable nature of the overlying Weald Clay Formation.'

2.20 Therefore, the surface water drainage strategy for the development will look to use Type C no infiltration pervious pavements and attenuation basins for the attenuation of surface water runoff. A HydroBrake Flow Control Chamber will control surface water discharge from the site to 8.60 l/s for the 100 year + 45% climate change critical rainfall event to an existing onsite ditch.

3.0 Legislative and Policy Framework

Flood and Water Management Act

3.1 The Flood and Water Management Act 2010 (FWMA) received Royal Assent on 8th April 2010. The Act was introduced to enforce some of the key proposals set out within UK Government flood and water strategies along with UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods.

3.2 LLFA's, including WSCC, have a responsibility under the FWMA to develop, maintain, apply and monitor the application of a strategy for local flood risk in their area. Local flood risk is defined as flood risk arising from surface run-off, groundwater and ordinary watercourses (i.e. non main rivers). The EA plays a role in managing the watercourses designated as 'main rivers'.

The Environment Agency Flood Map for Planning

3.3 The Environment Agency (EA) Flood Map for Planning gives an indicative prediction of areas at risk of fluvial and tidal flooding. The mapping is an amalgamation of modelled flood levels and historical flood event outlines.

3.4 The Flood Map is split into 'Flood Zones', which demarcate the extent of flooding from rivers or the sea for different return periods. The Flood Map for Planning shows the extent of the natural floodplain if there were no defences or other man-made structures. They do not provide a definitive picture of where flooding would occur; rather, they provide an indicative prediction of areas at risk.

3.5 Table 3.1, below, lists the flood zone categories and explains the flood risk probabilities they represent.

Table 3.1 – Flood Zone Categories

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. This is generally delineated as land having a 1 in 30 or greater annual probability of flooding. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map)

New National Flood Risk Assessment (NaFRA) and National Coastal Erosion Risk Map (NCERM)

3.6 On 25 March 2025 the EA updated their Flood map for planning service which displays flood zones. The flood zones have been updated using the new NaFRA data. For the first time the EA will be displaying surface water risk and adding new information to show how climate change may affect the extent of flood risk from rivers and the sea in the future. The improved service is intended to assist planners and

developers when making decisions about the location and design of new Development, and making it easier to produce FRAs.

3.7 The new NaFRA provides a single picture of current and future flood risk from rivers, the sea and surface water for England. It also:

- uses the best available data both from the Environment Agency and local authorities
- includes the potential impact of climate change on flood risk
- uses much higher resolution maps that make it easier to see where there is risk
- provides new data on depth of flooding, allowing people to understand the potential flood hazard they could face

3.8 The new NCERM provides the most up to date national picture of current and future coastal erosion risk for England. The EA has worked with local authorities, who supplied local data and verified outputs. It also:

- uses the best available evidence from the National Network of Regional Coastal Monitoring Programmes
- includes climate change impacts on coastal erosion risk, and allowances for sea level rise
- includes new information on areas of land instability at the coast caused by rainfall and rising groundwater levels which can contribute to cliff erosion and landslides
- makes erosion information more accessible to coastal managers, planners and the public by providing clearer online visualisations

The National Planning Policy Framework

3.9 The NPPF sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. The Technical Guidance to the NPPF provides further information on the policies set out in the NPPF. It encourages Development to take place in areas of lower flood risk wherever possible and stresses the importance of preventing increases in flood risk off-site to the wider catchment area. This includes ensuring that flood risk is taken into account at all stages of the planning process, avoiding inappropriate Development in areas at risk of flooding and directing Development away from those areas where risks are highest.

3.10 A site-specific FRA is required for proposals of 1ha or greater in Flood Zone 1, all proposals for Development in Flood Zones 2 and 3, or in an area within Flood Zone 1 that has critical drainage problems (as notified to the local planning authority by the EA). The FRA should identify and assess the risks of all forms of flooding to and from the Development and demonstrate how these flood risks will be managed so that the Development remains safe throughout its lifetime, taking climate change into account.

3.11 Within each Flood Zone, a key factor in determining planning applications for Development is the flood risk vulnerability of a Development. Table 2 of the Technical Guidance to the NPPF categorises different Development types according to their vulnerability to flooding. These categories are:

- Essential infrastructure;
- Highly vulnerable Development;
- More vulnerable Development;
- Less vulnerable Development, and;
- Water-compatible Development.

3.12 The proposed use of the Site is classified as 'More vulnerable' Development.

3.13 Within the different Flood Zones each of the above Development categories are considered appropriate or not permissible. The Technical Guidance to the NPPF lists these as:

Flood Zone 1:

- All the Development categories listed above are appropriate.

Flood Zone 2:

- Water-compatible, less vulnerable Development, more vulnerable Development and essential infrastructure is appropriate in this zone.

Flood Zone 3a:

- Water-compatible, less vulnerable Development and essential infrastructure is appropriate in this zone. Highly vulnerable Development should not be permitted in this zone.

Flood Zone 3b:

- Only water-compatible Development and essential infrastructure that has to be there should be permitted in this zone.

3.14 The above information sets out the basis by which Developments must be assessed in terms of flood risk. Later in this report the proposed Development will be reviewed against the Flood Zone in which it is located. This will inform the appropriateness of the proposed reconstruction, as per the advice within the Technical Guidance to the NPPF.

Lead Local Flood Authority

As of April 2015, the LLFA became a statutory consultee on all major planning applications. The LLFA is required to assess planning applications in respect of surface water drainage and sustainable drainage systems. WSCC is the LLFA for the Horsham Area.

4.0 Current Flood Risk

4.1 Flooding can arise from a variety or combination of sources. These may be natural, or artificial and may be affected by climate change. These are discussed, below, in the following two sections and are summarised in Table 6.1, which is in Chapter 6.

Tidal Flooding

4.2 The site is not in proximity of a tidally influenced river, thus Tilletts Lane cannot be considered at risk of tidal flooding.

Fluvial Flooding

4.3 The site is located within Flood Zone 1 according to the EA Flood Map for Planning (**Appendix C**) and the nearest area located in Flood Zone 2 is approximately 220m southeast of the site. Therefore, the site is considered to be at very low fluvial flood risk.

Flood Risk and Appropriateness of the Proposed Development

4.4 According to the classifications in the NPPF the site is considered to be 'More vulnerable' Development.

4.5 Table 3 of the PPG to the NPPF (see below) states that 'more vulnerable' development is appropriate in Flood Zone 1, thus the development is appropriate in this location.

Table 3 of the NPPF – Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Surface Water Flooding

4.6 Surface water, or pluvial flooding, results from rainfall-generated overland flow, where rainwater has not yet reached a watercourse or sewer and where the local drainage systems become overwhelmed. Pluvial flooding often occurs during short, very intense storms, but can also occur during longer periods of rainfall when the ground is already saturated, or where land has low permeability due to development.

4.7 In these conditions surface water can build up where the topography allows it to converge or pond. Where it gathers it will travel down prevailing gradients. Pluvial flooding then occurs at locations where

significant surface water flow paths converge, at localised low points and/or due to overland obstructions. In urban areas pluvial flooding often occurs where the built environment channels overland flow routes (down roads that are bounded by kerbs, for example) or where there are obstacles to the natural overland flow routes. Boundary walls and buildings are often the main causes and, hence, the likelihood of pluvial flooding to impact property and built-up areas.

4.8 Pluvial flooding is exacerbated in many cases by the mistreatment or failure of the below ground infrastructure (including partial or full blockages of gullies and/or within the combined sewers and the accumulation of fats, oils and greases within the sewer networks).

4.9 The RoFSW Extent and Depth Maps are shown in **Appendix D**.

4.10 The site is predominantly located in the Very Low surface water flood risk category (less than 1 in 1000 chance of flooding each year). However, the surface water flood extent mapping indicates there are three Low and Medium risk of surface water flooding flow paths (i.e. between 1 in 1000 and 1 in 100 and between 1 in 100 and 1 in 30 chance of flooding in any given year respectively) that appear to originate onsite. The maximum extent of the surface water flood flow paths does not interact with the locations of proposed residential units, and the surface water flood depth mapping indicates that the yearly chance of 'Up to 20cm' flooding between 2040 and 2060 in the location of the flood flow paths is Very Low. These areas of Low and Medium risk of surface water flooding will be dealt with through the site's surface water drainage strategy.

4.11 Therefore, the site can be concluded as having a low risk of surface water flooding.

Groundwater Flooding

4.12 There are no flood risk maps for groundwater, as stated by the Environment Agency in their 2011 guidance note 'flooding from groundwater'. Mapping products currently available only show areas where the geological and hydrological conditions may combine to cause groundwater flooding, but they should not be considered as groundwater flood risk maps. They only show susceptibility to groundwater flooding.

4.13 There are several mapping products that depict areas that may be susceptible to groundwater flooding, but they are not comparable in detail to the risk maps developed for fluvial, tidal and surface water, such as those used by practitioners and risk management authorities to support planning decisions. The mapping does not show the likelihood of groundwater flooding occurring and can only be considered as a hazard, but not a risk-based dataset.

4.14 As such, the mapping products can be viewed as indicative at best and should only be used as a prompt to review site-based information to determine whether groundwater is a risk factor that should be considered. Indeed, the Environment Agency state that:

"The susceptibility data should not be used on its own to make planning decisions at any scale and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding."

4.15 This FRA will review the groundwater flooding susceptibility mapping available, which has been supplied in the Envirocheck Landmark Flood Studies Report (FSR) and can be seen in **Appendix G**.

BGS Geological Indicators of Flooding

4.16 The BGS Geological Indicators of Flooding map shows that the site is not in an area with indicators of groundwater flooding.

BGS Groundwater Flooding Susceptibility

4.17 The BGS Groundwater Flooding Susceptibility map shows that the site is not in an area where there is potential for groundwater flooding to occur.

Geosmart Information Groundwater Flood Map

4.18 The Geosmart Information Groundwater Flood Map places the site in an area of 'negligible' risk.

Groundwater Flood Risk Summary

4.19 The site is not in an area with indicators of groundwater flooding and is not in an area with potential for groundwater flooding to occur. Due to this and being in an area of 'negligible' risk, it can be seen that the development site is at very low groundwater flood risk.

Flooding from Infrastructure Failure

4.20 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or because of a reduction in capacity due to collapse, siltation, blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.

4.21 Typically, sewer systems are constructed to accommodate rainstorms with a 30-year return period or less, depending on their age. Consequently, rainstorm events greater than 1 in 30-years would be expected to result in surcharging of some parts of the sewer system. In fact, due to most gullies being poorly maintained and often partially blocked with silt, leaves and other debris, their capacity is often estimated to be closer to the 1 in 10-year storm.

4.22 All Water Companies have a statutory obligation to maintain a register of properties/areas which have reported records of flooding from the public sewerage system, and this is shown on the 'DG5 Flood Register'. This includes records of flooding from foul sewers, combined sewers and surface water sewers that are deemed to be public and maintained by the Water Company.

4.23 The DG5 Flood Register only records sewer flooding incidents per postcode area and over a 10-year period, thus is not detailed in its resolution but it can provide an indicator of areas that have persistent sewer flooding problems.

4.24 Southern Water provided an extract from their DG5 Flood Register for Appendix A Figure 5A Sewer Flooding Incidents (2014-2024) in the Horsham District Council Level 1 Strategic Flood Risk Assessment[6] (SFRA). Appendix A Figure 5A identifies that the RH12 postcode experienced between 41 and 120 sewer flooding incidents between 2014-2024. The SFRA states 'given that Southern Water target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding in the future'. On the basis Southern Water have confirmed that there is adequate capacity in the sewer network to accommodate foul flow from the development at manhole reference TQ15338601, it is concluded that the development site is at low risk of sewer flooding.

Flooding from Artificial sources

4.25 The EA Maximum extent of flooding from reservoirs map shown in **Appendix D** indicates that the site is not in an area at risk of reservoir flooding.

4.26 There are no other artificial sources of flooding (such as canals) in the vicinity of the site that could cause flooding.

Historic Flooding

4.27 The FSR includes a EA/NRW Historic Flood Map showing historic flood events data, which can be seen in **Appendix H**.

[6] AECOM, Level 1 Strategic Flood Risk Assessment, Final Report, Horsham District Council, Project number: 60730513, Revision P03, Dated 05/09/2024

4.28 This map shows that no record of historic flood events data in the site location. Thus the EA/NRW Historic Flood Map supports this report's conclusion that the site is at low risk of flooding and that the proposed development is appropriate in this location.

5.0 Future Flood Risk & Climate Change

5.1 The NPPF and the supporting PPG sets out how flood risk should be considered over the lifetime of a development. This requires an increase in flood risk due to climate change to be taken into account. Both peak river flows and rainfall intensity should be assessed.

Peak River Flows

5.2 Please see Section 4.3.

Peak Rainfall Intensity and Climate Change

5.3 The site is currently open fields which can be described as greenfield. The proposed development will increase the impermeable area on site and, therefore, will increase the quantity of surface water runoff from rainfall.

5.4 With climate change it is becoming more common to see rainfall events of higher intensity, particularly in the southeast of England. Increased rainfall intensity affects river levels and drainage systems, with the result being an increase in surface water flooding and sewerage surcharge.

5.5 The NPPF states that, for flood risk assessments, the Peak Rainfall Allowances Map should be referenced to find out what the anticipated changes in peak rainfall are. Government guidance on Flood risk assessments: climate change allowances[7] clarifies that for developments which have a minimum lifespan of 100 years, the upper end climate change allowances for both the 3.3% AEP and 1% AEP events should be used.

5.6 The site lies within the 'Arun and Western Streams Management Catchment'[8] and the peak rainfall climate change allowances for this catchment are as follows in Table 5.2, below:

Table 5.2 – Climate Change Predictions for the London Management Catchment

1 in 30-year Rainfall Event	**Central Allowance**	**Upper End Allowance**
2050's epoch	20%	35%
2070's epoch	25%	40%
1 in 100-year Rainfall Event	**Central Allowance**	**Upper End Allowance**
2050's epoch	20%	45%
2070's epoch	25%	45%

5.7 In the 'Arun and Western Streams Management Catchment', the 'Upper End' climate change allowances for the 3.3% AEP and 1% AEP rainfall events are 40% and 45%, respectively.

5.8 The site is currently in an area of low surface water flood risk.

5.9 In addition, it is important that:

- Any changes to the land in this area must remain sensitive to the local surface water flood risk. This will ensure that any natural overland flow routes and surface water pathways will remain the same and the conveyance of surface water is not impeded.

[7] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[8] https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall

- The surface water strategy for the Site takes the latest climate change predictions into account, so as not to increase flood risk on- or off-site.

The Sequential and Exception Tests

5.10 The NPPF specifies that 'The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk)'.

5.11 On the basis the FRA indicates the site lies within Flood Zone 1 - i.e. land assessed as having less than a 0.1 per cent (1 in 1000) chance of river flooding occurring each year as defined in Government Guidance on Flood risk and coastal change[9] - and the flood risk assessment indicates a low risk of flooding from all sources both now and in the future, sequential and exception tests are indicated not to be required for the proposed development.

[9] https://www.gov.uk/guidance/flood-risk-and-coastal-change

6.0 Summary of Flood Risk

6.1 Historic, current and future flood risk, from all sources, has been reviewed in the context of the proposed development on Tilletts Lane. A summary of these flood risks is summarised in Table 6.1, below. The allocation of overall flood risk shows the residual flood risk once the site-specific conditions have been taken into account.

