

PINEWOOD CAMPUS, NINE MILE RIDE, WOKINGHAM

FLOOD RISK ASSESSMENT AND DEVELOPMENT DRAINAGE STRATEGY

DANDARA SOUTHERN LIMITED & LEGAL AND GENERAL ASSURANCE
(PENSIONS MANAGEMENT) LIMITED

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References

Environment Agency Flood Map Information © and database right www.environment-agency.gov.uk
Department for Environment, Food & Rural Affairs, Magic Maps, Magic Map Application (defra.gov.uk)
Contains British Geological Survey materials © UKRI [2025]
National Planning Policy Framework (Department for Communities and Local Government, February 2025)
PPG Flood risk and coastal change (Department for Communities and Local Government, August 2022)
Wokingham Borough Council Level 1 Strategic Flood Risk Assessment (JBA Consulting on behalf of Wokingham Borough Council, May 2023)
Wokingham Borough Development Plan (Wokingham Borough Council, February 2014)
Wokingham Borough Local Plan Update 2023 - 2040 Proposed Submission Plan
Local Flood Risk Management Strategy (Wokingham Borough Council, April 2015)

1 Executive Summary

SITE INFORMATION	CLIENT	Dandara Southern Limited & Legal and General Assurance (Pensions Management) Limited
	SITE NAME	Pinewood Campus, Nine Mile Ride, Wokingham
	SITE LOCATION	SU 83581 65973 Nine Mile Ride, Wokingham, RG40
	SITE AREA	11.4 ha
	CURRENT LAND USE	Brownfield- Building and car park
	PROPOSED LAND USE	136 Residential Dwellings
	SITE GEOLOGY – Superficial	River Terrace Deposits 6 – Sand and Gravel
	SITE GEOLOGY - Bedrock	Bagshot Formation – Sand
	SOIL INFILTRATION RATES	Between 1.2×10^{-5} m/s and 5.3×10^{-5} m/s
	GROUNDWATER LEVELS	Ongoing testing
	GROUNDWATER SPZ / AQUIFER	SPZ - No / Aquifer - Yes Secondary A (bedrock) Secondary A and Secondary (undifferentiated) (superficial)
	GROUND CONTAMINATION	Asbestos
FLOOD RISK	ENVIRONMENT AGENCY FLOOD ZONE	Flood Zone 1 - Lowest Risk < 0.1% (<1:1000)
	FLUVIAL (RIVERS & WATERCOURSES)	Flood Zone 1- Low Risk
	PLUVIAL (SURFACE WATER)	Low (Existing) / Very Low (Post Development)
	GROUNDWATER	Low Risk
	EXISTING/PROPOSED SEWERS & MAINS	Low Risk
	ARTIFICIAL	Negligible
	TIDAL	Flood Zone 1 - Lowest Risk < 0.1% (<1:1000)
FOUL & SURFACE	PROPOSED SURFACE WATER STRATEGY	Infiltration to Ground (subject to groundwater monitoring) Alternative strategy – discharge to watercourse
	PROPOSED SUDS TYPE	Permeable paving, swale, filter trench
	EXISTING SW PEAK FLOW RATE	N/A – infiltrates to ground
	PROPOSED SW PEAK FLOW RATE	N/A – 7.4 l/s/ Alternative 11.9 l/s
	FOUL WATER STRATEGY	Pumped to existing Thames Water sewer
	EXISTING FW PEAK FLOW RATE	N/A
	PROPOSED FW PEAK FLOW RATE	1.23l/s
MISC	FURTHER INVESTIGATIONS	Ongoing groundwater monitoring

2 Introduction

2.1 Scope

- 2.1.1 Dandara Southern Limited & Legal and General Assurance (Pensions Management) Limited are seeking detailed planning permission for the proposed erection of 136 dwellings (use class C3) together with associated parking, landscaping, public open space, drainage infrastructure, access and highway improvements, Suitable Alternative Natural Greenspace (SANG) and ancillary works. Following demolition of existing office campus and accessed from Nine Mile Ride, as existing. Hereafter, referred to as the site. Refer to **Appendix A** for the proposed Site Layout.
- 2.1.2 MJA Consulting has been appointed to provide a Flood Risk Assessment & Drainage Strategy suitable to submit as part of the planning application for the disposal of foul and surface water from the proposed development.

2.2 Report Structure

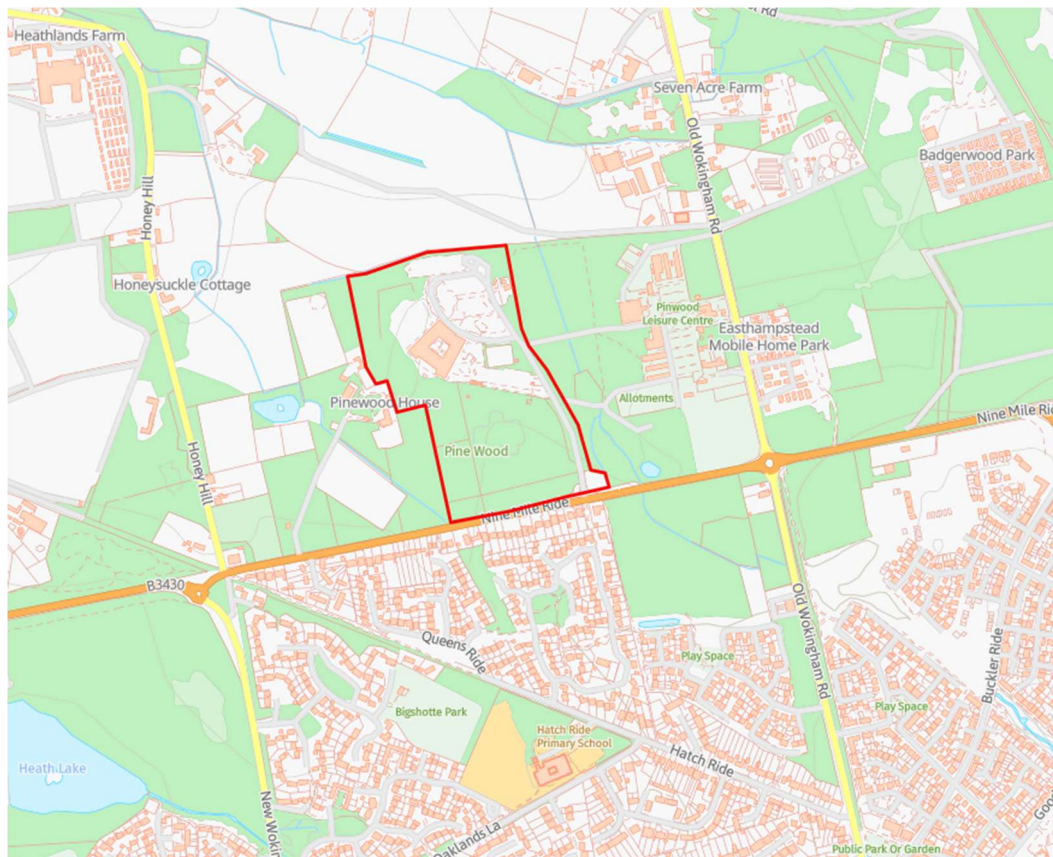
- 2.2.1 The National Planning Policy Framework (NPPF) and the Flood Risk and Coastal Planning Practice Guidance (PPG) is the current guidance on development and flood risk in England and Wales. The Flood Risk technical guidance for the National Planning Policy Framework requires a Flood Risk Assessment (FRA) to be carried out on sites over 1ha to consider all potential forms of flooding including that from river, sea, estuarial, land drainage, groundwater, overland flow, surface water run-off, sewer systems, and artificial water bodies (lakes, reservoirs, canals etc.) to both the development site and to offsite parties and land.
- 2.2.2 This report will take the structure of a 'Flood Risk Assessment' in accordance with the National Planning Policy Framework, the Flood Risk and Coastal Planning Practice Guidance, Environment Agency's Flood Risk Assessment Guidance and CIRIA Report 624 'Development and Flood Risk.
- 2.2.3 The objectives of this report are:
- To confirm whether the proposed development site is affected by current or anticipated future flooding from all sources for the lifetime of the site.
 - To confirm that this development will not increase the risk of flooding to any offsite properties and land or increase the population within a floodplain.
 - Demonstrate compliance with National, Regional and Local Planning Policy in relation to flood risk and drainage.
 - To undertake calculations to establish the foul and surface water runoff rates from the existing site (if applicable) and to assess the potential foul and surface water runoff from the proposed development.
 - To detail a suitable strategy for the management of foul and surface water generated from the proposed development allowing for future climate change.
 - To satisfy the approving planning authority that the most sustainable foul and surface water drainage solutions have been considered, in line with Environment Agency guidance, The Building Regulations (Document H 2002) and government legislation such as the Flood and Water Management Act 2010 (Defra) and The National Planning Policy Framework (NPPF & PPG).

3 The Development Site

3.1 Site Location and Description

- 3.1.1 The site is located to the north of Nine Mile Ride, Wokingham, Berkshire and is currently occupied by Johnson & Johnson Medical Ltd. The site is bound to the north, east and west by woodland and open fields. South of the site is Nine Mile Ride and beyond existing residential dwellings.
- 3.1.2 The entire site within the redline boundary is approximately 11.4 hectares and consists of the existing building formally used as the Johnson and Johnson headquarters, a large car park, a private multi use games area (MUGA) and dense woodland in the south. The net developable area is approximately 3.8 hectares. Refer to **Figure 1** below.