Table 6.1 – Summary of Residual Flood Risk From All Sources

Flood Source	Risk Level				Comment
	High	Medium	Low	Very Low	
Fluvial				X	The site is located within Flood Zone 1 according to the EA Flood Map for Planning (**Appendix C**) and the nearest area located in Flood Zone 2 is approximately 220m southeast of the site. Therefore, the site is considered to be at very low fluvial flood risk.
Tidal				X	In Tidal FZ1.
Groundwater			X		The site is not in an area with indicators of groundwater flooding and is not in an area with potential for groundwater flooding to occur. Due to this and being in an area of 'negligible' risk, it can be seen that the development site is at very low groundwater flood risk.
Surface Water			X		The surface water flood extent mapping indicates there are three Low and Medium risk of surface water flooding flow paths (i.e. between 1 in 1000 and 1 in 100 and between 1 in 100 and 1 in 30 chance of flooding in any given year respectively) that appear to originate onsite. The maximum extent of the surface water flood flow paths does not interact with the locations of proposed residential units, and the surface water flood depth mapping indicates that the yearly chance of 'Up to 20cm' flooding between 2040 and 2060 in the location of the flood flow paths is Very Low. These areas of Low and Medium risk of surface water flooding will be dealt with through

					the site's surface water drainage strategy. Therefore, the site can be concluded as having a low risk of surface water flooding.
Canals				X	There are no canals in the vicinity.
Reservoirs				X	The Reservoir Flood Risk Map places the site well outside a maximum extent of flooding.
Infrastructure Failure			X		On the basis Southern Water have confirmed that there is adequate capacity in the sewer network to accommodate foul flow from the development at manhole reference TQ15338601, it is concluded that the development site is at low risk of sewer flooding.
Increase due to Climate Change			X		Increased peak rainfall intensities[10] are expected to affect surface water flood risk and infrastructure. This has been taken into account in the proposed surface water drainage strategy.

[10] https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall

7.0 Proposed Surface Water Drainage Strategy

Sustainable Drainage Overview

7.1 Current planning policy and EA guidance requires developments to employ SuDS (Sustainable Drainage Systems) techniques wherever feasible. Careful design of SuDS features can ensure that a development's surface water drainage closely reflects the natural hydrology of the pre-developed site.

7.2 SuDS will attenuate and treat surface water run-off quantities at the source (source control) in line with NPPF and EA policies.

7.3 The key benefits of SuDS are as follows:

- Improving water quality over a conventional piped system by removing pollutants from diffuse pollutant sources (e.g., roads);
- Improving amenity through the provision of open green space;
- Improving biodiversity through increased areas for wildlife habitat; and
- Enabling a natural drainage regime that recharges groundwater (where possible).

7.4 SuDS provide a flexible approach to drainage, with a wide range of components from soakaways to large-scale basins or ponds. The individual techniques should be used where possible in a management train that mimics the natural pre-developed pattern of drainage.

Site Areas

7.5 The site areas to undergo development are to be assessed as follows in Table 7.1:

Table 7.1 – Site Areas

Breakdown of site areas	Proposed (ha)
Total site area	4.332
Total impermeable areas	1.462
Total permeable areas	2.870

Greenfield Runoff Rate

7.6 The greenfield runoff rates have been calculated using the QMED value, which is the index flood in the Flood Estimation Handbook (FEH). QMED has been calculated for rural and urban values in MicroDrainage using the catchment descriptors methodology, which includes the following input variables:

- Site Location
- SAAR – Standard Average Annual Rainfall 1961 – 1990 (mm)
- SPR Host - Standard percentage runoff derived from HOST soils data
- URBEXT (2000) - The extent of urban and suburban cover
- BFIHOST - Baseflow index derived from Hydrology of Soil Types (HOST) soils data
- FARL - Index of flood attenuation due to reservoirs and lakes

- Catchment Area – Hectares

7.7 The QMED calculation sheet from MicroDrainage can be seen in **Appendix I**, and is expressed as a runoff rate over the 1.462 ha impermeable area of the proposed development. This is summarised in Table 7.2, below.

Table 7.2 – QMED Runoff Rate

QMED Rural (l/s)	QMED Urban (l/s)
9.66	10.75

7.8 The calculated QMED Rural value is 9.66 l/s over the 1.462 ha impermeable area of the proposed development.

Urban Creep

7.9 An appropriate allowance should be made for urban creep throughout the lifetime of the development as per 'BS 8582:2013 Code of Practice for Surface Water Management for Developed Sites'.

7.10 WSCC have produced their own guidance on the percentage of urban creep that should be applied. They state that the consideration of urban creep should be assessed on a site-by-site basis but is limited to residential development only. The allowances set out in Table 5.2 of WSCC LLFA Policy for the Management of Surface Water must be applied to the impermeable area within the property curtilage according to the proposed development density. Table 5.2 is shown below.

Table 7.3: Table 5.2 of WSCC LLFA Policy for the Management of Surface Water

Residential development density (Dwellings per hectare)	Change allowance (% of impermeable area)
≤25	10
30	8
35	6
45	4
≥50	2
Flats & Apartments	0

7.11 In the hydraulic design of the site, urban creep results in a total impermeable area increase of 400m^2 within residential curtilages.

7.12 The results of the hydraulic modelling, inclusive of urban creep, will be discussed later in this report. At this stage, it should be noted that the proposed drainage strategy can attenuate all surface water arising in the 1 in 100-year + 45% critical rainfall event, inclusive of a 10% uplift due to urban creep, without flooding.

Drainage Strategy Overview

7.13 As discussed in Chapter 2 of this report, infiltration is indicated not to be feasible at the site due to the clay-based geology.

7.14 Therefore, the drainage strategy for the development will look to discharge surface water at a controlled rate via a vortex flow control to an existing onsite ditch.

7.15 The proposed drainage strategy can be seen in **Appendix J** of this report.

7.16 The design criteria achieved by the proposed drainage strategy, and how it has been developed in accordance with the sequential check of the drainage hierarchy is discussed, below.

Design Criteria

7.17 The drainage strategy has been designed in accordance with the design criteria outlined in West Sussex County Council's LLFA Policy for the Management of Surface Water. This ensures that the current drainage strategy accords with local policy requirements (as well as those of the NPPF). In brief, this includes:

- Using FEH Annual Maximum Catchment data rather than FSR data. It should be noted that FEH 2022 has been used, although in certain cases InfoDrainage does not acknowledge this dataset and assumes that it is 2013 and labels it as such.
- 10 % Urban Creep allowance has been applied for property curtilage.
- Using a runoff coefficient (CV) value of 1.0 in all hydraulic modelling (for both summer and winter storms, both of which have been assessed in the model).
- The full suite of rainfall events has been used.

7.18 The proposed drainage strategy for the development and how it has been designed has been outlined. With specific reference to how the proposed drainage strategy has been considered within each tier of the drainage hierarchy, this is discussed, below.

The Drainage Hierarchy

7.19 The drainage hierarchy is a sequential check that intends to ensure that all practical and reasonable measures are taken to manage surface water as high up the hierarchy (with '1' being the highest) as possible, and that the amount of surface water managed at the bottom of the hierarchy is minimised. The Planning Practice Guidance to the National Planning Policy Framework (NPPF) states that *"Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable".*

7.20 The drainage hierarchy presented in the NPPF presents only four tiers of drainage options. This has been expanded on and adopted by others and now can be viewed as the following:

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to the combined sewer
8. Discharge rainwater to the foul sewer

7.21 The first two tiers of the drainage hierarchy ensure that surface water is retained within the site boundary and does not increase flood risk to others. This is always the most preferable method of surface water management.

7.22 The next six tiers of the hierarchy provide regional control, but with decreasing levels of pollution removal and reduced potential for amenity and habitat creation.

7.23 Within the lower six tiers of the drainage hierarchy, there must be some form of flow restriction, so that off-site surface water discharge resembles greenfield runoff rates, as much as is reasonably practicable. This requires on-site storage facilities, which may include ponds, swales, subsurface storage tanks and

System C (non-infiltration) permeable paviours with flow control devices. Again, methods that provide the most potential for amenity and pollution removal should be favoured.

Tier 1 – Store rainwater for later use

7.24 Water re-use systems can rarely manage 100% of the surface water discharged from a development. This requires the surface water yield from the building and hardstanding areas to balance perfectly with the demand from the proposed development; too much demand will result in a lack of water supply; too little demand will cause the storage systems to become overwhelmed and could result in flooding when the next rainfall event happens. Consequently, even if there are opportunities and a need for rainwater recycling systems, further solutions for attenuating and discharging surface water will almost always be required.

7.25 There is likely to be a moderate rainwater yield from the roof areas of the development that could be used for domestic non-potable water uses. The proposed development includes landscaping that may benefit from having a supply of recycled rainwater for the watering of gardens, beds, etc.

7.26 The opportunity for water re-use and recycling on site has been explored and the water neutrality statement (WNS) for the site proposes the use of a rainwater harvesting system. This will be installed on half of the roof area in order to meet the demand for the proposed development. The water collected by the rainwater harvesting system will be utilised for flushing toilets and in the washing machines.

7.27 The rainwater harvesting tanks will be large enough to store 9.6% of the Annual Water Demand, providing 35 days of storge for periods of drought. Further details on this rainwater harvesting system can be found in the corresponding WNS for the site.

7.28 The rainwater harvesting system has been designed to store and re-use annual average rainfall inputs. This means that 100% of annual rainfall up to and including the 1 in 1-year event falling on the roof area contributing to the rainwater harvesting system will be reused and will not leave the site. This exceeds the Environment Agency's Rainfall Runoff for Development's guidance, which recommends that the first 5mm of rainfall should be attenuated, which covers only 50% of rainfall events.

7.29 The site has a total rainwater demand of around 122,799 litres, and rainwater harvesting tanks will provide a total storage volume of around 146,900 litres (146.9 m^3) as part of the proposed development.

Tier 2 - Use Infiltration techniques, such as porous surfaces in non-clay areas

7.30 As detailed in Chapter 2 infiltration techniques are not viable on site.

Tier 3 - Attenuate rainwater in ponds or open water features for gradual

7.31 Ponds and open water features are SuDS features that offer surface water attenuation, pollution mitigation and amenity and biodiversity benefits.

7.32 The attenuation basins will cover areas of 420m^2, 502m^2 and 877m^2; have side slopes of 1 in 3; have attenuation depths of 1.2m; and have a combined attenuation storage volume of 1585 m^3. Surface water runoff will be restricted by 2 no. Orifice Flow Control Chambers and 1 no. HydroBrake Flow Control Chamber that will control discharge to 8.60 l/s for the 100 year + 45% climate change critical rainfall event.

Tier 4 - Attenuate rainwater by storing in tanks or sealed water features for gradual release

7.33 Please see the Landscape Masterplan in **Appendix B** that shows the widespread extent of Type C No Infiltration Pervious Pavements proposed as part of the development. A proportion of this pervious pavement area (around 1745m^2) has been included in the InfoDrainage Hydraulic Model based on a

130mm thick pervious surface layer / laying course and 450mm thick type 3 subbase with 30% void ratio. This proportion of pervious pavement area alone will provide around 235m^3 attenuation storage.

Tier 5 - Discharge rainwater direct to a watercourse

7.34 The proposed outfall will discharge into an existing onsite ditch via a HydroBrake Flow Control Chamber.

Tier 6 - Discharge rainwater to a surface water sewer/drain

7.35 This tier of the drainage hierarchy will not be needed for surface water discharge.

Tier 7 - Discharge rainwater to the combined sewer

7.36 This tier of the drainage hierarchy will not be needed for surface water discharge.

Tier 8 - Discharge rainwater to the foul sewer

7.37 This tier of the drainage hierarchy will not be needed for surface water discharge.

InfoDrainage Hydraulic Modelling

7.38 The drainage strategy outlined above has been designed and hydraulically modelled in InfoDrainage. The results of the InfoDrainage hydraulic modelling for the proposed development can be seen in **Appendix K**.

7.39 The results of the hydraulic modelling shows that the surface water drainage strategy as outlined above can attenuate and discharge the surface water generated in the 1 in 100-year + 45% critical rainfall event, inclusive of a 10% uplift due to urban creep, without flooding. This manages flood risk on- and off-site and reduces overall local flood risk.

7.40 Additionally, the Interpave document Guide to the Design, Construction and Maintenance of Concrete Block Permeable Pavements edition 6 states 'permeable pavements reduce the volume of rainfall that flows out from them significantly and the time it takes for the water to flow out is much longer than for conventional drainage systems. Studies reported in CIRIA report C 582 (CIRIA, 2001) have shown that some 11% to 45% of rainfall flows out from the pavement during a rainfall event. Subsequently over the 2 to 4 days after an event, more water flows out to give a total outfall of between 55% and 100%'. On this basis, it is concluded that the long-term storage volumes provided by the widespread extent of Pervious Pavements proposed as part of the development are likely to be more than what is indicated by the half drain times in the hydraulic calculations.

8.0 Proposed Foul Water Drainage Strategy

8.1 The Southern Water Wastewater Plan in **Appendix F** shows an existing network of adopted foul and surface water sewers in Warnham. A capacity check has been undertaken with Southern Water, who confirmed that there is adequate capacity in the foul sewer network to accommodate a foul flow of 0.54 l/s from the development at manhole reference TQ15338601 in Church Street.

8.2 The gravity foul flow rate from the proposed development has been based on the following assumptions using the Southern Water Developer Services Foul Flow Excel Calculation:

- 125 litres per head per day
- Occupancy of 2.4 persons per dwelling
- Infiltration of groundwater is minimised to the low rate of 10% of base flow
- A Peaking Factor of 2.5

8.3 Using the Southern Water Developer Services Foul Flow Excel Calculation in **Appendix L**, the gravity foul flow rate from the proposed development for 59 dwellings is estimated be 0.53 l/s, therefore the capacity check undertaken by Southern Water confirms there is sewer capacity for the proposed development.

8.4 If for any reason a gravity connection to the Southern Water foul sewer network is not possible, a location for a pumping station has also been set aside as part of the development as part of a precautionary approach. In the scenario a pumping station is required, it is envisaged the rising main would exit the site via the proposed vehicle access.

9.0 Surface Water Runoff Quality

9.1 The NPPF states that developments should not have a detrimental impact on the environment, including the water environment. The technical guidance to the NPPF provides further advice on the benefits of ensuring runoff quality is to an appropriate standard.

9.2 The CIRIA SuDS Manual provides guidance on the treatment of surface water runoff. With regards to the proposed development, Table 4.3 of the CIRIA SuDS Manual rates the pollution hazard from roof water runoff as 'very low'. The only requirement for roof water runoff is the removal of gross solids and sediments, which would be achieved using standard catchpits and silt traps upstream of the main drainage network.

9.3 With regards to the property driveways and access roads, Table 4.3 of the CIRIA SuDS Manual rates the pollution hazard from residential car parking and low traffic roads as 'low'. To mitigate a 'low' pollution hazard, the CIRIA SuDS Manual recommends using a simple index approach in line with Section 26.7.1. This is discussed, below.

9.4 Table 26.2 of the CIRIA SuDS Manual provides pollution hazard indices for different land use classifications. The land use classification that requires consideration for the property driveways and access roads on the site is in Table 9.1 below.

Table 9.1 – Excerpt from Table 26.2 of CIRIA SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, homezones and general access roads with less than 300 traffic movements a day)	Low	0.5	0.4	0.4

9.5 To deliver adequate pollution treatment and mitigation, the CIRIA SuDS Manual recommends using a SuDS component that has a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type).

9.6 Table 26.3 of the CIRIA SuDS Manual provides indicative SuDS mitigation indices for each SuDS type. Table 9.2, below, which is an excerpt from Table 26.3, shows the mitigation index for SuDS basins.

Table 9.2 – Excerpt from Table 26.3 of CIRIA SuDS Manual

Type of SuDS Component	**Total Suspended Solids (TSS)**	**Metals**	**Hydro-Carbons**
Attenuation Basins	0.5	0.5	0.6

9.7 The mitigation indices for Attenuation Basins exceed those of the highest pollution hazard index figures from Table 9.1.

9.8 The above evidence shows how the Attenuation Basins may be constructed to provide sufficient pollution mitigation on their own, prior to discharge to surface water.

10.0 Residual Risk

10.1 Whilst the drainage strategy for the site has been designed to current standards, there would remain a small residual risk of flooding due to blockage or failure of on-site infrastructure. Therefore, appropriate and regular maintenance of the drainage infrastructure should be undertaken by the site management company or their agents (and the residents, where applicable).

10.2 To assist with this process, a Drainage Management and Maintenance Plan has been prepared, which sets out the principles for the long-term management and maintenance of the proposed surface water drainage system on the development. The Drainage Management and Maintenance Plan can be seen in **Appendix M**.

10.3 The purpose of this document is to ensure that those responsible for site maintenance have a robust inspection and maintenance plan going forwards. This will help ensure the optimum operation of the surface water drainage system and that it will be regularly maintained for the lifetime of the development. This will contribute to reducing the risk of surface water flooding both on- and off-site.

11.0 Summary and Conclusions

11.1 This FRA and Drainage Strategy has been produced by Motion on behalf of Broadbridge Heath Trust. It supports the planning application for the construction of 59 residential dwellings at Land to the east of Tilletts Lane, Warnham.

11.2 On the basis the FRA indicates the site lies within Flood Zone 1 - i.e. land assessed as having less than a 0.1 per cent (1 in 1000) chance of river flooding occurring each year as defined in Government Guidance on Flood risk and coastal change - and the flood risk assessment indicates a low risk of flooding from all sources both now and in the future, sequential and exception tests are indicated not to be required for the proposed development.

11.3 The drainage strategy has been designed in accordance with the design criteria outlined in West Sussex County Council's LLFA Policy for the Management of Surface Water. This ensures that the current drainage strategy accords with local policy requirements (as well as those of the NPPF). In brief, this includes:

- Using FEH Annual Maximum Catchment data rather than FSR data. It should be noted that FEH 2022 has been used, although in certain cases InfoDrainage does not acknowledge this dataset and assumes that it is 2013 and labels it as such.
- 10 % Urban Creep allowance has been applied for property curtilage.
- Using a runoff coefficient (CV) value of 1.0 in all hydraulic modelling (for both summer and winter storms, both of which have been assessed in the model).
- The full suite of rainfall events has been used.

11.4 Rainwater harvesting tanks will provide a total storage volume of around 146.9 m^3 as part of the proposed development.

11.5 As detailed in Chapter 2 infiltration techniques are not viable on site, however surface water run-off from the existing site drains by a network of ditches, ordinary watercourses and culverts to Boldings Brook approximately 950m east of the site.

11.6 The surface water drainage strategy for the development will look to use Type C no infiltration pervious pavements and attenuation basins for the attenuation of surface water runoff. A HydroBrake Flow Control Chamber will control surface water discharge from the site to 8.60 l/s for the 100 year + 45% climate change critical rainfall event to an existing onsite ditch.

11.7 The results of the hydraulic modelling shows that the surface water drainage strategy as outlined above can attenuate and discharge the surface water generated in the 1 in 100-year + 45% critical rainfall event, inclusive of a 10% uplift due to urban creep, without flooding. This manages flood risk on- and off-site and reduces overall local flood risk.

11.8 Additionally, the Interpave document Guide to the Design, Construction and Maintenance of Concrete Block Permeable Pavements edition 6 states 'permeable pavements reduce the volume of rainfall that flows out from them significantly and the time it takes for the water to flow out is much longer than for conventional drainage systems. Studies reported in CIRIA report C 582 (CIRIA, 2001) have shown that some 11% to 45% of rainfall flows out from the pavement during a rainfall event. Subsequently over the 2 to 4 days after an event, more water flows out to give a total outfall of between 55% and 100%'. On this basis, it is concluded that the long-term storage volumes provided by the widespread extent of Pervious Pavements proposed as part of the development are likely to be more than what is indicated by the half drain times in the hydraulic calculations.

11.9 Using the Southern Water Developer Services Foul Flow Excel Calculation, the gravity foul flow rate from the proposed development for 59 dwellings is estimated be 0.53 l/s, therefore the capacity check undertaken by Southern Water confirms there is sewer capacity for the proposed development.

11.10 If for any reason a gravity connection to the Southern Water foul sewer network is not possible, a location for a pumping station has also been set aside as part of the development as part of a precautionary approach. In the scenario a pumping station is required, it is envisaged the rising main would exit the site via the proposed vehicle access.

11.11 The proposed surface water drainage strategy is able to mitigate all pollution hazards created on site using SuDS features and no further pollution mitigation is needed.

11.12 Residual risk has been addressed through the development of a drainage management and maintenance plan that provides a framework through which the site's drainage system should be managed in perpetuity.

11.13 In conclusion, the site is at low risk of flooding and the proposed drainage strategy can discharge the 1 in 100-year + 45% critical rainfall event with no flooding. As such, flood risk and surface water management should not form an impediment to the progress of this planning application.

Appendix A

Proposed Site Layout

Scale 1:500

Masterplan

Knob Hill, Warnham

Scale:1:500 @ A1
Drawing Number: 6294-PL101 Rev | 2024/06| Drawn By: LL/CB

ADAM ARCHITECTURE
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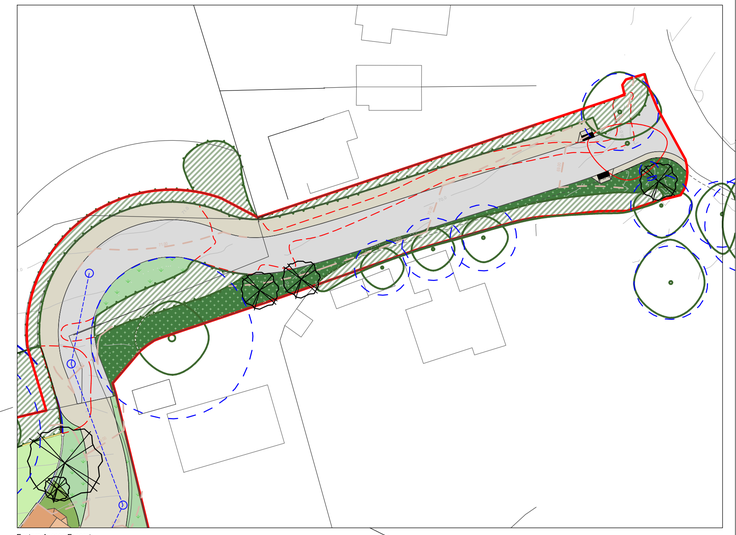
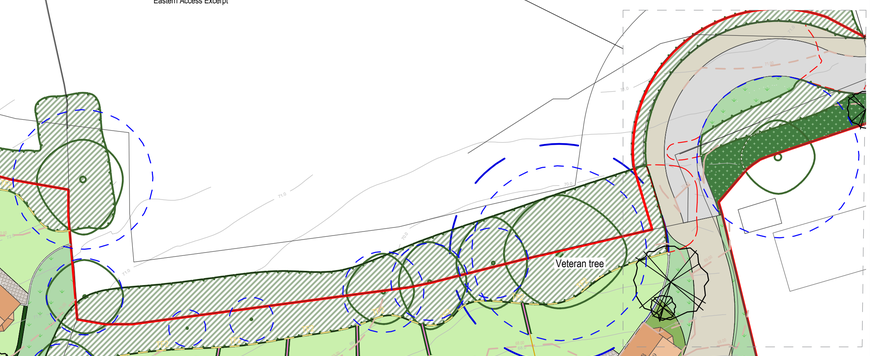


Eastern Access Excerpt



0m 10m 20m

north

- All dimensions in millimetres unless otherwise indicated. All levels in metres relative to Ordnance Datum and are positive (AOD) unless otherwise indicated.
- Figure dimensions only to be taken from this drawing. Dimensions and levels to be checked on site.
- Do not re-scale this drawing.
- All civil/structural matters including existing and proposed services, sub-base construction, site structures and retaining walls are subject to design/confirmation by an appropriately qualified Engineer. Refer to information by others.
- The original version of this drawing was produced in colour - monochrome copies should not be relied upon to accurately reflect all drawing elements.
- This drawing has been prepared for planning purposes only and should not be used for quantification, tender or construction.

- Site boundary
- Existing tree to be retained and protected in accordance with BS 5837:2012 - refer to arboricultural report MDJAC-240.25-TRCA-01 by MDJ Arboricultural consultancy limited dated June 2024
- Root Protection Area - refer to arboricultural report. To remain undisturbed and uncompacted (no material or equipment storage permitted)
- Veteran tree buffer
- Existing tree to be removed
- 10m ecological buffer zone
- Existing contours
- Proposed Contours (1m intervals)
- Existing scrub retained
- Proposed tree
- Proposed fruit tree
- Proposed espalier fruit trees to walls /trellis
- Proposed woodland planting
- Proposed native shrub planting
- Proposed hedge
- Proposed ornamental planting beds
- Proposed wildflower meadow
- Proposed amenity grass
- Proposed climbers to bulb succession & herb beds adjacent to walls and fences
- Play area with safety surfacing where required
- Rain gardens
- Bark mulch
- TF1 Jackson's Estate railing fencing (or equivalent), black finish, with gates
- TF2 Jackson's Timber Post and Rail fencing (or equivalent)
- TF3 Jackson's Timber knee rail (or equivalent)
- TF4 Jackson's Timber picket fence (or equivalent)
- Wattle fence - 1.5m ht and planted on both sides with native hedge
- TF5 Jackson's Closeboard Fence (or equivalent)
- 125mm raised kerb
- DK Dropped kerb
- Gapped kerb to rain gardens
- Shared surface: Sureset Permeable Resin bound gravel - Pearl Jam
- Vehicular Bitmac with Marshalls (or equivalent) Conservation Kerb throughout
- Permeable Block paved (Parking areas) Marshall Tegula Permeable Paving - Traditional
- Footpath: Sureset Permeable Resin bound gravel - Barley Butter (or equivalent)
- Slab paving Marshall Conservation x Paving (or equivalent) Cream, Size 600x600mm
- Silva cell system under trees in streetscape
- Timber bench
- Timber seat (with back)
- Timber bollards - Broxap BX17 Domed -Square (or equivalent)
- Proposed ditch/swales
- Proposed attenuation basin
- Gravel Strip
- TigerMulch - for playground surface

Note:
- Play equipment shown indicitively
- Lighting to be added at later date once known.

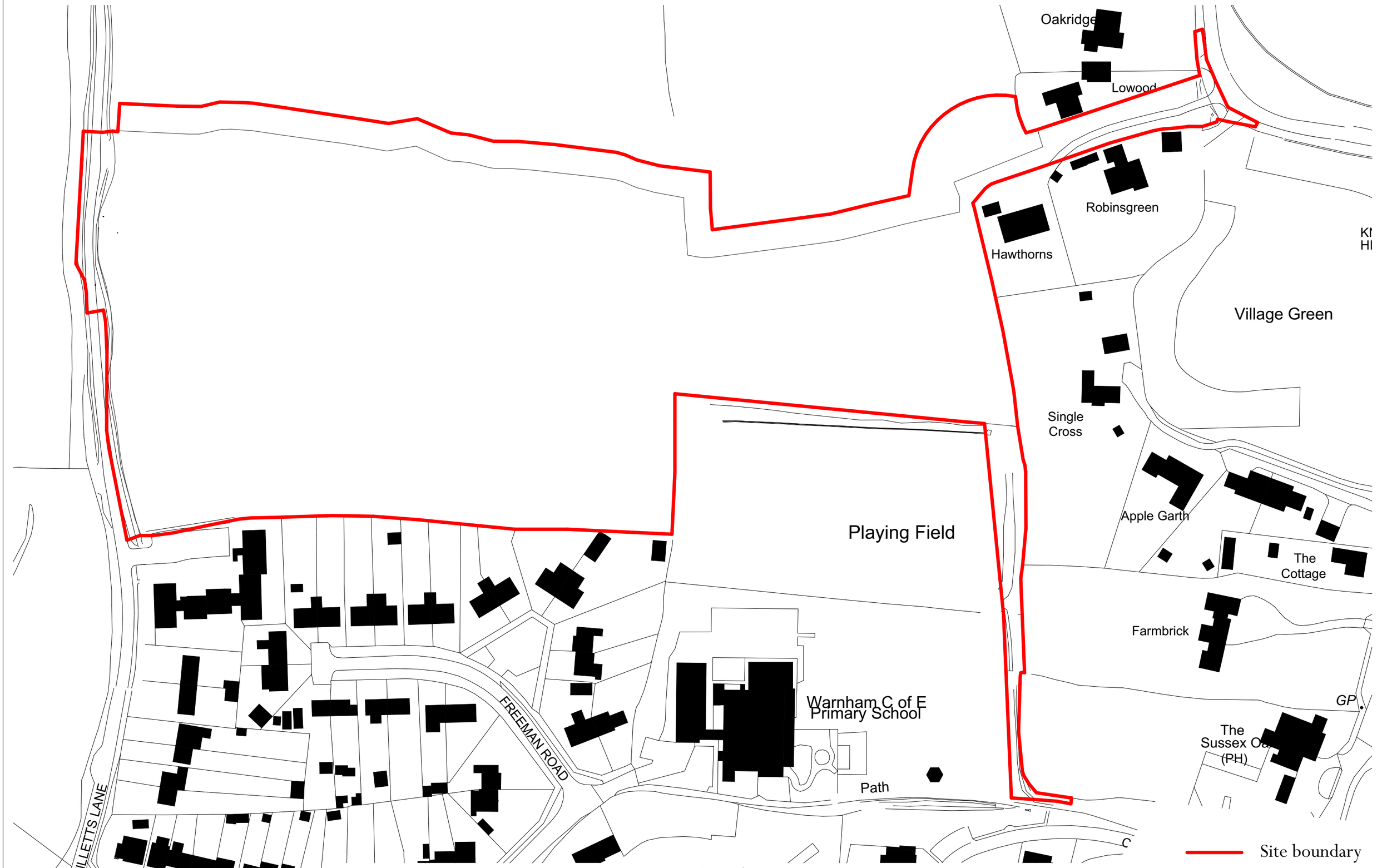
rev.	date	by	chk	notes
P05	30/04/25	NC	LF	Drainage layout added
P04	25/04/25	NC	LF	LAP & LEAP areas added
P03	08/04/25	NC	LF	Updated proposed contours
P02	03/03/25	NC	LF	Updated according to architect's plans
P01	25/02/25	EF/TJ	LF	First issue

project	Tillets Lane, Warnham
title	Landscape Masterplan
status	Stage 3
scale @ A1	1:500
dwg no	2516-TFC-XX-00-DR-L-1001

terrafirma LANDSCAPE ARCHITECTS
Suite B, Ideal House, Bedford Road, Petersfield, Hampshire GU32 3QA Tel: +44 (0)1730 262 060 Web: www.terrafirmaconsultancy.com

Appendix B

Site Location Plan



Site Location Plan

Knob Hill, Warnham

Scale:1:1250 @ A3

Drawing Number: 6294-PL100 Rev 01 | 2024/06 | Drawn By: LL/CB

ADAM ARCHITECTURE

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Appendix C

EA Flood Map for Planning

Flood map for planning

Your reference	Location (easting/northing)	Created
1lbwar 2404044	**515621/133927**	**7 May 2025 17:07**

Your selected location is in flood zone 1, an area with a low probability of flooding.