Figure 1: Site Location



3.2 Topography

- 3.2.1 A topographical survey of the site was undertaken by MK Surveys in August 2025 which indicates the site is relatively flat with the highest point of the site being surveyed at approximately 72.22m above ordnance datum (m AOD), located along the southern

boundary. The lowest point of the site has been surveyed at approximately 65.97m AOD and is located in the north eastern corner. Overall, the site has a gentle fall from south to north.

3.3 Geology

- 3.3.1 Information published by the British Geological Society (BGS) indicates the majority of the site is underlain with bedrock deposits of Bagshot Formation comprising of sand. A small section in the south-east corner of the site is underlain with bedrock deposits of Windlesham Formation comprising of sand, silt and clay. The site is underlain with superficial deposits of River Terrace Deposits 6 comprising sand and gravel. Refer **Figure 2** and **Figure 3** below.

Figure 2: BGS Mapping – Bedrock Deposits

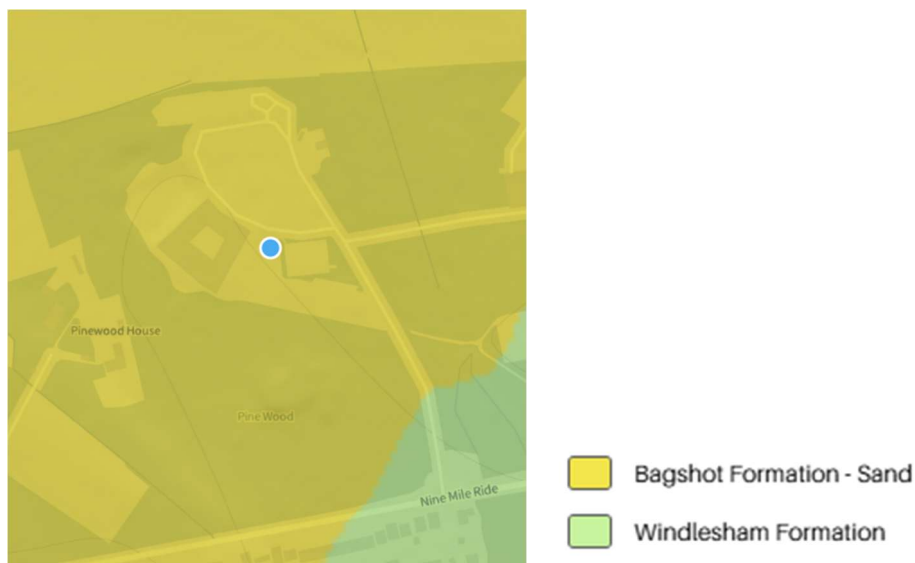


Figure 3: BGS Mapping – Superficial Deposits



- 3.3.2 A ground investigation was carried out by Geotechnical and Environmental Associated Limited (GEA). The ground conditions encountered confirmed the BGS data is correct, stating that a

generally moderate thickness of made ground was encountered over River Terrace Deposits and the Bagshot Formation. The full report is included in **Appendix C**.

- 3.3.3 Infiltration testing was undertaken by IBEX Consulting Engineers in August 2025. As part of this assessment soil logs and groundwater monitoring was undertaken. The full report has been included in **Appendix D**.
- 3.3.4 The geology encountered on site has been summarised by IBEX as made ground and topsoil overlying the River Terrace Deposits, consistent with the BGS data and the GEA ground investigation.
- 3.3.5 Infiltration testing was undertaken by IBEX in three locations across the site, with three other tests unsuccessful due to obstructions. The testing was undertaken at a depth of up to 2.0m bgl. Three tests were undertaken in each location (where possible), and a permeability rate has been provided for each location. An extract from the Infiltration Testing Summary has been provided in **Figure 4** below.

Figure 4: Summary of infiltration testing results, provided by IBEX

Reference	Geology	Calculated Infiltration Rates (m/s)		
		1 st Cycle	2 nd Cycle	3 rd Cycle
SA01	River Terrace Deposits	1.2X10 ⁻⁵	1.2X10 ⁻⁵	1.2X10 ⁻⁵
SA02	River Terrace Deposits	1.1X10 ⁻⁵	1.2X10 ⁻⁵	1.2X10 ⁻⁵
SA03	River Terrace Deposits	5.3X10 ⁻⁵	2.8X10 ⁻⁵	2.5X10 ⁻⁵
SA04	Made Ground	N/D	N/D	N/D
SA05	Made Ground	N/D	N/D	N/D
SA06	Made Ground	N/D	N/D	N/D
N/D: Not determined due to the presence of obstructions and unstable deeper areas of Made Ground				

- 3.3.6 The testing demonstrates that an infiltrating surface water drainage solution may be feasible for the development. the proposed surface water drainage strategy is discussed in **Section 6** of this report.

3.4 Groundwater

- 3.4.1 Initial groundwater depths were measured by Geotechnical and Environmental Associated Limited (GEA). 18 boreholes were tested at depths between 2mbgl and 5mbgl. Groundwater strikes were recorded between 2m bgl and 4m bgl.
- 3.4.2 Following the initial site investigation by GEA. Groundwater monitoring has been undertaken in 5 of the original boreholes (BH07, BH10, BH12, BH16, BH17). These have been referenced as WS instead of BH but the locations are as per the BH Location Plan in the GEA report. Groundwater monitoring results to date and shown in **Figure 5** below:

[illegible]

- 3.5.1 According to the findings of the ground investigation carried out by GEA, contamination testing has revealed the presence of asbestos within the made ground in the northwest of the site at low concentrations (up to 0.004%). GEA recommend the placement of a 600mm clean soil cover system in soft landscaped areas in the northwest of the site or additional testing following the site strip to determine the need for a clean cover system. Where made ground is removed entirely, no additional measures are required.
- 3.5.2 Considering the mitigation strategies recommended by GEA, the existing contamination should not have any detrimental impact on the surface water drainage strategy.
- 3.5.3 Elsewhere no contaminants or unusual soil gas conditions have been detected.

3.6.1 A review of the Department for Environment, Food & Rural Affairs (Defra) “Magic Map” confirms that the site is not within a Groundwater Source Protection Zone. The site is underlain by Secondary A aquifer in the bedrock deposits. A small section of the site is underlain by a Secondary (undifferentiated) aquifer with the majority of the site underlain by a Secondary A aquifer in the superficial deposits. Refer to **Figures 6 to 8** below.

The map displays the study area with various protection zones and the site location. The legend on the right side of the map defines the following zones:

- Zone I - Inner Protection Zone:** Represented by a solid red color.
- Zone I - Subsurface Activity:** Represented by a red color with a white grid pattern.
- Zone II - Outer Protection Zone:** Represented by a solid green color.
- Zone II - Subsurface Activity:** Represented by a green color with a white grid pattern.
- Zone III - Total Catchment:** Represented by a solid blue color.
- Zone III - Subsurface Activity:** Represented by a blue color with a white grid pattern.
- Zone of Special Interest:** Represented by a solid brown color.

The map shows the site location (indicated by a black arrow and a red square) within the context of these protection zones. The site is located within the Zone I - Inner Protection Zone, which is adjacent to the Zone I - Subsurface Activity area. The map also shows the surrounding area, including the River Sever and various roads and settlements.

Figure 7: Magic Maps – Aquifer Designations – Superficial

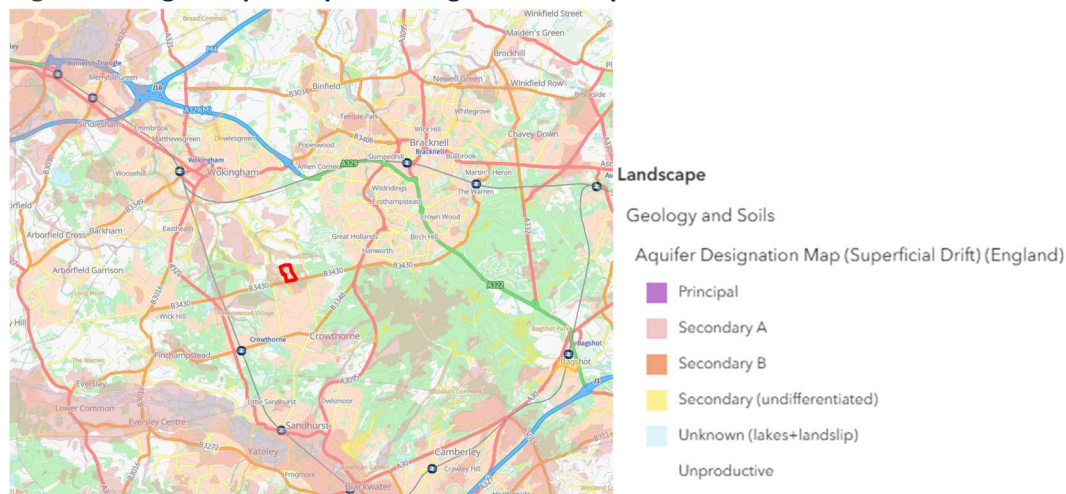
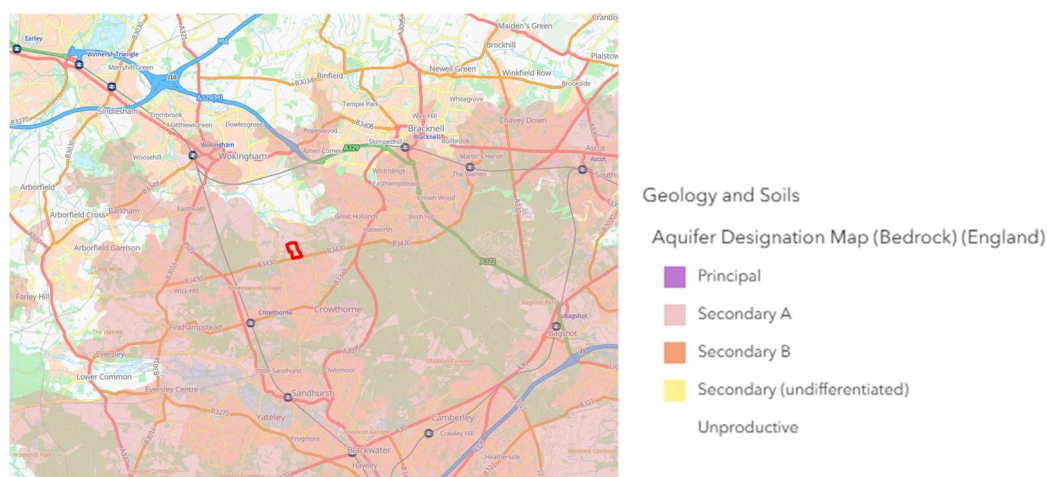