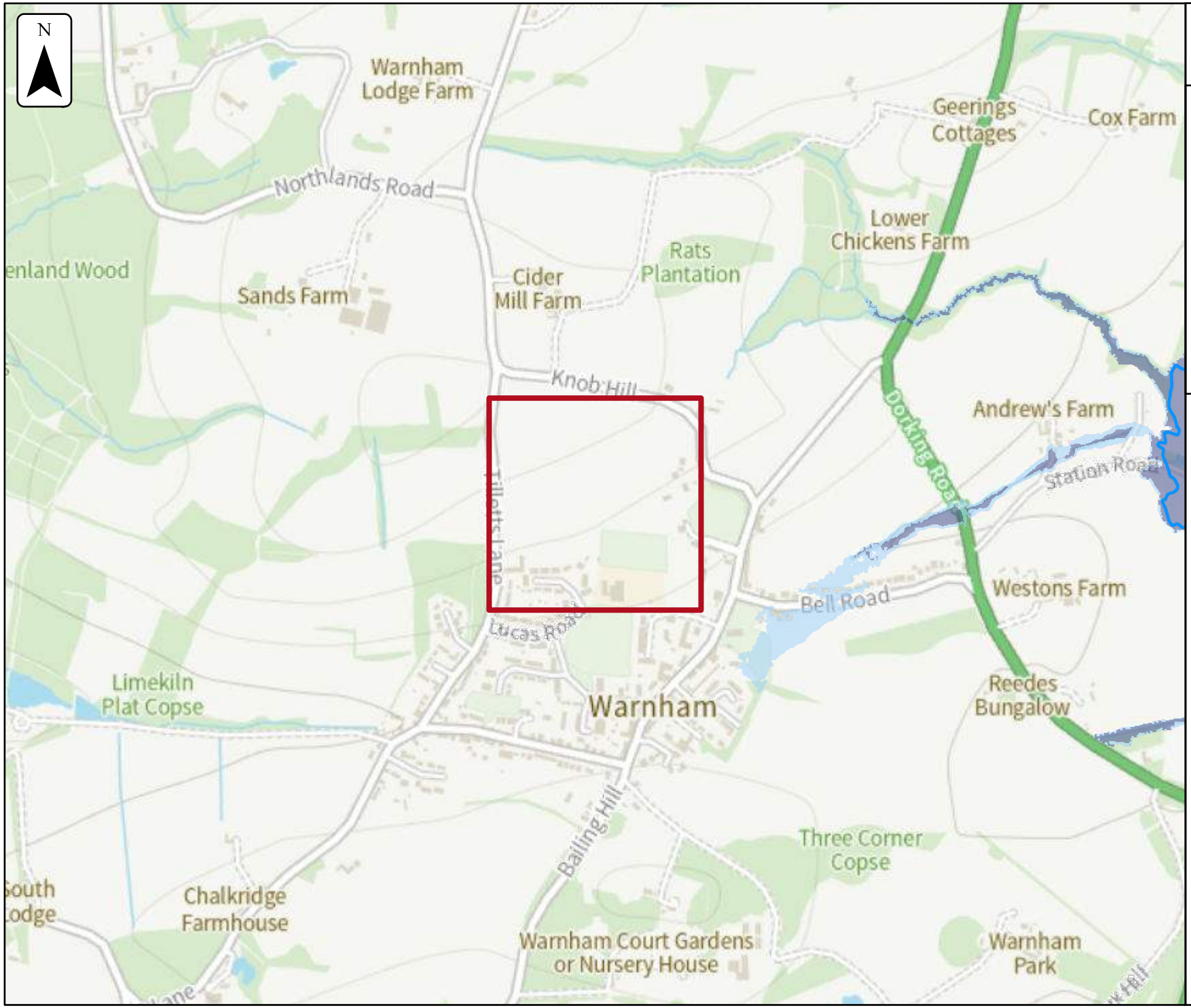
You will need to do a flood risk assessment if your site is **any of the following**:

- bigger than 1 hectare (ha)
- in an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
1lbwar 2404044

Location (easting/northing)
515621/133927

Scale
1:10,000

Created
7 May 2025 17:07

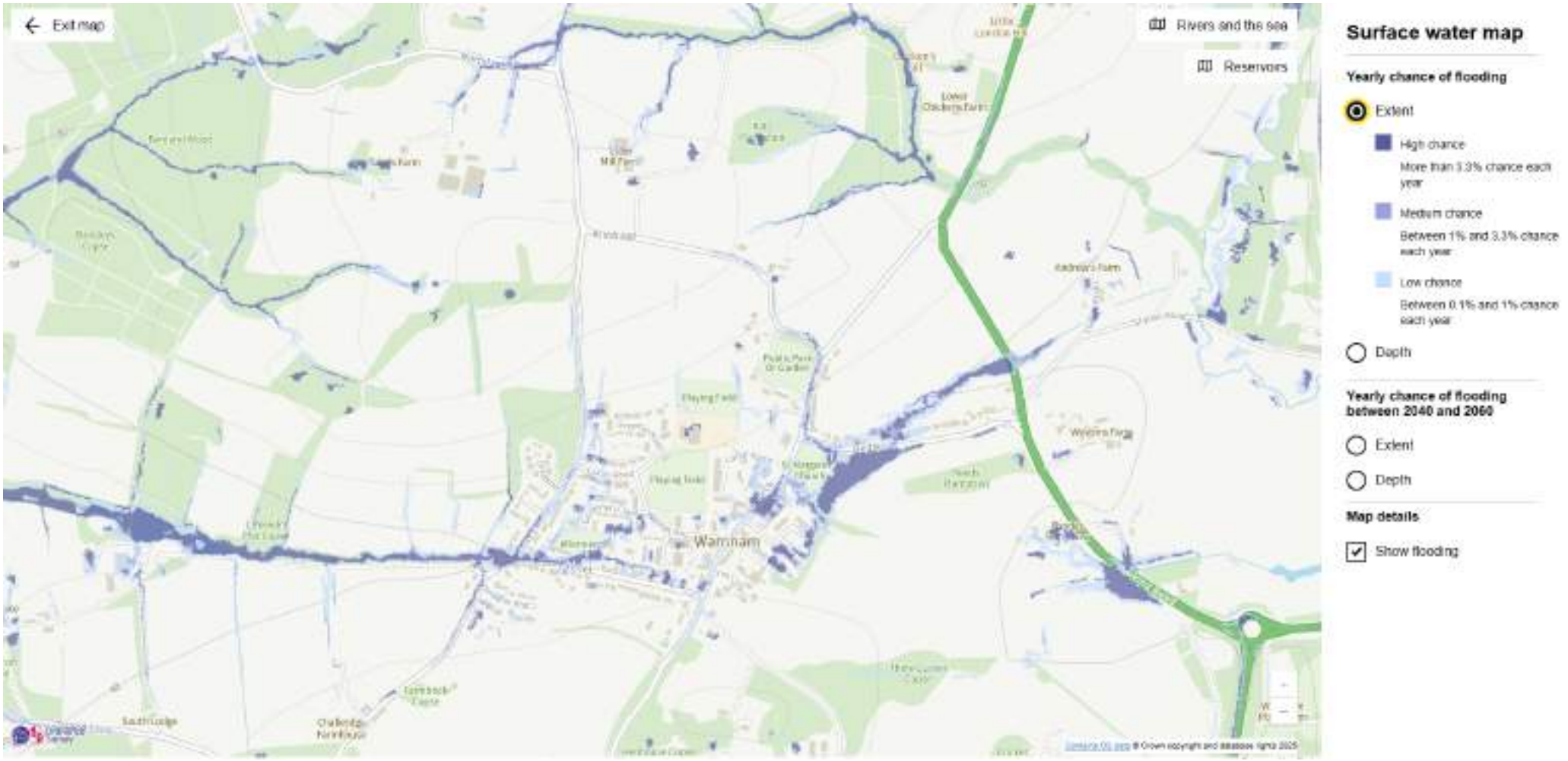
- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 100 200 300m

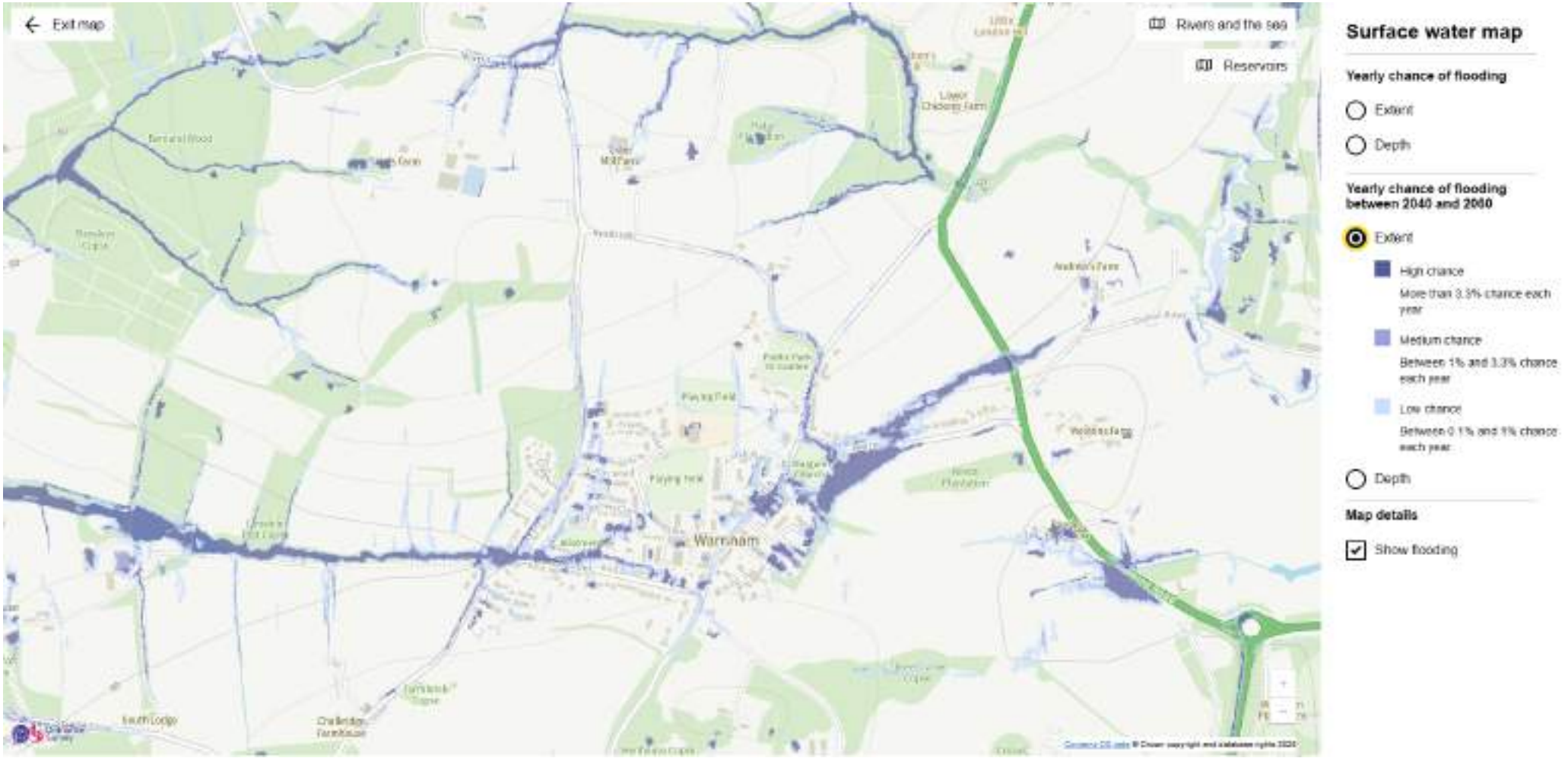
Appendix D

RoFSW Extent and Depth and Maximum Extent of Flooding from Reservoirs Maps

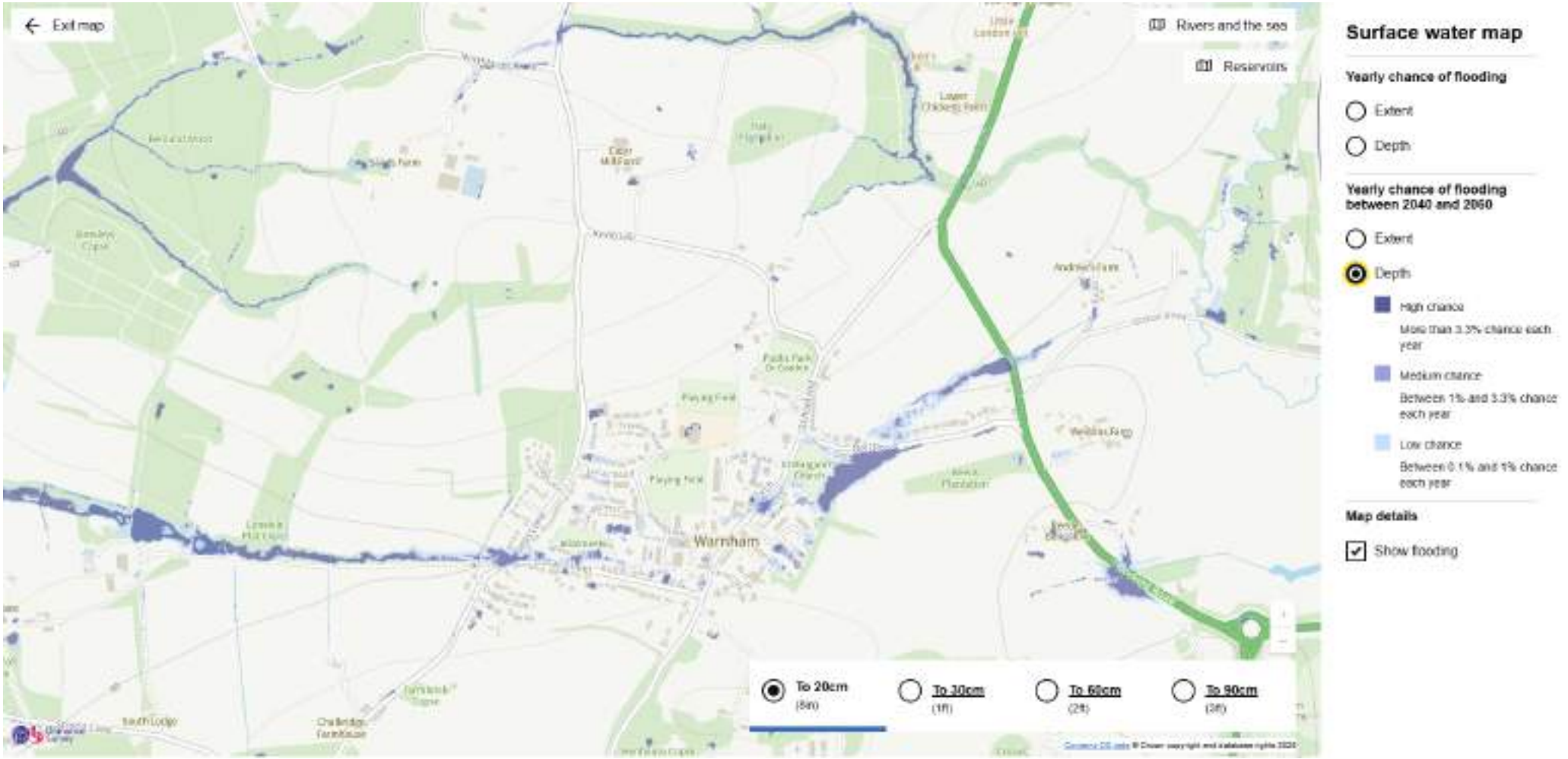
Surface Water Flood Risk (Extent)