Figure 8: Magic Maps – Aquifer Designations – Bedrock



3.7 Hydrology and existing site drainage characteristics

- 3.7.1 The site is currently occupied by the Johnson and Johnson headquarters building, a large car park as well as areas of woodland and green space. There is an existing drainage system serving the site. Rainwater is currently collected and routed towards cellular storage tanks beneath the car park. It is thought these tanks are designed to infiltrate into the ground. There is an existing outfall into the ditch to the north, it is thought that this is an overflow from the infiltrating tanks.

4 Policy Compliance

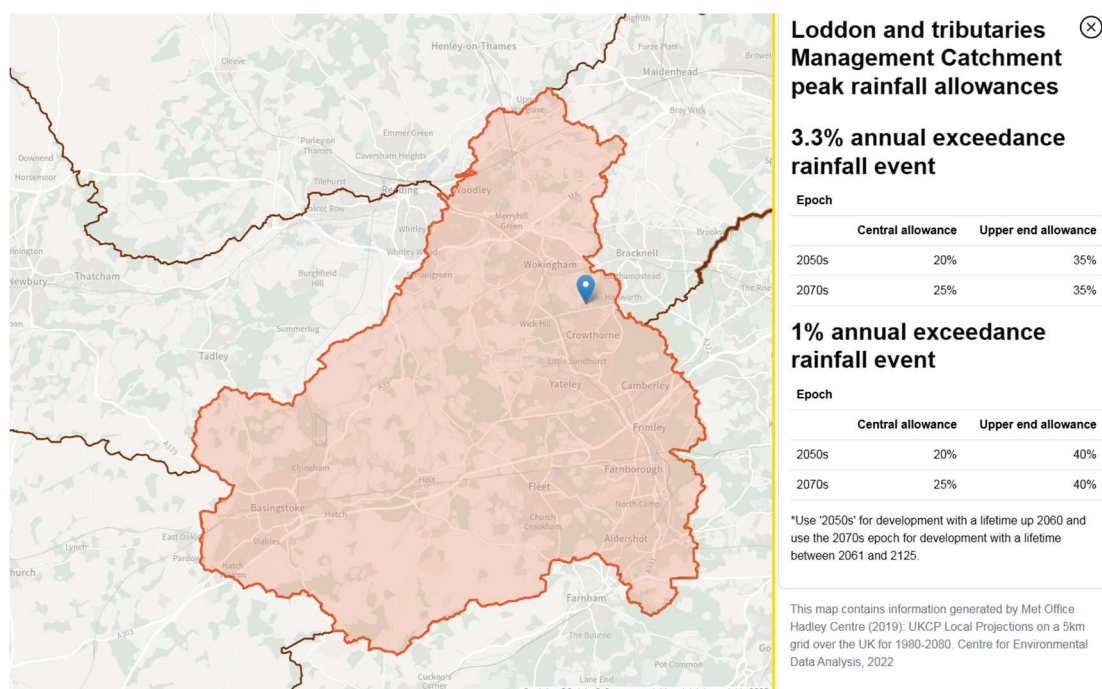
4.1 National Planning Policy

- 4.1.1 The National Planning Policy Framework (NPPF) provides national guidance to planning authorities, developers, the public, and the Environment Agency (EA), to ensure that flood risk is considered at all stages of the planning process.
- 4.1.2 The NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.
- 4.1.3 NPPF sets out a robust approach to the Sequential Test and is intended to provide a rigorous understanding of flood risk. Its aim is to steer new development to areas at the lowest probability of flooding (i.e., Flood Zone 1). The Sequential Test would normally be completed by the Local Planning Authority (LPA) to inform the preparation of the Local Development Framework (LDF).
- 4.1.4 The Sequential Test requires that all sources of flooding are considered, which is undertaken in **Section 5** of this report.
- 4.1.5 The NPPF also states that major developments should incorporate SuDS unless there is clear evidence that this would be inappropriate. The systems used should:
- Take account of advice from the Lead Local Flood Authority.
 - Have appropriate proposed minimum operational standards.
 - Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development.
 - Where possible, provide multifunctional benefits.
- 4.1.6 The proposed development complies with the National Planning Policy Framework (NPPF) in terms of flood risk and drainage as is demonstrated within this FRA.

4.2 Climate Change

- 4.1.7 Based on the most recent advice on climate change reported in NPPG, peak rainfall intensity, sea level, peak river flow, offshore wind speed and extreme wave heights are all expected to increase in the future. It is recommended that considerations for future climate change are included in Flood Risk Assessments for proposed developments.
- 4.1.8 The Environment Agency publish guidance on how to use climate change allowances in Flood Risk Assessments and Drainage Strategies. The Department for Environment and Rural Affairs has produced a Climate Change Allowance map for the country. The map provides information on the peak rainfall allowance depending on the Management Catchment the site relates to.
- 4.1.9 Having reviewed the Climate Change Allowance map the site lies within Loddon and tributaries Management Catchment. **Figure 9** below summarises climate change allowances within this catchment.

Figure 9: DEFRA Climate Change Allowance Map



4.1.10 The proposed surface water drainage strategy will be designed to cater for the upper allowance for the 2070s epoch, thus providing a suitable surface water drainage solution for the lifetime of the development. All events up to and including the 100 year + 40% climate change event will be catered for within the proposed system. Further analysis will be undertaken to establish the effect on the system for the 1 in 30 year + 40% climate change event. See **Section 7** below for details of the proposed surface water drainage strategy.

4.3 Wokingham Borough Development Plan (revised) 2014-2026

4.1.11 The Wokingham Borough Development Plan includes the Adopted Managing Development Delivery Local Plan (MDD) which was adopted in January 2014 and sets out the long-term vision and strategic context for managing and accommodating growth within the Borough of Wokingham until 2026. The aim of the MDD is to set out:

- The areas where development will take place.
- The areas that will be protected
- Policies that will be used to determine planning applications.

4.1.12 The Wokingham Borough MDD has been reviewed as part of the preparation of this FRA the following paragraphs identify policies relevant to flood risk and drainage and how the proposals comply with said policy.

4.1.13 Policy CC04: Sustainable Design and Construction of the MDD relates to Water Management and states:

“Water Management:

2.29 The South East's and Loddon Catchment water resource issues justify a policy approach to meet full CfSH levels and minimum standards for water use. The Environment Agency 'Areas of Water Stress – Final Classification (2007)' shows that the Borough is an area of severe water stress. The Loddon Catchment acquires 55% of its water supply from groundwater. Setting

limits on water consumption also protects the nearby Special Areas of Conservation from impacts of water abstraction.

2.30 Climate change combined with growing population and household formation and high water usage rates will impact on water resources and water quality. Therefore, developments including conversions, alterations and extensions shall incorporate measures in their design, landscaping, construction and operation, to avoid water wastage.

2.31 All new homes shall at least meet the internal potable water consumption targets of 105 litres or less per person per day. This is a mandatory standard required to meet CfSH Level 3 and 4. This target is above current Building Regulations requirements, but is necessary due to the level of water stress and planned population growth in the Borough.

2.32 All new non-residential proposals of more than 100 sq m gross nonresidential floorspace shall at least meet or exceed statutory requirements for water resource management. This could be through requirements to meet a BREEAM standard.

2.33 In line with Core Strategy policy CP1 - Sustainable Development (criteria 6), development must incorporate facilities for recycling of water and waste to help reduce per capita water consumption. Rainwater and grey water recycling (water butts or more complex collection and treatment systems) can significantly reduce water consumption, particular potable water. Grey water recycling will need to be energy efficient. Landscaping and gardens must be designed to minimise water demand. Sustainable Drainage Systems (SuDS) can significantly reduce demand for water by incorporating SuDS as part of the design and landscaping of the site, as set out in the Sustainable Design and Construction SPD and Companion Guide.

2.34 The Borough's water resources and supplies shall be protected by resisting development proposals that would pose an unacceptable threat to surface water. Proposals that seek to increase water availability shall be encouraged."

- 4.1.14 The proposed surface water strategy for the development (See Sections 6 and 7) demonstrates the surface water runoff from the development will be appropriately treated prior to discharging into the ground. Therefore, there will be an improvement into the quality of the water discharging from the site into the ground.
- 4.1.15 This FRA has been prepared to demonstrate the development proposals comply with National Planning Policy in relation to flood risk.
- 4.1.16 In reference to Section 3 the site is not underlain by a principal aquifer or within a Groundwater Source Protection Zone so there is no risk to public water supplies.
- 4.1.17 Therefore, the proposed development complies with Policy CCO4 of the MDD.

4.2 Wokingham Borough Local Plan Update 2023 - 2040 Proposed Submission Plan

- 4.2.1 The Wokingham Borough Local Plan Update 2023-2040 sets out the vision, strategic objectives and strategy for managing development across Wokingham Borough and will replace the MDD

(2014) plan once adopted. The policies relevant to drainage and flood risk have been identified below.

4.2.2 Policy FD1: Development and flood risk (from all sources) states:

1. Development proposals must take into account at all stages of development, and at the appropriate stage of the planning application process, all sources of flood risk, including historic flooding, current and future impacts of climate change, and cumulative impacts. Development proposals must be consistent with national policy and guidance and demonstrate how they have used, and where relevant comply with the site specific recommendations of, the Strategic Flood Risk Assessment (SFRA) to help determine the suitability of the proposal.

4.2.3 This FRA demonstrates the development proposals comply with National Planning Policy in relation to flood risk. The SFRA has been reviewed in **Section 4.3** below and an evaluation of flood risk to the site is included in **Section 5**.

4.2.4 Policy FD2: Sustainable drainage states:

1. Development proposals must ensure surface water arising, including the impact of climate change, is managed in a sustainable manner. This must be demonstrated through either a: a) Site-specific Flood Risk Assessment; or b) Surface Water Drainage Strategy.

a) Development proposals will only be supported where the proposal would reproduce greenfield runoff characteristics and return run-off rates and volumes back to the original greenfield levels for greenfield sites; and for brownfield sites both run-off rates and volumes be reduced to as near greenfield as practicably possible, or 40% betterment of existing, whichever is achievable;

2. The provision of SuDS should:

a) Be of an appropriate design (in line with the principles and local standards set out in the council's latest SuDS strategy and technical guide and any current national technical standards) to meet the long term needs over the lifetime of the development and which achieve wider social, ecological and environmental benefits;

b) Include a clear strategy for adoption and maintenance to the satisfaction of the council, as the Lead Local Flood Authority (LLFA);

c) Do not cause adverse impacts on the public sewerage network serving the development where discharging surface water to a public sewer. Any discharges should be agreed in writing by the local sewerage undertaker;

d) Effectively manage flood risk, improve the water environment, enhance biodiversity and mitigate and adapt to the effects of climate change;

3. In addition, residential development proposals of 10 dwellings or more, or non-residential development proposals of 1,000 m² or greater gross internal area, and developments in areas at risk of flooding from all sources, must incorporate SuDS as an intrinsic part of the

design and layout of the proposal, unless it can be effectively demonstrated that it is not feasible within the constraints of the site.

- 4.2.5 This document includes the preparation of two Surface Water Drainage Strategies; one is an infiltration strategy (subject to groundwater monitoring) the alternative strategy proposes discharge to a watercourse at greenfield rates.
- 4.2.6 The drainage strategies incorporate SuDS using a permeable road design throughout the site. Where the surface water network passes through green space, a swale has been included in the design. The Surface Water Strategy is described in **Section 6**.
- 4.2.7 Therefore, the proposed development complies with Policy FD2.

4.3 Wokingham Borough Council Strategic Flood Risk Assessment (SFRA)

- 4.3.1 As the Lead Local Flood Authority (LLFA) Wokingham Borough Council (WBC) has a responsibility for managing flooding in the area. In 2023 WBC produced a Preliminary Flood Risk Assessment for the borough. The purpose of the report is to summarise preliminary Flood Risk in the area.
- 4.3.2 The SFRA is a high-level overview of flood risk from a variety of and combination of flood sources including surface water, groundwater and ordinary water courses as well as the interaction with main rivers, the sea and reservoir flooding.
- 4.3.3 The SFRA has been reviewed in preparation of this FRA. There is no specific mention of historical flooding on the site, however there are historic records of nearby flooding north of the site. The site has not been identified as a flood risk area. **Section 5** of this report discusses the flood risk to the site and surrounding area.

4.4 Wokingham Borough Council Local Flood Risk Management Strategy

- 4.4.1 WBC have prepared a Local Flood Risk Management Strategy. The aim of the strategy is to set out how local flood will be reduced and managed by the authorities involved and describes their approach in the form of six main objectives, a strategic action plan and tailored policies.
- 4.4.2 The Strategy has been reviewed in preparation of this FRA. The proposed development and surface water drainage strategy, as set out in Section 6 of this report, has been developed in accordance with WBC's vision and complies with the Flood and Water Management Strategy.

5 Evaluation of Flood Risk

- 5.1.1 The NPPF was revised in December 2024 in response to the proposed reforms to the National Planning Policy Framework and other changes to the planning system consultation. The purpose of the revision related to achieving sustainable growth in the planning system. The revised NPPF has not changed any of the policies relating to flood risk.

5.2 Sources of Flooding

- 5.2.1 NPPF identifies potential sources of flooding that require investigation for the site to pass the sequential test:

- Flooding from rivers - fluvial flooding
- Flooding from the sea - tidal flooding
- Flooding from land - pluvial flooding (surface water flooding)
- Flooding from groundwater
- Flooding from sewers
- Flooding from artificial sources (reservoirs, canals)

5.3 History of Flooding

During the data collection process, it is important to consider the information which already exists for the site location with respect to flood risk. The main source of data for flood risk and recorded incidents of flooding for this site has been the *Wokingham Borough Council Level 1 Strategic Flood Risk Assessment (SFRA) (May 2023)*

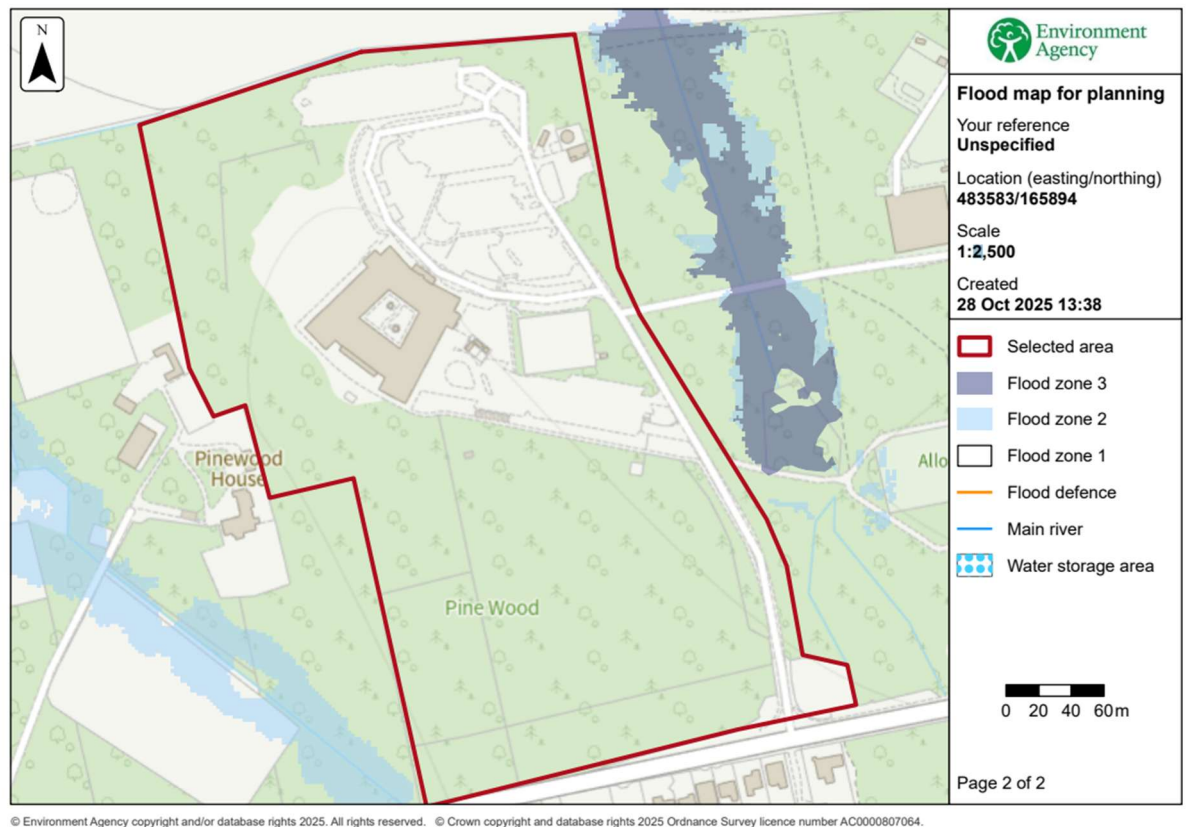
- 5.3.1 Within the SFRA consultation was carried out with all appropriate authorities and organisations including the Environment Agency, Thames Water, South East Water and local community stakeholders to identify known or perceived problem areas with respect to flooding.
- 5.3.2 With reference to the above, and in the context of the proposed development there are no recorded historic issues of the site flooding from the following potential sources including:
- Fluvial (Rivers)
 - Tidal.
 - Groundwater.
 - Pluvial (Surface water runoff).
 - Existing foul, storm and combined sewers or potable water main infrastructure.
 - Artificial infrastructure.