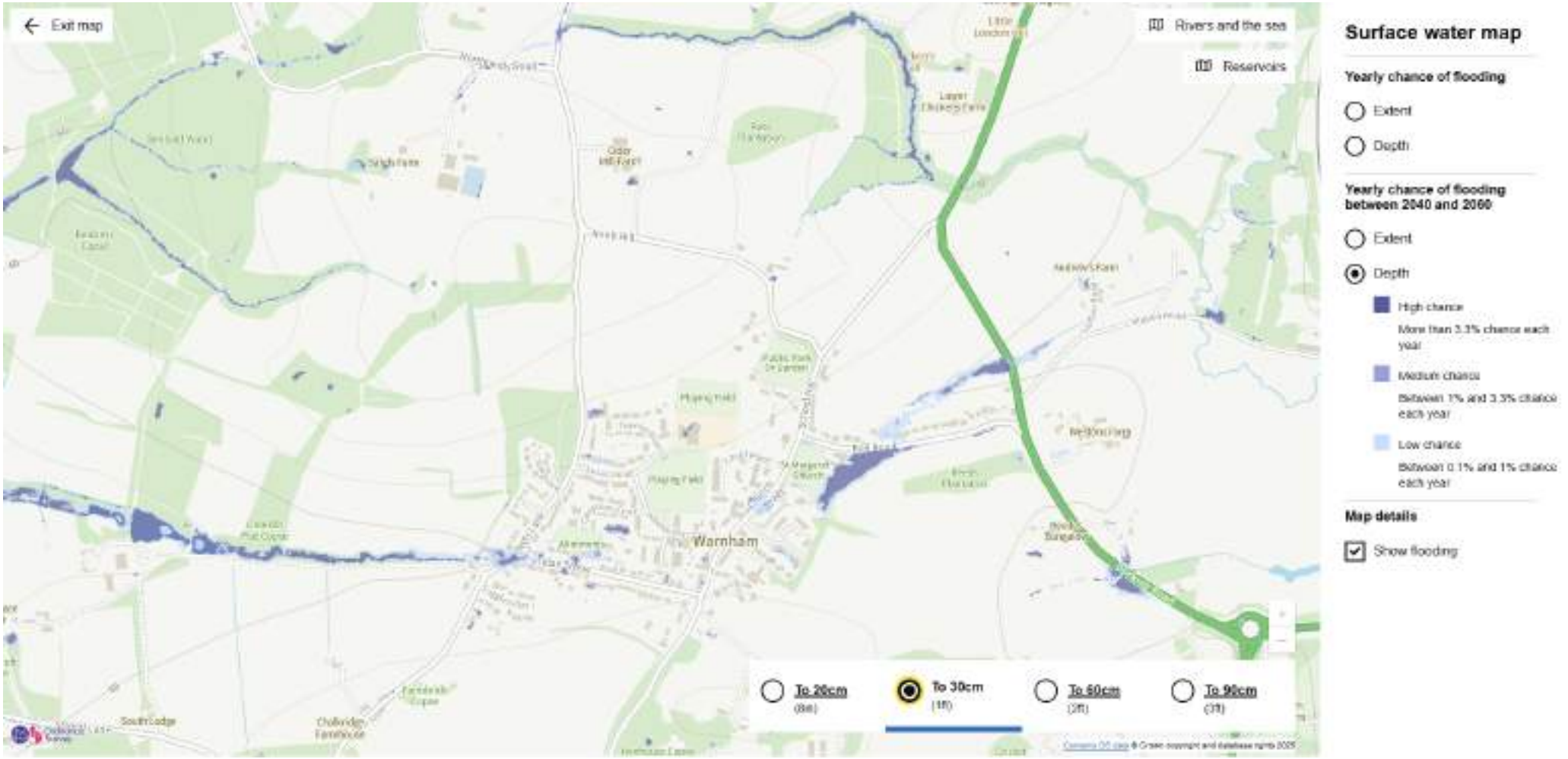
Surface Water Flood Risk (Extent)



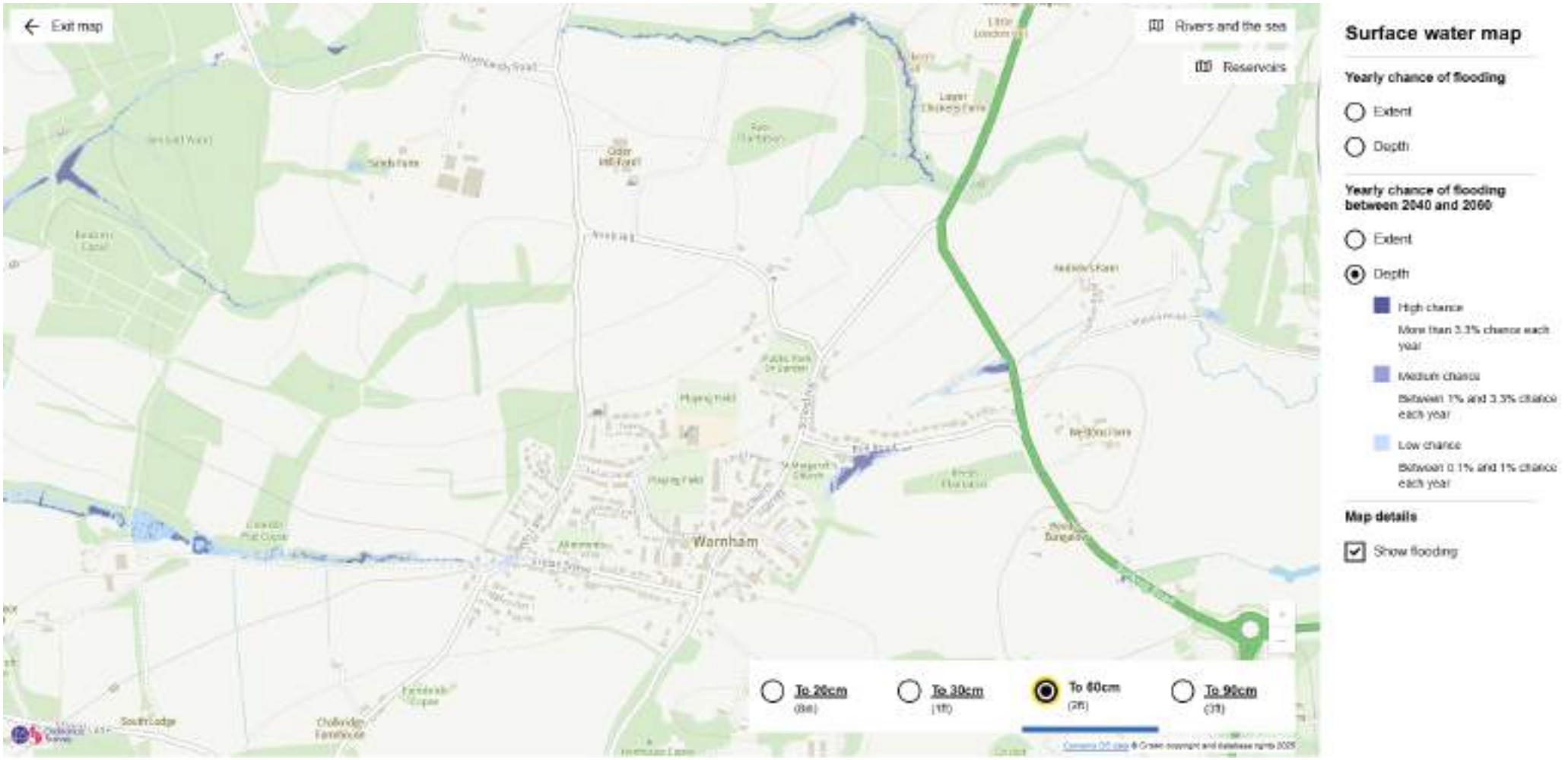
Surface Water Flood Risk (Depth)



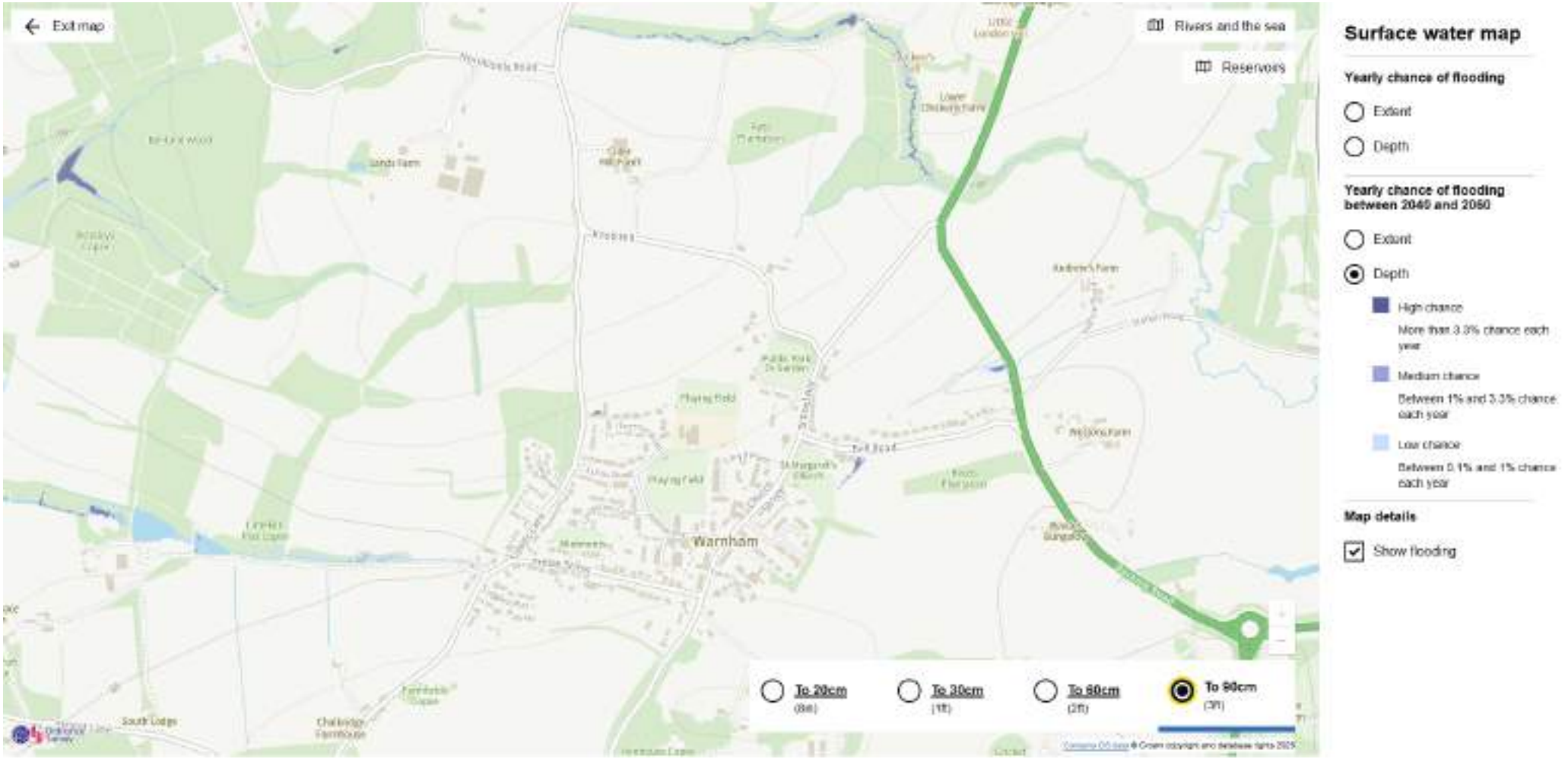
Surface Water Flood Risk (Depth)



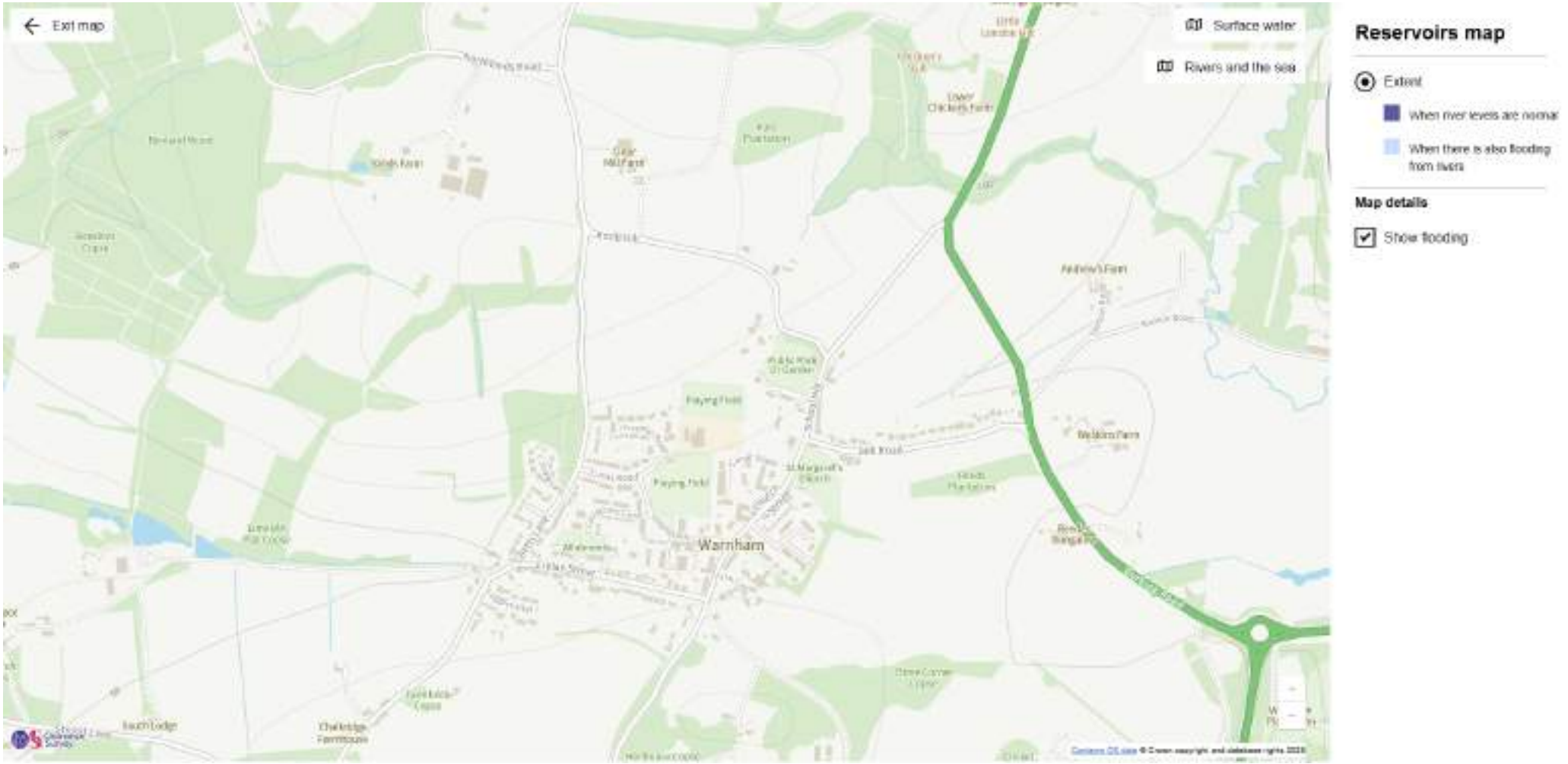
Surface Water Flood Risk (Depth)



Surface Water Flood Risk (Depth)



Reservoir Flooding



Appendix E

Topographic Survey

A1

Do Not Scale

NOTES

1. The Grid and Levels are orientated to OS Active Grid using OSTN 15.
2. Please request any survey control information if required.
3. Surveyed boundary features are not necessarily legal boundaries.
4. Dimensions should not be scaled. All dimensions should be checked on site before any fabrication / construction.
5. Copyright of all data produced by InCo Surveys shall remain with InCo Surveys unless otherwise specifically agreed.
6. Information provided should not be altered or modified in any way. It should not be used for any purpose other than for which it was intended and should not be issued to other parties without prior agreement.
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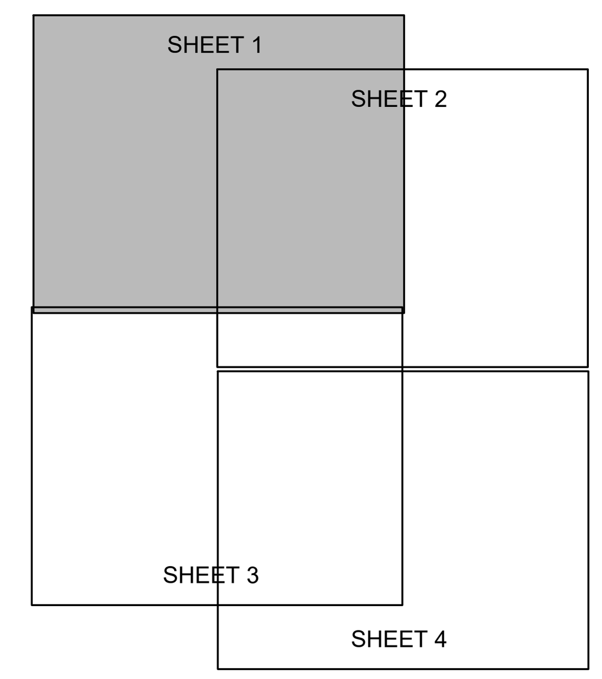
10. All pipe diameters and levels are assumed to be correct, however due to non entry to inspection chambers, these should be verified before any works commence.
11. External eaves levels are surveyed to lowest tile position.

North

LEGEND
B - Bollard
CL - Cover Level
EAV - Eaves Level
FH - Fire Hydrant
FPO - Fence Post
GV - Gas Valve
IC - Inspection Cover
IL - Invert Level
LP - Lamp Post
MT - Multi Trunk
RID - Ridge Level
RS - Road Sign
SC - Stop Cock
SV - Sluice Valve
TK - Top of Kerb
TW - Top of Wall
WM - Water Meter
WO - Wash Out

KEYPLAN



Rev	Revised By	Date	Revision

Project
LAND OFF TILLETTS LANE
WARNHAM, HORSHAM
WEST SUSSEX

Drawing Title
TOPOGRAPHIC SURVEY

16 Allcard Close
Horsham
RH12 5AJ
Tel No: 07867411903

www.incosurveys.co.uk

InCo Surveys

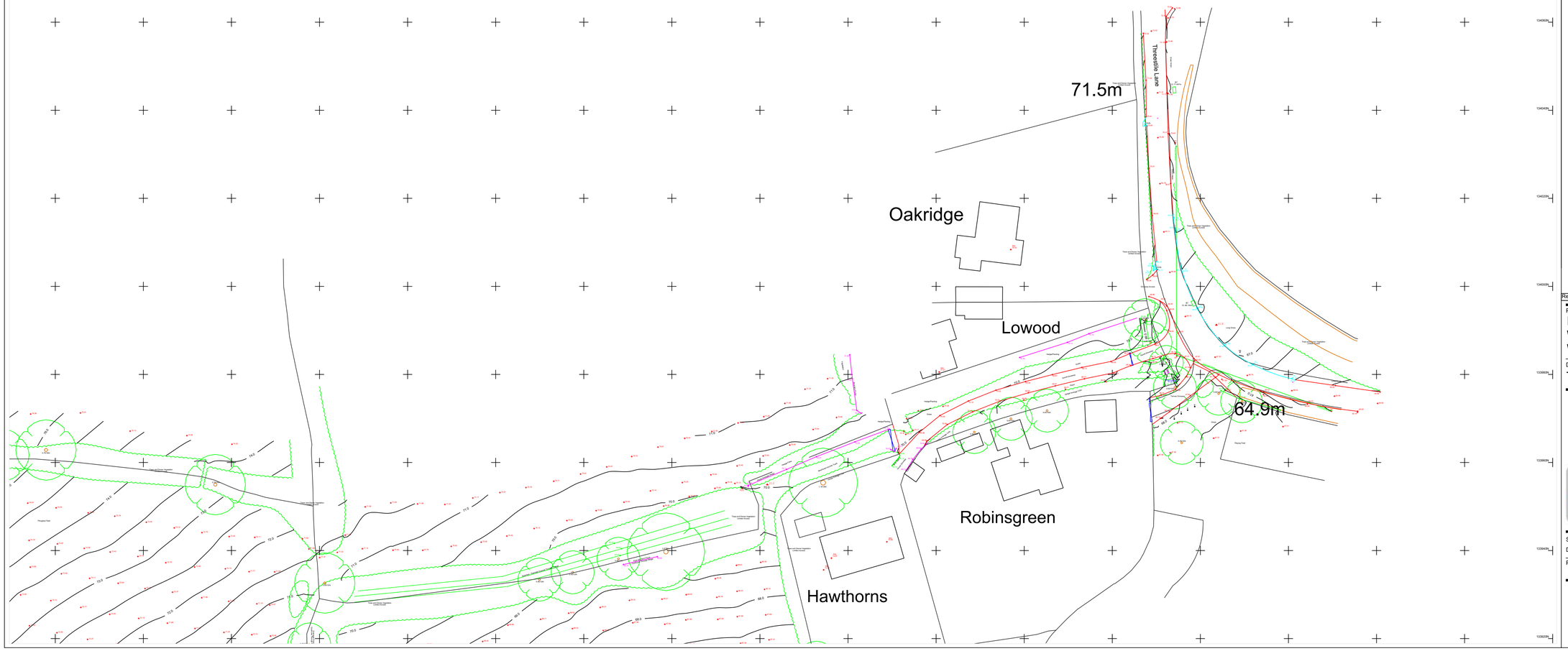
Surveyed: M.Jones May 2024
Drawn: M.Jones May 2024

Project No.	Drawing Status	Scale (@ A1)
S24852	INFORMATION	1:500

TOPOGRAPHIC SURVEY
Sheet 1 of 4

A1

Do Not Scale



NOTES

1. The Grid and Levels are orientated to OS Active Grid using OSTN 15.
2. Please request any survey control information if required.
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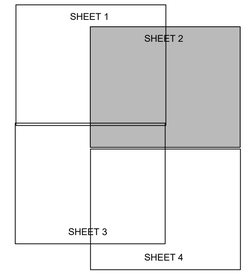
KEYPLAN



Rev	Revised By	Date	Revision

Project
LAND OFF TILLETTS LANE
WARNHAM, HORSHAM
WEST SUSSEX

Drawing Title
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16 Allcard Close
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InCo Surveys

Surveyed:	M.Jones	May 2024
Drawn:	M.Jones	May 2024

Project No.	Drawing Status	Scale (@ A1)
S24852	INFORMATION	1:500

TOPOGRAPHIC SURVEY
Sheet 2 of 4

A1

Do Not Scale

NOTES

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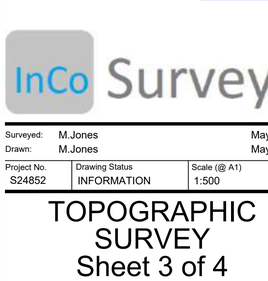
KEYPLAN



Rev	Revised By	Date	Revision

Project
LAND OFF TILLETTS LANE
WARNHAM, HORSHAM
WEST SUSSEX

Drawing Title
TOPOGRAPHIC SURVEY

16 Allcard Close
Horsham
RH12 5AJ
Tel No: 07867411903

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Surveyed:	M.Jones	May 2024
Drawn:	M.Jones	May 2024

Project No.	Drawing Status	Scale (@ A1)
S24852	INFORMATION	1:500

TOPOGRAPHIC SURVEY
Sheet 3 of 4

A1

Do Not Scale

NOTES

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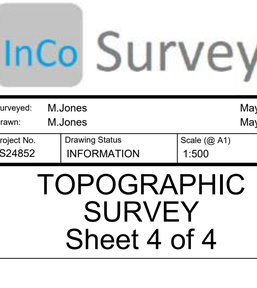

Rev	Revised By	Date	Revision

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S24852	INFORMATION	1:500

TOPOGRAPHIC SURVEY
Sheet 4 of 4

Appendix F

Southern Water Wastewater Plan and Capacity Check Response

(c) Crown copyright and database rights 2024 Ordnance Survey 100031673 | Date: 10/04/24 | Scale: 1:1250 | Map Centre: 515518,133809 | Data updated: 12/01/24 | Our Ref: 1441347 - 1 | Wastewater Plan A1

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2024 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Foul Gravity Sewer | Combined Gravity Sewer | Culverted Water Course or Treated Effluent | Surface Water Gravity Sewer | Rising Main, Vacuum or Syphon | Combined Pumping Station | Foul Pumping Station | Water Treatment Works | Section 104 Area | Building Over Agreement Area | Foul Manhole | Combined Manhole | Surface Water Manhole | Dish Entry Manhole, Devonshire Chamber, Dummy Manhole or Surface Water Soakaway | Combined Outfall | Foul Outfall | Surface Water Outfall | Surface Water Inlet

ljagiela@motion.co.uk

Tillets Lane Warnham

WATER for LIFE from Southern Water

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0701	F	53.41	50.06	
2401	F	49.03	47.60	
2501	F	48.16	46.96	
2601	F	0.00	0.00	
2602	F	0.00	0.00	
2603	F	0.00	0.00	
2604	F	0.00	0.00	
3401	F	0.00	0.00	
3402	F	49.19	47.88	
3403	F	0.00	0.00	
3501	F	51.71	50.31	
3502	F	52.26	51.03	
3505	F	0.00	0.00	
3601	F	55.23	0.00	
3602	F	54.93	53.55	
3603	F	57.70	55.75	
3604	F	55.75	54.39	
3605	F	0.00	0.00	
3606	F	0.00	0.00	
3607	F	0.00	0.00	
4501	F	51.17	50.45	
4502	F	52.94	51.41	
4504	F	55.39	53.22	
4505	F	54.29	52.53	
4506	F	0.00	0.00	
4507	F	0.00	0.00	
4508	F	0.00	0.00	
4601	F	59.31	0.00	
4602	F	56.79	55.67	
4603	F	57.03	55.49	
4604	F	55.90	54.00	
4605	F	0.00	0.00	
4701	F	0.00	0.00	
4702	F	0.00	0.00	
4703	F	0.00	0.00	
4704	F	0.00	0.00	
4705	F	0.00	0.00	
4706	F	0.00	0.00	
5403	F	0.00	0.00	
5404	F	0.00	0.00	
5502	F	55.59	54.18	
5503	F	55.35	53.82	
5504	F	0.00	0.00	
5601	F	56.05	54.95	
5602	F	58.53	57.19	
5604	F	57.05	55.14	
5605	F	55.68	55.14	
5607	F	0.00	0.00	
5701	F	64.99	63.70	
5702	F	62.44	61.06	
5703	F	59.85	58.56	
5704	F	60.48	58.93	
6501	F	57.15	54.75	
6502	F	0.00	0.00	
6503	F	0.00	0.00	
6701	F	61.88	60.42	
7401	F	57.52	55.70	
7501	F	57.01	54.34	
7502	F	56.49	53.84	
7503	F	55.84	53.55	
7504	F	55.27	53.32	
7601	F	0.00	0.00	
7602	F	0.00	0.00	
8401	F	55.63	53.97	
8501	F	55.61	54.05	
8502	F	55.25	53.76	
8503	F	55.45	53.57	
8504	F	55.11	53.40	
8505	F	54.65	53.11	
8506	F	0.00	0.00	
8507	F	54.87	52.66	
8601	F	54.91	52.85	
8602	F	54.89	52.48	
8603	F	0.00	0.00	
8604	F	0.00	0.00	
8701	F	55.71	53.11	
9501	F	53.66	51.83	
9502	F	53.17	0.00	
9503	F	54.70	52.48	
9504	F	53.96	51.96	
9601	F	0.00	0.00	
9602	F	0.00	0.00	
9603	F	0.00	0.00	
9604	F	0.00	0.00	
9605	F	0.00	0.00	
9703	F	54.79	52.62	
9704	F	53.93	51.44	
9801	F	59.32	57.29	
9802	F	59.06	57.26	
9803	F	58.52	56.64	
9804	F	57.41	0.00	
9805	F	0.00	0.00	
9806	F	57.49	56.15	
0751	S	53.48	0.00	
2452	S	49.31	0.00	
2456	S	49.10	0.00	
2550	S	49.25	0.00	
2551	S	49.40	48.63	
3550	S	52.00	50.46	
3551	S	50.37	49.53	
3650	S	57.62	56.05	
3651	S	55.62	53.32	
3652	S	60.27	58.65	
3653	S	55.12	53.11	
4551	S	51.20	49.75	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
4552	S	51.18	49.83	
4553	S	51.30	50.71	
4554	S	52.75	51.48	
4555	S	0.00	0.00	
4556	S	54.94	52.43	
4651	S	55.45	53.84	
4652	S	56.18	54.59	
4653	S	57.10	56.05	
4654	S	58.02	56.80	
4655	S	58.14	57.00	
4656	S	58.83	57.64	
5551	S	55.60	54.39	
5552	S	55.33	54.06	
5553	S	0.00	0.00	
5651	S	58.68	57.59	
5750	S	59.74	58.82	
6551	S	57.00	55.70	
6751	S	60.94	60.02	
6752	S	61.19	60.44	
7551	S	55.47	53.85	
7552	S	56.40	54.90	
7751	S	58.36	57.46	
8651	S	55.01	53.30	
8652	S	55.03	52.88	
8751	S	55.74	52.51	
8752	S	55.82	52.20	
9751	S	53.76	51.64	
9752	S	54.31	51.93	
9851	S	59.73	58.34	
9852	S	57.60	55.47	
9853	S	58.53	57.09	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

from Southern Water

Chris Gray
84 North Street
Guildford
Surrey
GU1 4AU

Your ref

Our ref
15078

Date
08 May 2024

Contact
Tel 0330 303 0119

Dear Mr Gray,

Level 1 Capacity Check Enquiry: Land to the east of Tillets Lane, Warnham, West Sussex, RH12 3RQ.

We have completed the capacity check for the above development site and the results are as follows:

Foul Water

There is currently adequate capacity in the local sewerage network to accommodate a foul flow of **0.54 l/s** for the above development at manhole reference TQ1533**8601**. Please note that no surface water flows (existing or proposed) can be accommodated within the existing foul sewerage system unless agreed by the Lead Local Flood Authority in consultation with Southern Water, after the hierarchy Part H3 of Building Regulations has been complied with.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: developerservices.southernwater.co.uk

Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

Please get in touch via the Get Connected customer dashboard if you have any queries.