5.4 Fluvial

- 5.4.1 The Environment Agency (EA) is the principal flood risk management operating authority in England. The EA have carried out a national flood risk assessment (NaFRA) which assesses the probability of flooding to land from all main rivers in England. The results of this modelling are combined and calibrated against data from recorded flood events to produce the Environment Agency's Flood Zone Map.
- 5.4.2 The latest "Risk of Flooding from Rivers and Sea" maps, available from the government website, provides information on flood risk that considers flood defences. This map shows the

site is in Flood Zone 1 and has a very low risk of flooding from rivers and the Sea (Fluvial and Tidal). Refer to **Figure 10** below.

Figure 10: Government Flood Maps for Planning – Rivers and Sea



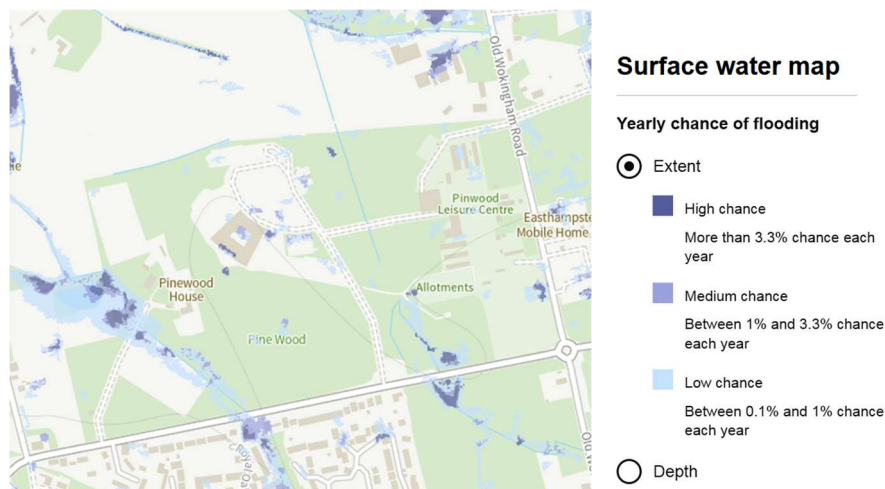
5.5 Tidal

5.5.1 The site is not shown to be at risk of tidal flooding.

5.6 Surface Water (pluvial) and Overland Flood Flow / Exceedance

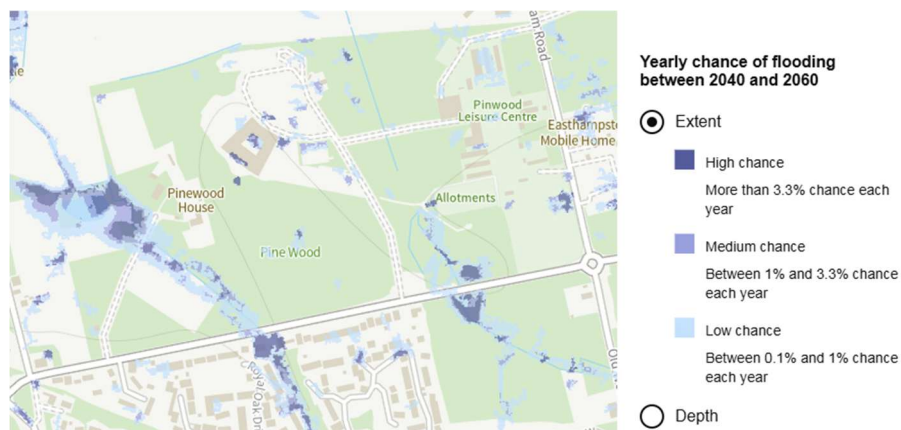
- 5.6.1 Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding. Increased run-off from developed areas consisting of impermeable surfaces can increase overland flows. If the flow paths of these overland flows are not carefully considered during the detail design and planning stages, flooding from overland flows could occur.
- 5.6.2 Surface water flood maps are available from the Government website. The surface water flood map for this site shows areas where there is a high, low and medium chance of pluvial flooding. These areas are located along the northern boundary and within the centre of the site. Refer to **Figure 11** below.

Figure 11: Government Flood Maps for Planning – Surface Water (Pluvial) Extent. Yearly Chance of flooding



- 5.6.3 The online mapping also provides information on the yearly flooding chance between the years of 2040 and 2060. This map shows the extent of pluvial flooding has slightly increased within the areas identified above. Refer to **Figure 12** below.

Figure 12: Government Flood Maps for Planning – Surface Water (Pluvial) Extent. Yearly Chance of flooding between 2040 and 2060



- 5.6.4 The areas of pluvial flooding along the northern boundary appear to be related to an existing ditch / drain within the woodland. The online mapping shows that there is a very small area where there is a medium chance of pluvial flooding ponding to a depth of up to 30cm. This area is thought to be caused by rainfall landing on the site and flowing towards a local low spot that is currently an impermeable surface from the previous use of the site. This is not caused by rainfall flowing from offsite over the land to this area (overland flow path). The remainder of the site has a low chance of flooding up to 30cm deep. Refer to **Figures 13** and **14** below.

Figure 13: Government Flood Maps for Planning – Surface Water (Pluvial) Depth. Yearly Chance of flooding to 30cm

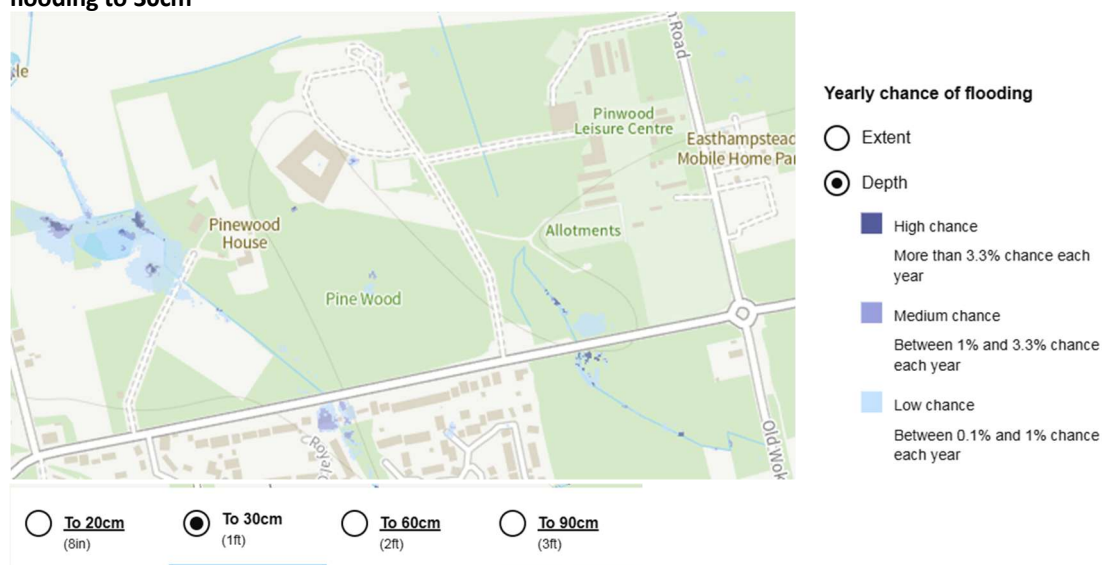
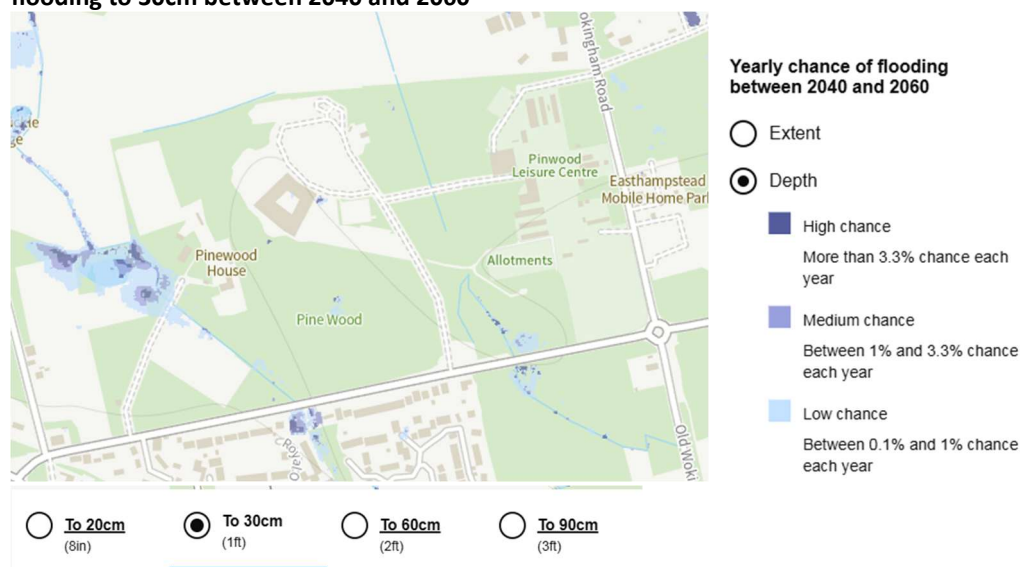


Figure 14: Government Flood Maps for Planning – Surface Water (Pluvial) Depth. Yearly Chance of flooding to 30cm between 2040 and 2060



5.6.5 The online mapping shows there is an area of high chance of flooding up to 20cm deep within the central area of the site, however this area is small. Refer to **Figures 15** and **16** below.