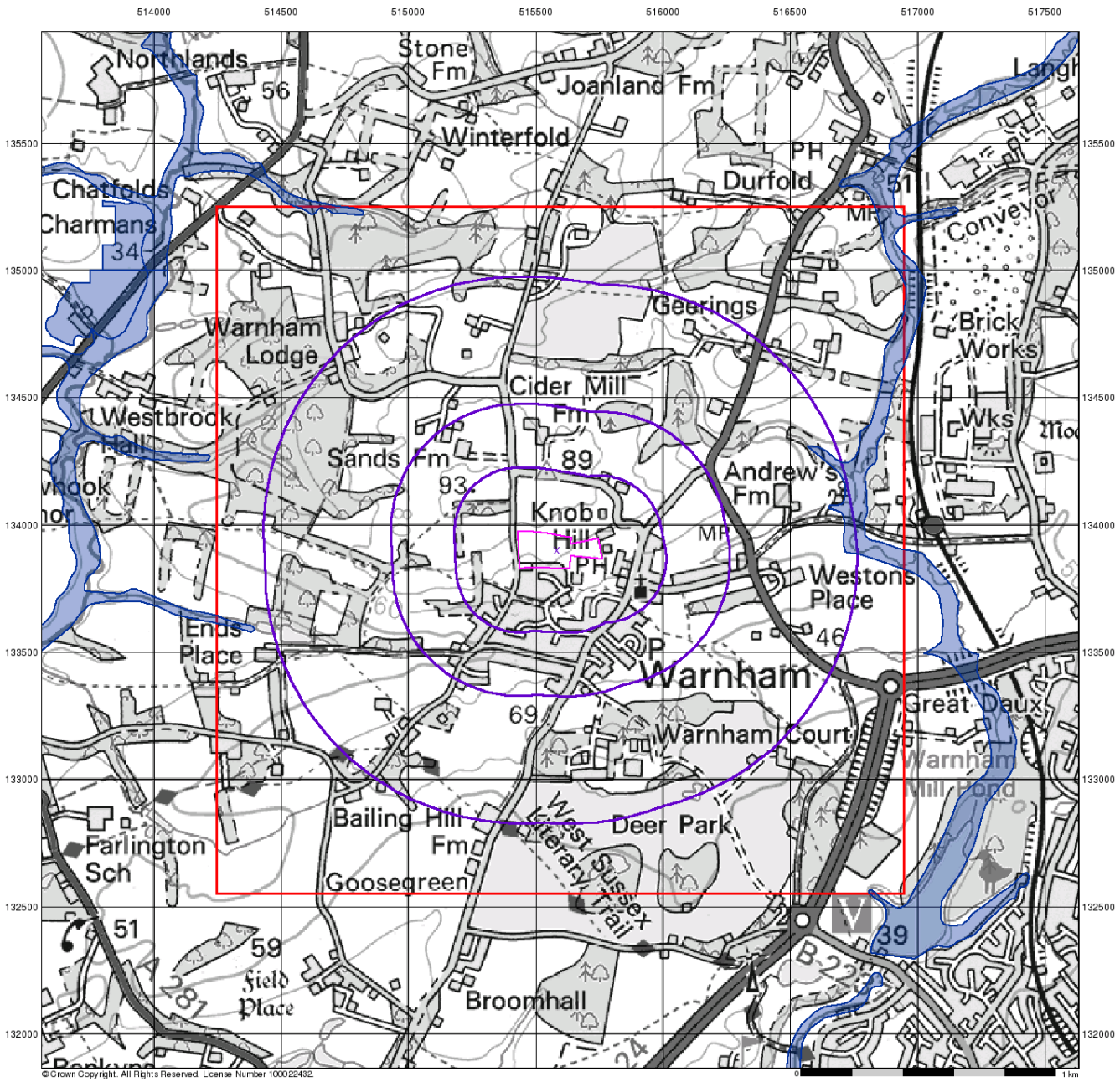
Yours sincerely,

Future Growth Planning Team
Developer Services

southernwater.co.uk/developing-building/planning-your-development

Appendix G

Groundwater Flooding Sustainability Mapping



motion

BGS Flood Data (1:50,000)

General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

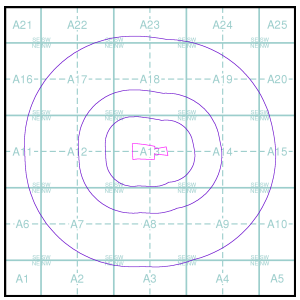
BGS Geological Indicators of Flooding

Coastal

Inland

Bodies of Water

BGS Flood Data Map - Slice A



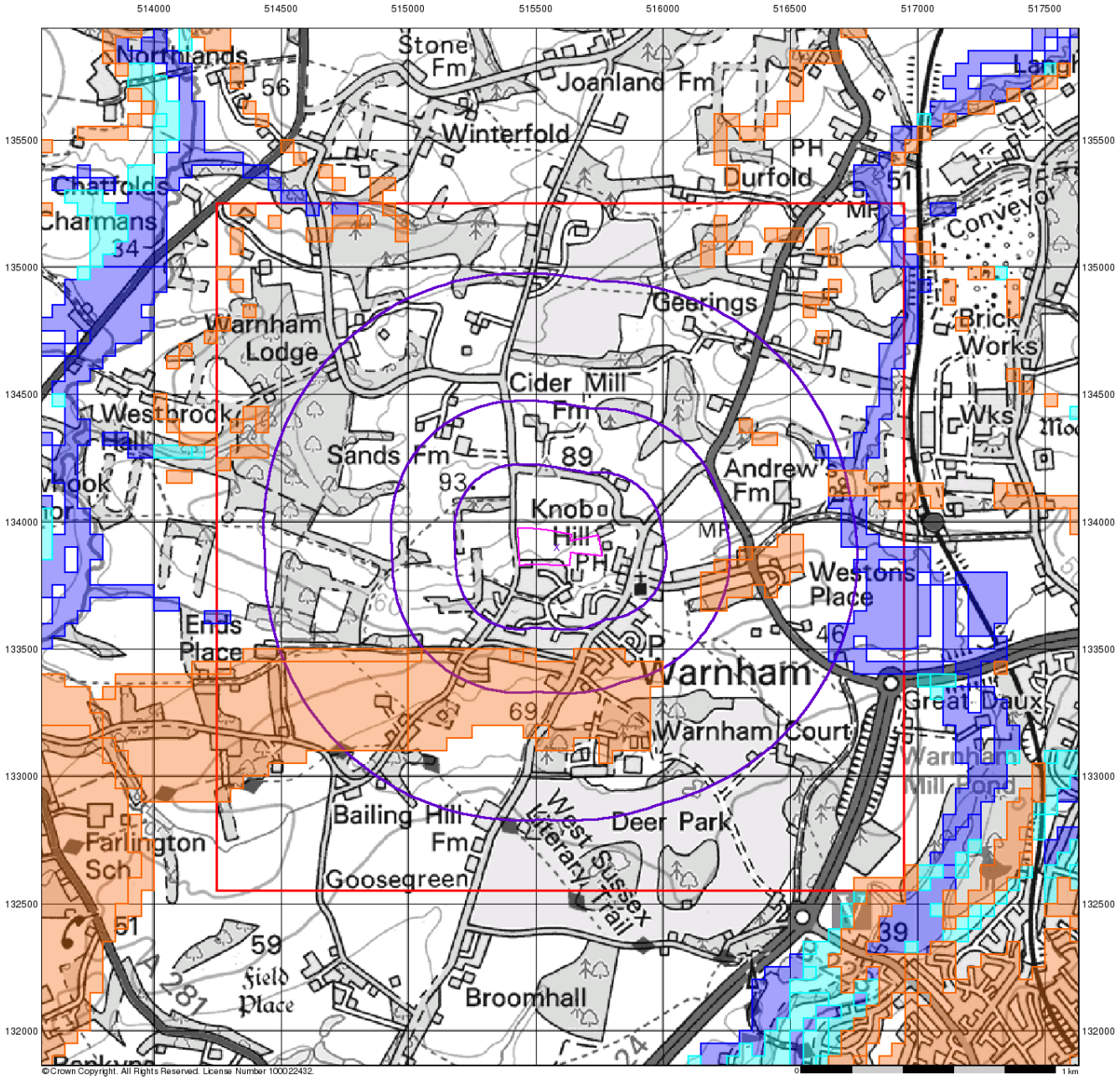
Order Details

Order Number:	342878905_1_1
Customer Ref:	1lbwar/2404044 - LJ
National Grid Reference:	515580, 133900
Slice:	A
Site Area (Ha):	3.51
Search Buffer (m):	1000

Site Details

Tillets Way, Warnham, Horsham, RH12 3RQ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



motion

BGS Flood Data (1:50,000)

General

Specified Site | Specified Buffer(s) | Bearing Reference Point

Slice | Map ID

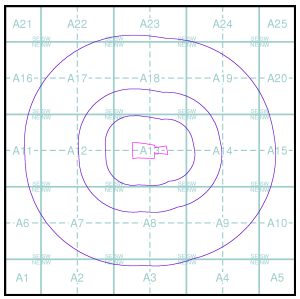
BGS Groundwater Flooding Susceptibility

Potential for Groundwater Flooding to Occur at Surface

Potential for Groundwater Flooding of Property Situated Below Ground Level

Limited Potential for Groundwater Flooding to Occur

BGS Flood Data Map - Slice A



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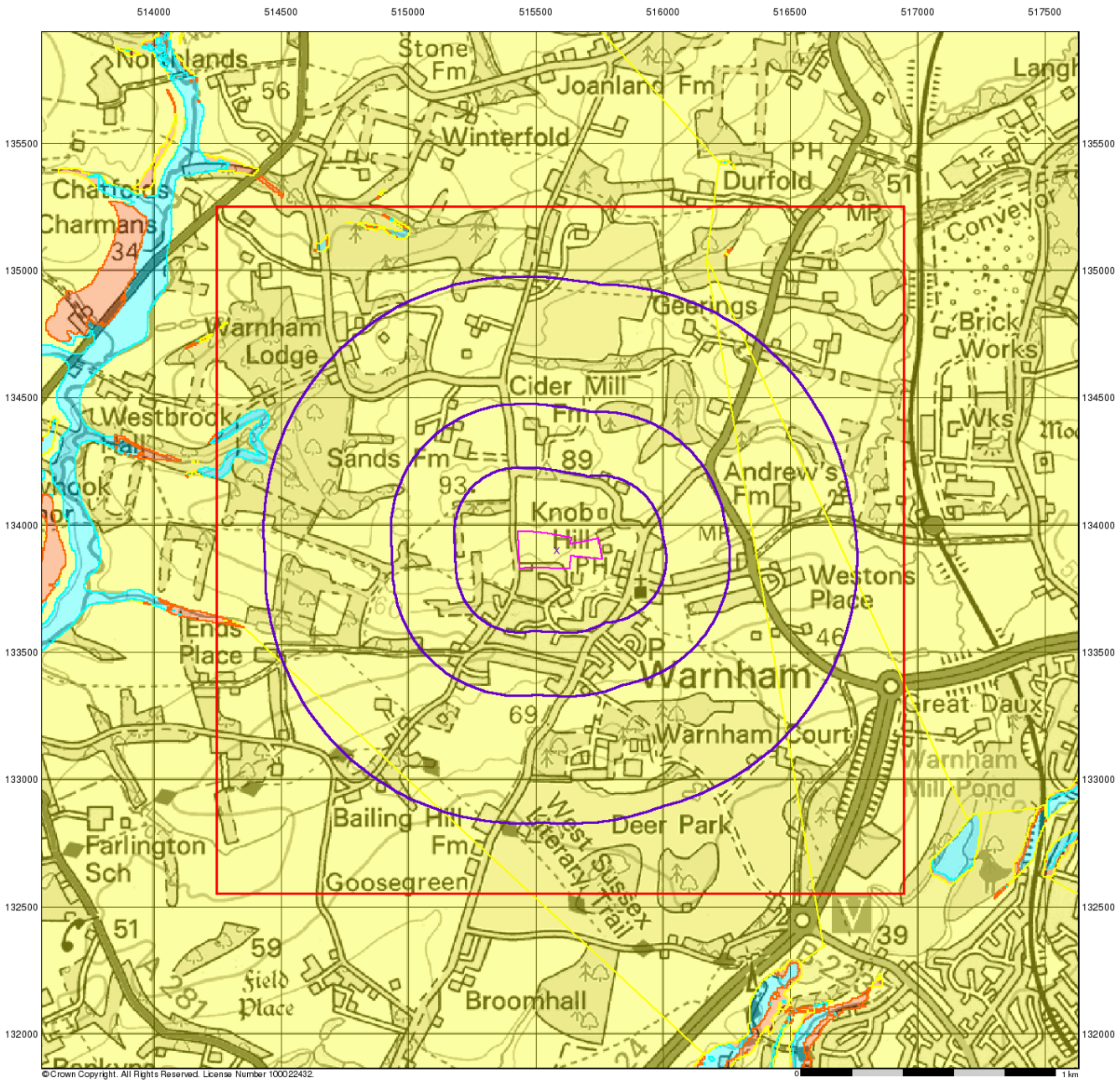


motion

GeoSmart Information Groundwater Flood Map (1:50,000)

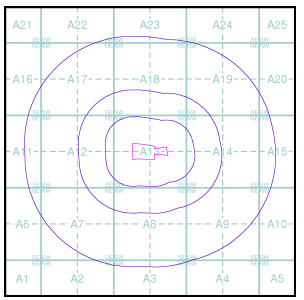
General

Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice

GeoSmart Information Groundwater Flooding Risk

High Risk
Moderate Risk
Low Risk
Negligible Risk

GeoSmart Information Groundwater Flood Map - Slice A



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Order Number:	342878905_1_1
Customer Ref:	1lbwar/2404044 - LJ
National Grid Reference:	515580, 133900
Slice:	A
Site Area (Ha):	3.51
Search Buffer (m):	1000

Site Details

Tillets Way, Warnham, Horsham, RH12 3RQ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

Appendix H

EA/NRW Historic Flood Map

motion

EA/NRW Historic Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

Historic Flood Events Data

- Channel Capacity Exceeded (no raised defences)
- Channel Capacity Exceeded /Surface Water
- Groundwater/High Water Table
- Local Drainage/Surface Water
- Mechanical Failure
- Obstruction/Blockage - Bridge
- Obstruction/Blockage - Channel
- Historical Flood Liabilities
- Obstruction/Blockage - Culvert
- Obstruction/Blockage - Debris Screen
- Operational Failure/ Breach of Defence
- Other
- Overtopping of Defences
- Surface Water
- Unknown

Contours (height in metres)

Standard Contour 105 100 95

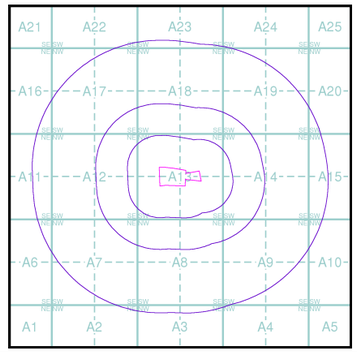
Master Contour

Spot Height *167.8

MLW Mean Low Water

MHW Mean High Water

EA/NRW Historic Flood Map - Slice A



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Slice:	A
Site Area (Ha):	3.51
Search Buffer (m):	1000

Site Details

Tillets Way, Warnham, Horsham, RH12 3RQ

Landmark INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

Appendix I

FEH QMED Calculations

Land to the east of Tilletts Lane, Warnham:	Date: 09/05/2025		
	Designed by: CC	Checked by: CG	Approved By: JM
Report Title: UK and Ireland Rural Runoff Calculator	Motion: 84 North Street Guildford GU1 4AU		

FEH

Details

Site Location	GB 516400 133950 TQ 16400 33950
Rainfall Version	2022
Data Type	Catchment