Figure 15: Government Flood Maps for Planning – Surface Water (Pluvial) Depth. Yearly Chance of flooding to 20cm

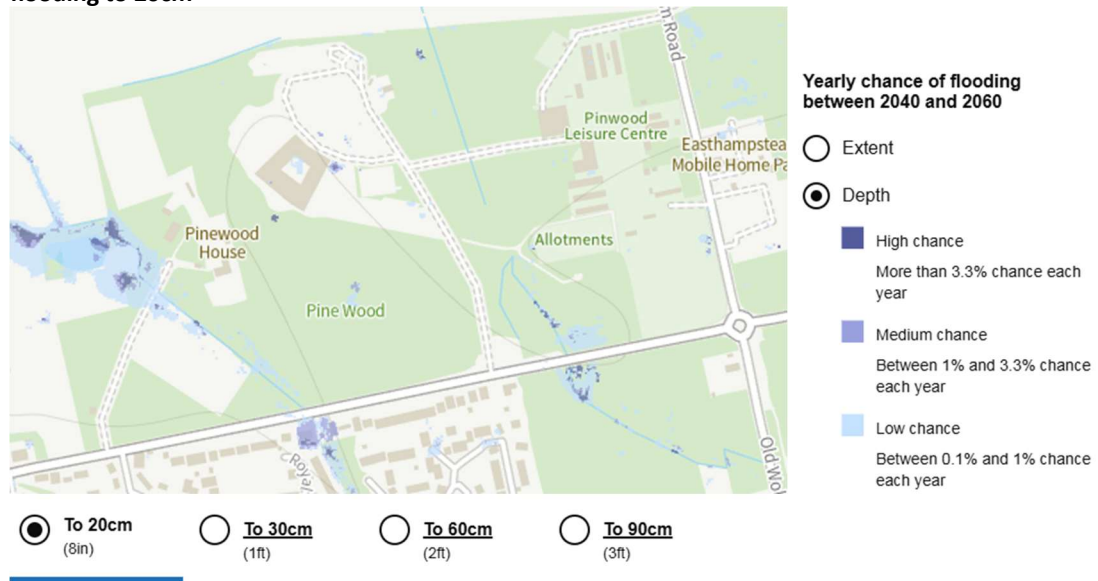
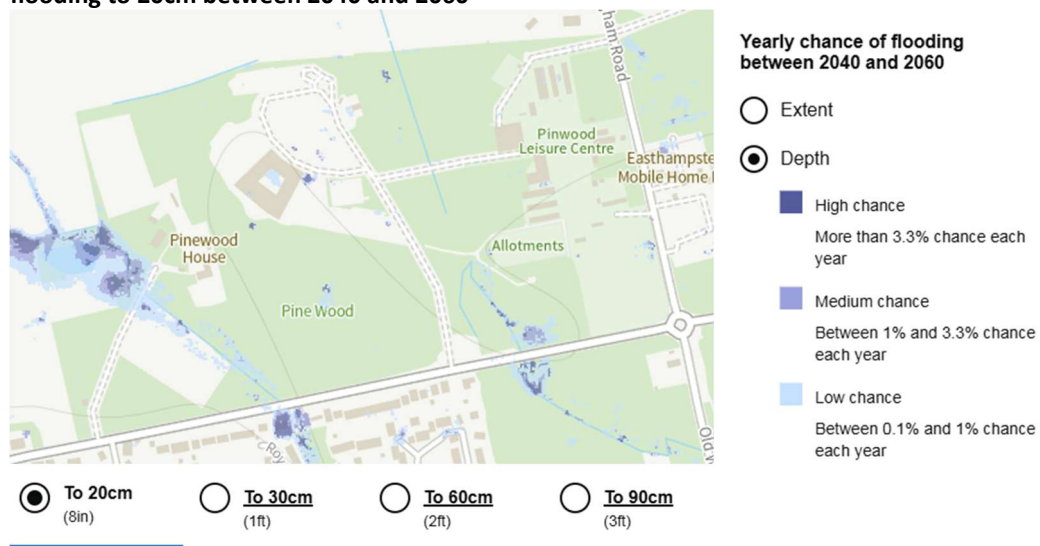


Figure 16: Government Flood Maps for Planning – Surface Water (Pluvial) Depth. Yearly Chance of flooding to 20cm between 2040 and 2060



- 5.6.6 Due to the introduction of the proposed surface water drainage strategy the pluvial flood risk will be reduced as rainwater will be collected, conveyed and stored beneath the ground prior to infiltrating or discharging to the existing watercourse. Therefore, the existing ponding will no longer occur within the centre of the site.
- 5.6.7 The occurrence of overland flooding at the site due to an extreme rainfall event exceeding the design capacity of the drainage system and SuDS, or a failure of the associated flow controls have been considered both during the construction and operational phase of the development.
- 5.6.8 If SuDS or the piped drainage system becomes overwhelmed by exceptional rainfall, then exceedance routes are proposed to protect people and property by providing unobstructed overland flow routes across the development.

- 5.6.9 The design levels of hard paved and landscaped areas will aim to contain and convey flood flows through areas of the site to cause minimum flood risk to properties and residents such as parking areas and low-lying open space.
- 5.6.10 All proposed attenuation features within the development are designed to manage the 1 in 100 year return storm (1% chance of occurrence each year) plus an extra allowance of 40% for the potential increase in peak rainfall predicted up to 2125.
- 5.6.11 Any residual risk of overland flooding to properties is to be mitigated by the provision of raised property slab levels a minimum of 150mm above surrounding ground level.
- 5.6.12 The described protection measures ensure that properties both within the proposed development and any offsite parties and land will not be affected by overland runoff in the event of a reasonably extreme rainfall event exceeding the design storm or a failure or a blockage of the SuDS structures within the system.
- 5.6.13 Based on the above the existing site can be considered to have a low risk of pluvial flooding, further reduced post development.

5.7 Groundwater

- 5.7.1 The Government website shows that groundwater flooding is unlikely in this area. The ongoing groundwater testing shows that groundwater has been recorded at the highest level of 1.04mbgl to date. Ongoing monitoring is being undertaken to establish the highest groundwater level beneath the site.
- 5.7.2 The PFRA and the Environment Agency confirm that no recorded events of groundwater flooding have been identified at or within the vicinity of the site. Therefore, the risk of groundwater flooding is considered to be low.

5.8 Artificial Sources

- 5.8.1 The main cause for flooding from an artificial source such as a canal or reservoir would be a structural failure in the walls of the canal / reservoir or some form of accident-causing significant damage to the structure of the canal. This is highly unlikely.
- 5.8.2 There are no canals in the vicinity of the site. Government data states that the site is unlikely to be at risk of flooding from artificial sources.
- 5.8.3 With reference to the SFRA there have been no recorded incidents of flooding to the site or surrounding areas from artificial sources and risk of reservoir flooding is very low. Therefore, the risk of flooding to the site from artificial sources is considered to be negligible.

5.9 Existing Sewers & Water Mains

- 5.9.1 The existing drainage records provided by Thames Water state there have been no incidents of flooding from sewers on the site or surrounding area.

5.10 Proposed Site Drainage

- 5.10.1 A Flood Risk Assessment requires that an evaluation of all proposed artificial drainage systems and infrastructure within, or in close proximity to the site is carried out. In the context of this development, the following systems are to be installed which need to be assessed in terms of potential flooding through the capacity of the systems being exceeded or the structural, hydraulic, mechanical or operational failure of the system occurring during the lifetime of the development:
- Piped foul water sewers, manholes, and potable water mains.
 - Permeable roads throughout the site
 - SuDS for the temporary conveyance and attenuation of surface water.
- 5.10.2 All main foul and surface water drains, sewers and manholes will be designed and constructed in accordance with *Sewerage Sector Guidance* with all private drainage constructed in accordance with *The Building Regulations Part H, BS EN 752 or BS EN 12056-2* as appropriate, ensuring adequate design capacity and robust structural integrity for the lifetime of the development. This will not only prevent the risk of flooding to both the development and offsite parties but will avoid the potential contamination of groundwater by preventing the ingress of groundwater into the pipework and egress of sewage into the underlying soils.
- 5.10.3 All SuDS within the drainage system will be sized to manage the runoff from the exceptionally rare 1 in 100 storm event (1% AEP), plus an additional 40% allowance for predicted future climate change effects (in accordance with EA recommendations up to the year 2125).
- 5.10.4 The new development must not create or exacerbate existing flood risk elsewhere and in particular to properties, land and highways downstream of the site. During the design of the proposed development careful consideration has been given to the most sustainable method of surface water disposal, in this case initially infiltration on site with an alternative strategy being a discharge to the existing watercourse.
- 5.10.5 All surface water runoff from impermeable areas on the proposed development will be safely disposed at a controlled rate to mimic the existing natural runoff regime for the undeveloped greenfield site. This will ensure that the risk of flooding to properties and land downstream of the site will not increase as a result of this proposed development.