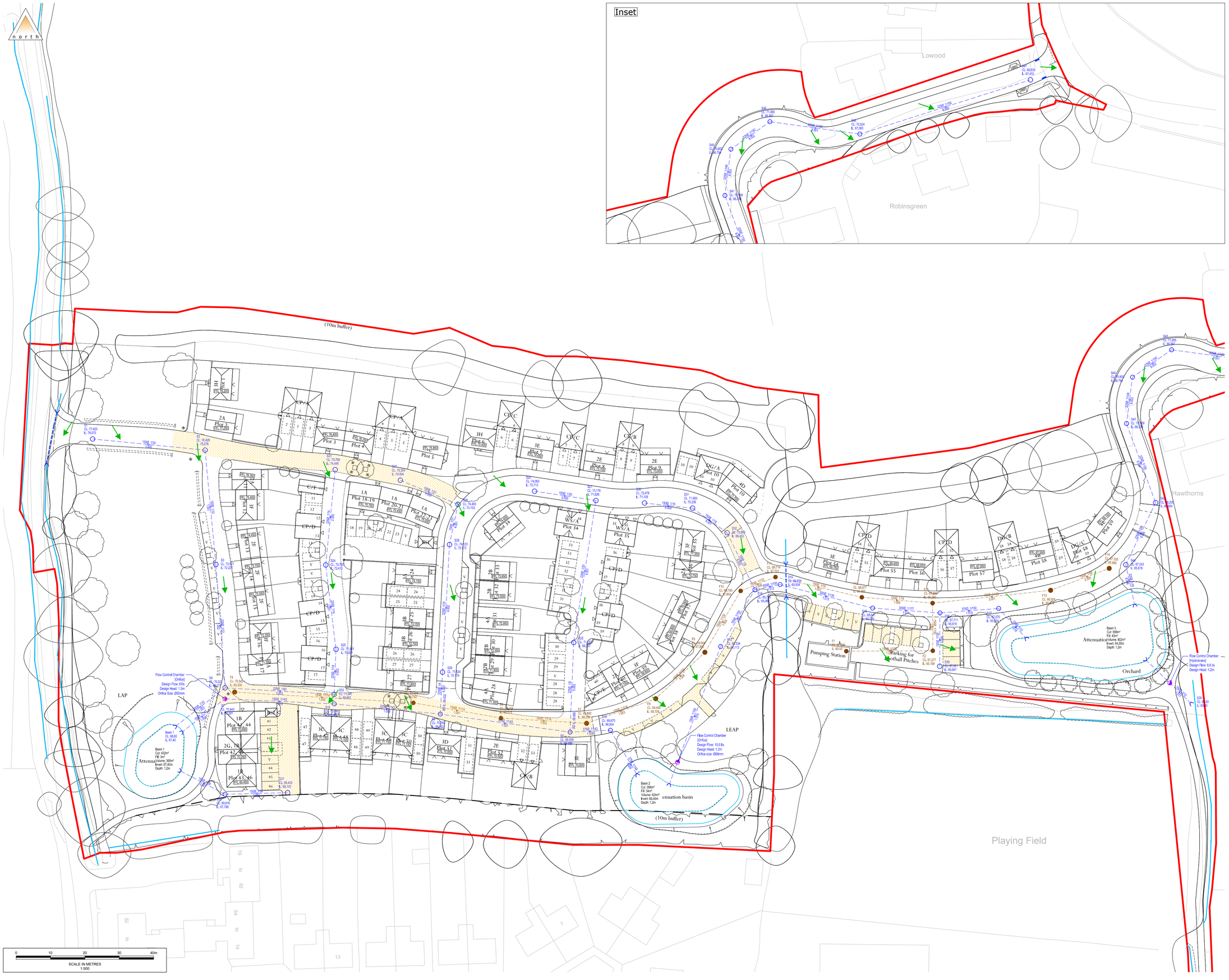
Area (ha)	52.00
SAAR (mm)	784.0
SPRHOST (%)	46.18
URBEXT 2000	0.125
BFIHOST	0.34
FARL	1.000

Results

QMED Rural (L/s)	305.8
QMED Urban (L/s)	340.5

Appendix J

Proposed Drainage Strategy



Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. This drawing has been based upon survey information supplied by InCO Surveys and Motion cannot guarantee the accuracy of the data provided.
3. Any discrepancies should be reported to the architect and/or engineer immediately, so that clarification can be sought prior to the commencement of works.
4. This drawing should be read in conjunction with all other relevant architect and engineering details, drawings and specification.
5. All works to be carried out in accordance with the Sewerage Sector Guidance Appendix C. All works to private drainage systems are to be in accordance with the Building Regulations Approved Document Part "H" 2015 edition.
6. 350mm minimum cover is to be provided for private pipes laid in soft/paved areas, with 900mm minimum cover to be provided for private pipes laid beneath roads / driveways unless not practicable. Where unachievable, shallow pipe drains may require protection using concrete surround or paving slabs bridging the trench, subject to the NHBC Inspector's requirements.
7. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames.

Legend

- Site Boundary
- Proportion of Type C No Infiltration Pervious Pavement Included in InfoDrainage Model (See Landscape Masterplan for all Pervious Pavement Locations)
- Surface Water Attenuation Basin
- Surface Water Gravity Pipe
- Foul Water Gravity Pipe
- Surface Water Manhole
- Surface Water Flow Control Chamber
- Proposed Headwall
- Foul Water Manhole
- Proposed Culvert
- Ordinary watercourse
- Indicative Surface Water Gully Location
- Exceedance flow route

P02	Second Issue	ST	CG	JM 09/05/2025
P01	First Issue	CC	CG	JM 18/04/2025
Rev.	Description	Drn	Chk	App Date

Drawing Status:

FOR PLANNING
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

Client:
Broadbridge Heath Trust

Project:
Land to the east of Tilletts Lane, Warnham

Title:
Drainage Strategy

Scale: 1:500 (@ A1)

Drawing: 2404044-0550
Revision: P02

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Appendix K

InfoDrainage Modelling Results

Land to the east of Tilletts Lane, Warnham:	Date: 09/05/2025		
	Designed by: CC	Checked by: CG	Approved By: JM
Report Details: Type: Junctions Storm Phase: Surface Network 1	Motion: 84 North Street Guildford GU1 4AU		

Name	Junction Type	Easting (m)	Northing (m)	Cover Level (m)	Depth (m)	Invert Level (m)	Chamber Shape	Diameter (m)	Lock
S1	Manhole	515436.868	133946.794	77.425	1.350	76.075	Circular	1.500	None
S2	Manhole	515469.582	133943.549	76.428	1.350	75.078	Circular	1.500	None
S3	Manhole	515472.726	133910.292	73.577	1.350	72.227	Circular	1.500	None
S4	Manhole	515475.414	133874.383	70.521	1.350	69.171	Circular	1.500	None
S7	Manhole	515475.373	133871.173	70.443	3.152	67.291	Circular	1.200	None
S8	Manhole	515538.047	133866.734	70.782	3.930	66.852	Circular	1.200	None
S9	Manhole	515575.793	133861.502	69.939	3.353	66.586	Circular	1.200	None
S10	Manhole	515587.547	133862.038	69.670	3.166	66.504	Circular	1.200	None
S13	Manhole	515619.612	133886.395	69.534	3.421	66.113	Circular	1.200	None
S14	Manhole	515629.585	133902.913	69.726	3.742	65.984	Circular	1.200	None
S15	Manhole	515636.932	133904.426	69.639	3.705	65.934	Circular	1.200	None
S16	Manhole	515663.843	133897.596	68.641	2.912	65.729	Circular	1.200	None
S17	Manhole	515700.532	133897.478	67.070	1.566	65.504	Circular	1.200	All
S19	Manhole	515507.156	133869.712	70.980	3.911	67.069	Circular	1.200	None
S20	Manhole	515565.472	133931.596	74.063	1.350	72.713	Circular	1.500	None
S21	Manhole	515583.304	133928.886	73.176	1.350	71.826	Circular	1.500	None
S22	Manhole	515576.857	133887.564	71.057	1.350	69.707	Circular	1.500	None
S23	Manhole	515507.441	133937.866	75.795	1.350	74.445	Circular	1.500	None
S24	Manhole	515504.694	133910.127	73.760	1.350	72.410	Circular	1.500	None
S25	Manhole	515507.685	133885.603	71.951	1.350	70.601	Circular	1.500	None
S26	Manhole	515543.189	133927.752	74.483	1.350	73.133	Circular	1.500	None
S27	Manhole	515526.418	133934.778	75.354	1.350	74.004	Circular	1.500	None
S28	Manhole	515540.713	133916.058	74.123	1.550	72.573	Circular	1.500	None
S29	Manhole	515538.677	133878.937	71.524	1.350	70.174	Circular	1.500	None
S30	Manhole	515597.474	133928.160	72.478	1.350	71.128	Circular	1.500	None
S31	Manhole	515611.438	133926.652	71.683	1.447	70.236	Circular	1.500	None
S32	Manhole	515621.490	133919.523	70.803	1.350	69.453	Circular	1.500	None
S33	Manhole	515507.144	133872.502	71.047	1.350	69.697	Circular	1.500	None
S35	Manhole	515756.341	133870.024	64.000	1.000	63.000	Circular	0.000	All
S36	Manhole	515683.443	133896.171	67.711	2.093	65.618	Circular	1.200	None
S37	Manhole	515493.600	133843.884	69.453	1.350	68.103	Circular	1.500	None
S38	Manhole	515475.416	133843.418	69.616	1.829	67.788	Circular	1.200	None
S39	Manhole	515683.374	133880.656	67.001	1.054	65.947	Circular	1.500	None
S44	Manhole	515737.506	133910.162	67.243	1.425	65.818	Circular	1.200	All
S43	Manhole	515746.222	133928.343	68.205	1.665	66.540	Circular	1.200	All
S41	Manhole	515737.749	133951.346	70.109	3.406	66.703	Circular	1.200	All
S40	Manhole	515739.468	133964.779	70.800	4.006	66.794	Circular	1.200	All
S45	Manhole	515750.907	133972.798	71.065	4.178	66.887	Circular	1.200	All
S46	Manhole	515777.018	133969.151	70.524	3.461	67.063	Circular	1.200	All
S47	Manhole	515826.686	133984.925	68.535	1.125	67.410	Circular	1.200	All

Land to the east of Tilletts Lane, Warnham:	Date: 09/05/2025		
	Designed by: CC	Checked by: CG	Approved By: JM
Report Details: Type: Junctions Storm Phase: Surface Network 1	Motion: 84 North Street Guildford GU1 4AU		

Outlets

Junction	Outlet Name	Outgoing Connection	Outlet Type
S1	Outlet	S1-S2	Free Discharge
S2	Outlet	S2-S3	Free Discharge
S3	Outlet	S3-S4	Free Discharge
S4	Outlet	S4-S6	Free Discharge
S7	Outlet	S7-S19	Orifice
	Diameter (m) 0.050		
	Coefficient of Discharge 0.600		
	Invert Level (m) 67.291		
S8	Outlet	S8-S9	Free Discharge
S9	Outlet	S9-S10	Free Discharge
S10	Outlet	S10-S12	Free Discharge
S13	Outlet	S13-S14	Free Discharge
S14	Outlet	S14-S15	Free Discharge
S15	Outlet	S15-S16	Free Discharge
S16	Outlet	S16-S36	Free Discharge
S17	Outlet	S17-S34	Free Discharge
S19	Outlet	S19-S8	Free Discharge
S20	Outlet	S20-S21	Free Discharge
S21	Outlet	S21-S22	Free Discharge
S22	Outlet	S22-S9	Free Discharge
S23	Outlet	S23-S24	Free Discharge
S24	Outlet	S24-S25	Free Discharge
S25	Outlet	S25-S33	Free Discharge
S26	Outlet	S26-S28	Free Discharge
S27	Outlet	S27-S26	Free Discharge
S28	Outlet	S28-S29	Free Discharge
S29	Outlet	S29-S8	Free Discharge
S30	Outlet	S30-S31	Free Discharge
S31	Outlet	S31-S32	Free Discharge
S32	Outlet	S32-S14	Free Discharge
S33	Outlet	S33-S4	Free Discharge
S36	Outlet	S36-S17	Free Discharge
S37	Outlet	S37-S38	Free Discharge
S38	Outlet	S38-S6	Free Discharge
S39	Outlet	S39-S36	Free Discharge
S44	Outlet	S44-S34	Free Discharge
S43	Outlet	S43-S44	Free Discharge
S41	Outlet	S41-S43	Free Discharge
S40	Outlet	S40-S41	Free Discharge
S45	Outlet	S45-S40	Free Discharge
S46	Outlet	S46-S45	Free Discharge
S47	Outlet	S47-S46	Free Discharge

Basin 2

Type : Pond

Dimensions

Exceedance Level (m)	67.610
Depth (m)	1.210
Base Level (m)	66.400
Freeboard (mm)	10
Initial Depth (m)	0.000
Porosity (%)	100
Average Slope (1:X)	3.60
Total Volume (m³)	423.873

Depth (m)	Area (m²)	Volume (m³)
0.000	217.89	0.000
0.100	238.13	22.794
0.200	259.34	47.660
0.300	281.12	74.676
0.400	303.46	103.898
0.500	326.37	135.382
0.600	349.84	169.185
0.700	373.88	205.365
0.800	398.48	243.976
0.900	423.65	285.076
1.000	449.38	328.721
1.100	475.68	374.968
1.200	502.54	423.873

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	S10-S12
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	S12-S13
Outlet Type	Orifice

Diameter (m)	0.068
Coefficient of Discharge	0.600
Invert Level (m)	66.400

Advanced

Perimeter	Circular
Length (m)	35.466
Friction Scheme	Manning's n
n	0.03

Basin 3

Type : Pond

Dimensions

Exceedance Level (m)	65.710
Depth (m)	1.210
Base Level (m)	64.500
Freeboard (mm)	10
Initial Depth (m)	0.000
Porosity (%)	100
Average Slope (1:X)	3.70
Total Volume (m³)	801.756

Depth (m)	Area (m²)	Volume (m³)
0.000	473.11	0.000
0.100	503.13	48.804
0.200	534.32	100.669
0.300	566.08	155.681
0.400	598.40	213.897
0.500	631.28	275.374
0.600	664.74	340.167
0.700	698.76	408.335
0.800	733.34	479.933
0.900	768.49	555.017
1.000	804.20	633.645
1.100	840.48	715.872
1.200	877.33	801.756

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	S17-S34
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	S44-S34
Bypass Destination	(None)
Capacity Type	No Restriction

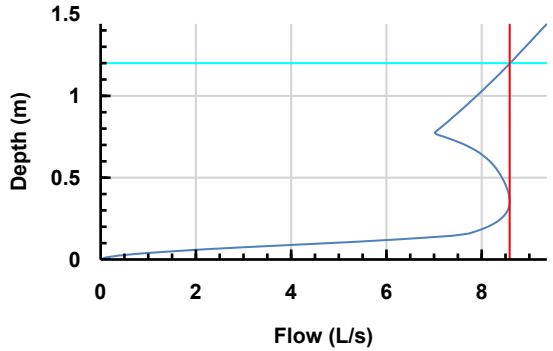
Outlets

Outlet

Outgoing Connection	S34-S35
Outlet Type	Hydro-Brake®

Invert Level (m)	64.500
Design Depth (m)	1.200
Design Flow (L/s)	8.6
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☑

Unit Reference	SHE-0133-8600-1200-8600



Advanced

Perimeter	Circular
Length (m)	49.294
Friction Scheme	Manning's n
n	0.03

Basin 1

Type : Pond