5.11 Sequential Test

- 5.11.1 The flood risk technical guidance to the National Planning Policy Framework (NPPF) categorises residential developments as 'More Vulnerable' within the risk classification. 'More vulnerable' developments located within Flood Zone 1 are considered appropriate under the NPPF.
- 5.11.2 The NPPF guidance states that planning authorities should complete a risk based 'Sequential Test' at all stages of the planning process, to steer new development to areas with the lowest probability of flooding.
- 5.11.3 The site is located entirely within Flood Zone 1 (lowest risk) and is for residential development therefore it is considered to have passed the Sequential Test.

6 Surface Water Drainage Strategy

- 6.1.1 The National Planning Policy Framework (NPPF) requires that developments do not exacerbate flood risks both to the development site and to offsite parties and land, which means there is a need to control surface water drainage and overland runoff to ensure there are no increases in peak rates and volumes of runoff as a result of the development.
- 6.1.2 Environment Agency guidance and government legislation such as the Flood and Water Management Act (Defra 2010) requires surface water drainage strategies for new developments to be in accordance with the ideals of 'sustainable development' via the provision of Sustainable Drainage Systems (SuDS).
- 6.1.3 SuDS are more sustainable than conventional drainage methods because they can mitigate many of the adverse effects of urban stormwater runoff on the environment. This can be achieved through reducing peak runoff rates and volumes to sewer networks and watercourses, reducing the risk of downstream flooding.
- 6.1.4 The Building Regulations Document H (2015) details the appropriate hierarchy of potential methods for disposing surface water from a development:
- 1) A soakaway or some other adequate infiltration system, or where that is not practicable;
 - 2) A watercourse, or where that is not possible;
 - 3) A sewer.
- 6.1.5 Swales are included in the infiltrating solution as a key SuDS feature to slow runoff while forming part of a central green-blue corridor through the site. Their design increases amenity space and provides biodiversity benefits, contributing to a sustainable drainage network.
- 6.1.6 All drains and manholes/inspection chambers will be designed and constructed in accordance with the Building Regulations Part H and BS EN 752, ensuring adequate capacity and robust structural integrity for the lifetime of the development. This will ensure that no polluted discharge from the drainage system to ground will take place.
- 6.1.7 **Section 3** of this report discusses the ground conditions within the site and shows that the existing site is partly suitable for an infiltrating drainage solution based on groundwater data received to date. The latest groundwater testing indicates that groundwater is present up to 1.04 m bgl around WS12 in the north east corner of the site and 1.2 m bgl around WS07 in the south east corner of the site. As a result, infiltration is not feasible in this area, although it remains suitable across the rest of the site, subject to receipt of further groundwater monitoring. Therefore, the proposed surface water drainage strategy incorporates SuDS and infiltration features to sustainably discharge surface water runoff to the ground. The following paragraphs describe the proposed surface water drainage strategy for the development.
- 6.1.8 As groundwater testing is still ongoing, two design solutions have been prepared. Both options retain the use of permeable paving throughout.
- 1) Incorporating infiltration across the west of the site (Option 1).
 - 2) A non-infiltrating solution discharging into the existing watercourse along the north boundary for use should future groundwater investigations identify high groundwater levels across the entire site (Option 2).

- 6.1.9 Both strategies outflow to the watercourse at a rate less than the existing greenfield rate. The existing greenfield rate has been calculated using the impermeable catchments that are flowing to the watercourse rather than infiltrating. **Table 1** below details the existing greenfield rates for each strategy. The greenfield rates calculated in Flow are included in **Appendix F** for Option 1 and **Appendix H** for Option 2.

Table 1: Greenfield Rates

	Impermeable Area (Ha) discharging to existing watercourse	Greenfield Rate (l/s)		
		Qbar	1 Year	100 Year
Option 1 (Infiltrating)	1.62	7.4	6.3	23.7
Option 2 (Non-Infiltrating)	2.59	11.9	10.1	38.0

6.2 Surface Water Drainage Strategy - Option 1

- 6.2.1 The site has been split into 31 smaller catchments. Catchments 1-18 do not infiltrate into the ground due to the presence of high groundwater. Surface water runoff from these catchments will be collected and routed into the subbase of the permeable paving before entering a perforated pipe which connects the catchments to the existing watercourse along the northern boundary of the site. These catchments discharge into the watercourse at maximum rate of 7.4 l/s (Qbar).
- 6.2.2 A flow control system has been proposed to ensure the discharge into the existing watercourse does not exceed the greenfield rate (7.4l/s) of the site. Refer to **Appendix F** for details of greenfield calculations calculated using Flow.
- 6.2.3 Catchments 19-31 are suitable for infiltration. Surface water runoff will be collected and routed to the sub-base of the permeable roads. The sub-bases of the permeable roads have been designed to ensure they are laid within the permeable strata thus allowing surface water in the subbase to infiltrate into the existing ground.
- 6.2.4 The depth of the subbase is determined by infiltration testing at multiple locations across the site and storage requirements.
- 6.2.5 Surface water from catchments 28 and 31 discharges into proposed swales within the blue green corridor located in the central area of the site before infiltrating into the existing ground.
- 6.2.6 Refer to **Appendix E** for the Option 1 Surface Water Drainage Strategy and Catchment Plan.

6.3 Surface Water Drainage Strategy - Option 2

- 6.3.1 This option has been proposed if further groundwater monitoring confirms infiltration is not suitable across the site.
- 6.3.2 Surface water will be collected and stored in the non-infiltrating (lined) permeable paving sub-bases. The sub-bases of the permeable paving will be laid to fall towards a central trench, containing a perforated pipe, or towards a diffuser outlet that will allow flows to be conveyed to the existing watercourse on the northern boundary.
- 6.3.3 The depth of the subbase is determined by storage requirements. Three attenuation tanks are provided to meet storage requirements.
- 6.3.4 A flow control system is in place to ensure the outfall flow matches the greenfield flow rate (11.9l/s) of the site. The outfall to the watercourse is 11.9l/s. Refer to **Appendix H** for details of greenfield flow rate calculations.
- 6.3.5 Patios and footpaths of private dwellings will drain to lawns and soft landscaped areas.
- 6.3.6 Refer to **Appendix G** for the Option 2 Surface Water Drainage Strategy and Catchment Plan.

6.4 Causeway Flow Calculations

- 6.4.1 SuDS guidance (CIRIA C753) recommends an inclusion of additional 10% impermeable area to account for potential future development (Urban creep), which has been added to the calculation. The site layout in **Appendix A** was used to assess the impermeable areas on the developed site.
- 6.4.2 For the purpose of modelling and sizing the attenuation requirement for proposed SuDS areas, a 40% increase in rainfall intensity has been added to the calculations in accordance with National guidance on climate change allowances. This SuDS strategy will ensure that the surface water runoff from the future development will be attenuated and discharged as described above.
- 6.4.3 An indicative infiltrating surface water drainage strategy and alternative surface water drainage strategy have been prepared and included in **Appendices E** and **G** respectively of the report. Simulation calculations for the strategic SuDS demonstrate that for the respective critical storm events of up to 1 in 100-year return period plus a 40% allowance for climate change, the drainage system and storage of run off is contained within the storage features. The full results for the infiltrating solution (Option 1) are included in **Appendix F** and the full results for the alternative solution (Option 2) are included in **Appendix H**.
- 6.4.4 The preliminary SuDS system for the development has been designed to accord with current National, Regional and Local policy and guidance. This guidance will be followed should the site gain planning permission, when full final design details will be developed to release planning conditions and enable construction, including any potential updates resulting from changes to the masterplan.

7 Water Quality and Pollution Prevention

- 7.1.1 The proposed SuDS scheme has been designed to mitigate the contamination of the receiving groundwater and watercourse. The CIRIA SuDS Manual 2015 details an approach for establishing the hazard posed by the intended land use activities and the extent to which the proposed SuDS components can reduce and mitigate the contamination risk to the receiving groundwater and watercourse.
- 7.1.2 Referring to Table 26.2 – ‘Pollution hazard indices for different land use classifications’ considering the proposed development is for 136 residential units and due to the anticipated traffic movements on the main access road its land use results in a medium pollution hazard. With the smaller private drives and parking courts resulting in a low pollution hazard, therefore a ‘Simple Index’ method can be used to make a qualitative assessment of the proposed SuDS management. Refer to **Figure 17** below.

Figure 17: CIRIA Table 26.2 – ‘Pollution hazard indices for different land use classifications’ CIRIA C753, 2015

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7

- 7.1.3 Table 26.3 of the CIRIA SuDS Manual – Indicative SuDS mitigation indices for discharge to surface waters provides mitigation indices relating to discharges to surface waters. Refer to **Figure 18** below.

Figure 18: CIRIA Table 26.3 – ‘Indicative SuDS mitigation indices for discharges to surface waters’ CIRIA C753, 2015

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters			
Type of SuDS component	Mitigation indices¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

7.1.4 Table 26.4 of the CIRIA SuDS Manual – Indicative SuDS mitigation indices for discharge to groundwaters provides mitigation indices relating to SuDS features that infiltrate into the ground. Refer to **Figure 19** below.

Figure 19: CIRIA Table 26.4 – ‘Indicative SuDS mitigation indices for discharge to groundwaters’ CIRIA C753, 2015

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater			
Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates¹	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.6 ⁴	0.5	0.6
A soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.4 ⁴	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.4 ⁴	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.8 ⁴	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.		

7.1.5 To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type). Where the mitigation index of an individual component is insufficient, two or more components in a series is required, where:

$$\text{Total SuDS mitigation index} = \text{mitigation index}_1 + 0.5 (\text{mitigation index}_2)$$

- 7.1.6 The proposed surface water strategies (**Appendix E** and **Appendix G**) show that all surface water run-off from the main access road (medium pollution hazard) will be collected by Networks 1-9, 23 and 24.
- 7.1.7 All remaining networks have a low pollution hazard. Flows from roofs, within the smaller access roads and private parking courts will flow through a proposed permeable pavement sub-base before being attenuated in a cellular storage system and discharged to the ground.
- 7.1.8 **Table 2** below summarises the Total SuDS mitigation index for the main access road of the proposed development where Pollution Hazard Indices are considered to be medium.

Table 2: 'Total SuDS mitigation Index – Main Access Road (Medium Hazard Pollution)'

Pollutant	Pollution Hazard Indices (medium)	Permeable Pavement Mitigation Indices ¹	Total SuDS Mitigation Indices
Total Suspended Solids (TSS)	0.7	0.7	0.7
Metals	0.6	0.6	0.6
Hydrocarbons	0.7	0.7	0.7

¹ Mitigation Indices taken from Table 26.3 of the CIRIA SuDS Manual – Indicative SuDS Mitigation Indices for discharges to surface waters.

- 7.1.9 Table **3** below summarises the Total SuDS mitigation index for the remaining networks of the proposed development where Pollution Hazard Indices are considered low.

Table 3: 'Total SuDS mitigation Index – Network 1 (Low Hazard Pollution)'

Pollutant	Pollution Hazard Indices (low)	Permeable Pavement Mitigation Indices ¹	Total SuDS Mitigation Indices
Total Suspended Solids (TSS)	0.5	0.7	0.7
Metals	0.4	0.6	0.6
Hydrocarbons	0.4	0.7	0.7

¹ Mitigation Indices taken from Table 26.4 of the CIRIA SuDS Manual – Indicative SuDS Mitigation Indices for discharges to ground waters.

- 7.1.10 As can be seen from Table 2 and 3 above the Total SuDS mitigation indices for the site exceed the pollution hazard indices as required by CIRIA SuDS Manual for the required pollutants (Total Suspended Solids (TSS), metals and hydrocarbons) for the medium and low-risk classifications of this site for discharges into groundwater.



- 7.1.11 The proposals include a discharge into the existing watercourse. It can be seen from Table 26.3 that the permeable paving mitigation indices for discharges to surface water are the same as Table 26.4 for discharges to ground waters and therefore can be concluded that the mitigation indices are acceptable for both discharge to ground (infiltration) and discharge to the watercourse.
- 7.1.12 The proposed drainage strategy incorporates measures to exceed the water quality target requirements within the SuDS Manual and therefore complies with the Water Framework Directives for discharge of runoff into groundwaters and watercourses.

8 Foul Water Drainage Strategy

- 8.1.1 Thames Water is the statutory sewerage undertaker for the site and existing Thames Water records have been acquired. Refer to **Appendix I** for the sewer records.
- 8.1.2 Two Thames Water foul rising mains are located outside the proposed development boundary: one runs south-to-north to the west of the site, and the other runs eastward along the northern perimeter. Both rising mains convey flows to the East Hampstead Park Sewage Treatment Works, situated to the northeast. A decommissioned Thames Water sewer is also shown on the public sewer records, running south-westward to the south of the site.
- 8.1.3 Foul flows from the existing building are currently collected and conveyed to a private foul water pump station on the western side of the site. Flows are then pumped to the existing public Thames Water sewer.
- 8.1.4 A potential foul water strategy has been proposed by MJA to demonstrate that foul water flows can be suitably discharged for the development. The proposed foul water strategy will discharge foul flows, generated from the development, via gravity into a new foul water pumping station near the northern boundary of the site.
- 8.1.5 Flows will then be pumped to the eastern boundary of the site to the existing foul water pump station and then into the existing Thames Water Sewer utilising the existing pumps and rising main, subject to confirmation on size and condition. The proposed foul water strategy is included alongside the surface water strategies in **Appendix E** and **Appendix G**.
- 8.1.6 Peak foul water flows for the development have been calculated at 1.23 l/s based on 136 residential units. Discharge to the public foul water drainage network will be subject to a formal capacity assessment by Thames Water to confirm that sufficient treatment and network capacity is available.
- 8.1.7 Thames Water is obligated to provide network capacity at the agreed point of connection. Should the assessment identify insufficient capacity, upgrades to the existing infrastructure may be required. These improvements would be funded through the relevant infrastructure charges paid by the developer.
- 8.1.8 Subject to capacity confirmation, infrastructure charge agreement, and Thames Water approval, the development can be appropriately served for foul water discharge, and the proposed foul drainage strategy is considered suitable.

9 Flood Risk Management Measures

- 9.1.1 NPPG requires that the safety of people and the proposed development be considered against each source of flooding identified in **Section 5**.
- 9.1.2 This residential development is to be located within Flood Zone 1 and therefore, even with the potential for climate change, properties will not be at risk of fluvial or tidal flooding throughout the lifetime of the development. Furthermore, risk from all sources of flooding has been classified as low and are acceptable.
- 9.1.3 A preliminary surface water drainage strategy incorporating SuDS has been proposed to manage the increase in run-off from the site over the lifetime of the development, such that it will not place properties at risk of surface water flooding.
- 9.1.4 The SuDS system including pipe work will be maintained by a suitably qualified Management Company for the lifetime of the development, such that it will not place properties either on the site or elsewhere at an increased risk of surface water flooding.
- 9.1.5 The flood risk to the proposed development and surrounding area, as a consequence of the development is therefore considered to be low and no specific flood risk management measures will be required.

10 Residual Risks

10.1 Residual Flood Risk

- 10.1.1 As the site's residential properties will be built in Flood Zone 1, they will not be at risk of flooding, even with allowance for climate change.
- 10.1.2 Extreme rainfall events are generally predictable, but by their nature predictions are based on probability and thus subject to uncertainty. Therefore, an unquantifiable residual risk remains that events exceeding those predicted may occur, notably surcharging or blocking of sewers or gullies.
- 10.1.3 If the drainage system is overwhelmed, either by a storm event with a magnitude greater than that designed for or due to a blockage, the design of the finished site levels will direct flows away from dwellings and ensure that there is no risk of floodwaters ponding to any significant depth. In addition, the overland flow paths for any such exceedance storm events will be designed to route overland flows towards open space areas.

10.2 Management

- 10.2.1 The traditional piped network and the SuDS system for the proposed development will be managed by a suitably qualified management company for the lifetime of the development.
- 10.2.2 For any additional SuDS element of the scheme, WBC as required under the FWMA as the Lead Local Flood Authority (LLFA), will approve the scheme in detail.
- 10.2.3 A Maintenance and Management Plan for the SuDS will be provided when the surface water strategy is approved. This will provide information on a regime for ensuring the surface water network and SuDs features operate efficiently and effectively for the lifetime of the development.

11 Conclusion and Recommendations

11.1 Overview

- 11.1.1 This report has been prepared to assess the implications of Flood Risk for the proposed development of Pinewood Campus, Wokingham, Berkshire. The proposed development is for 136 residential dwelling units with associated parking, landscaping, public open space, drainage infrastructure, access and highway improvements, Suitable Alternative Natural Greenspace (SANG) and ancillary works as shown on the Masterplan (**Appendix A**).

11.2 Probability of Flooding

- 11.2.1 The site lies within Flood Zone 1 and has a very low risk of flooding from rivers or the sea. All potential sources of flood risk to and from the site, as listed in NPPF, have been assessed and the risks of flooding occurring have all been assessed as low. In assessing the flood risk, the impacts of climate change have been considered for the lifetime of the proposed development and are also considered acceptable. Surface water runoff will be dealt with via use of SuDS to reduce flood risk both on and off the site.

11.3 Flood Risk Management

- 11.3.1 As the development evolves post planning the detailed levels design should consider the routing of exceedance flows around the development to avoid flooding of existing and proposed residential dwellings.
- 11.3.2 As the proposed residential development lies within Flood Zone 1, and with the above-mentioned mitigation, the risk of flooding from all sources is assessed to be low and the safety of people is considered acceptable for all foreseeable flooding events.

11.4 Offsite Impacts

- 11.4.1 The Preliminary Surface Water Drainage Strategies set out in this assessment proposes management of surface water run-off from the development through the use of sustainable drainage techniques which will provide an improved surface water drainage regime and flood risk profile.
- 11.4.2 Consequently, this will reduce surface water run-off flows from the site, for storm return periods up to the 1 in 100-year event, plus an allowance for the detrimental effects of climate change. The proposed development will not increase the risk of flooding elsewhere. The implementation of the SuDS schemes as proposed, is likely to reduce any existing risk of downstream flooding.

11.5 Recommendations

- 11.5.1 Due to the positive outcome of these assessments, there is no reason why the site should not continue through the planning process and be approved for residential development in respect of flood risk and surface water drainage.



APPENDIX A

SITE LAYOUT