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MR ADRIAN SHOOTER

THE BEECHES AT STEEPLE ASTON

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

JUNE 2019

wardell armstrong

Wardell Armstrong
2 Devon Way, Longbridge, Birmingham, West Midlands, B31 2TS, United Kingdom
Telephone: +44 (0)121 580 0909 www.wardell-armstrong.com

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PREPARED BY:

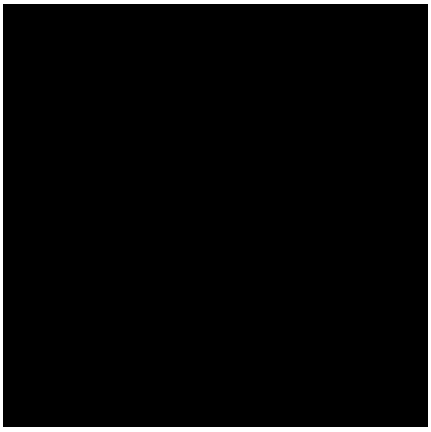
Adriana Garcia Engineer

REVIEWED BY:

Kerry Whitehouse Associate Director

APPROVED BY:

Graham Whitehouse Technical Director



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EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) & Drainage Strategy is part of a suite of documents that supports the outline planning application by Mr Adrian Shooter, for the erection of up to 9 dwellings with all matters reserved except the means of access on to Heyford Road at the Beeches in the village of Steeple Aston within the administrative area of Cherwell District Council in Oxfordshire.

The development covers a total area of approximately 1.34 hectare. The site currently comprises a large residential house with surrounding green spaces. The proposed work involves the erection of up to 9 dwellings in the domestic curtilage of The Beeches.

This FRA & Drainage Strategy assesses the risk of flooding from all sources, including from fluvial, tidal, surface water, groundwater, existing and proposed drainage infrastructure and other artificial sources in accordance with the National Planning Policy Framework. The Site is located wholly within Flood Zone 1 (low risk of fluvial and tidal flooding) and is at low risk of flooding from all other sources.

To ensure that the development does not have any adverse offsite impacts and increases flood risk elsewhere it is also necessary to demonstrate that the sustainable drainage of surface water and foul drainage from the proposed development can be achieved. This FRA & Drainage Strategy demonstrates the principles of surface water drainage to be adopted, which ensure that surface water runoff is sustainably managed and disposed of at greenfield runoff rates. In order to achieve this restriction, the use of on plot lined soakaways and permeable access road and drives are proposed for the development which will serve the highways and residential areas.

Preliminary infiltration tests have not been carried out to date. However, based on the geology of the site, it is believed that the ground has potential for infiltration. Therefore, the drainage strategy for the development is to dispose of surface water via infiltration.

Foul water will be connected to the existing Thames Water sewer network. A pumping station at the Beeches will pump the sewage from the development to the Thames Water nearest manhole (MH 7301) just north in Heyford Road. Thames Water have confirmed that there is capacity within the existing network to receive flows from this development.

The impact of climate change has been considered throughout this assessment, both when considering flood risk and in designing the surface water drainage system. The Proposed Development is therefore considered to be safe and appropriate in this regard and can be suitably drained for the lifetime of the development.

1 INTRODUCTION

1.1.1 Wardell Armstrong was instructed by Mr Adrian Shooter to produce a Flood Risk Assessment (FRA) & Drainage Strategy for the erection of up to 9 dwellings in the domestic curtilage of The Beeches with all matters reserved except the means of access on to Heyford Road at the Beeches in the village of Steeple Aston.

1.1.2 This report assesses the flood risk at the site from all sources in accordance with the National Planning Policy Framework and details the proposed foul and surface water drainage strategy. The potential for Sustainable Drainage Systems (SuDS) will also be discussed and suitable features proposed.

1.2 Structure of Report

1.2.1 The purpose of this report is to provide a technical appraisal of the flood risk pre and post development by assessing all potential sources of flood risk. In addition, this report provides a comprehensive site wide surface water and foul drainage strategy, demonstrating the principles of sustainable surface water management and foul treatment disposal. This report will form part of a larger suite of information to support an outline planning application for the proposed development of the site.

1.2.2 This report describes the results of the assessment and takes into account the recommendations of National Planning Policy Framework (NPPF) published in March 2012 and updated by the Ministry of Housing, Communities and Local Government (MHCLG) in February 2019. This report has been developed through consultation of Thames Water.

1.2.3 The desk study comprises existing site information, including a topographical survey, existing flood risk, ground investigations, geological and other available mapping, and the development proposals. Information from the following sources has been used:

- The Environment Agency (EA);
- Cherwell District Council (CDC);
- Oxfordshire County Council (OCC);
- The British Geological Survey (BGS); and
- Thames Water.

1.3 Acknowledgements

1.3.1 Within this report, data from the BGS website has been 'Reproduced with the permission of the British Geological Survey © NERC. All Rights Reserved'. Reproduction of any BGS materials does not amount to an endorsement by NERC or any of its employees of any product or service and no such endorsement should be stated or implied.

1.3.2 Data from the Environment Agency has also been used in this report. Flood zone data is now classed as Open Data. 'Open Data can be accessed, used and shared by anybody. It allows access to our data under the Open Government Licence – free of charge and free of restriction, even for commercial use.'

2 EXISTING SITE CONDITIONS

2.1 The Site and Surrounding Area

2.1.1 The 1.34-hectare (ha) site is located to the south of Steeple Aston. The nearest postcode is OX25 4SN and an approximate grid reference at the centre of the Site is SP 47689 25234. The Site is wholly located within the administrative area of Cherwell District Council in Oxfordshire.

2.1.2 The site is located at the south edge of the village and bounded by agricultural land to the south, west and north-west and to the east and north-east by residential properties and Heyford Road. Within the boundaries of the site to the east there is a large residential property. An approximate 1 mile long private light railway currently borders the garden of the site resembling an eight shape, there is also a station, and various small buildings. The Site is roughly rectangular with a projection to the east where the access drive to the existing house meets Heyford Road, Refer to Figure 1 for a Site Boundary Plan.

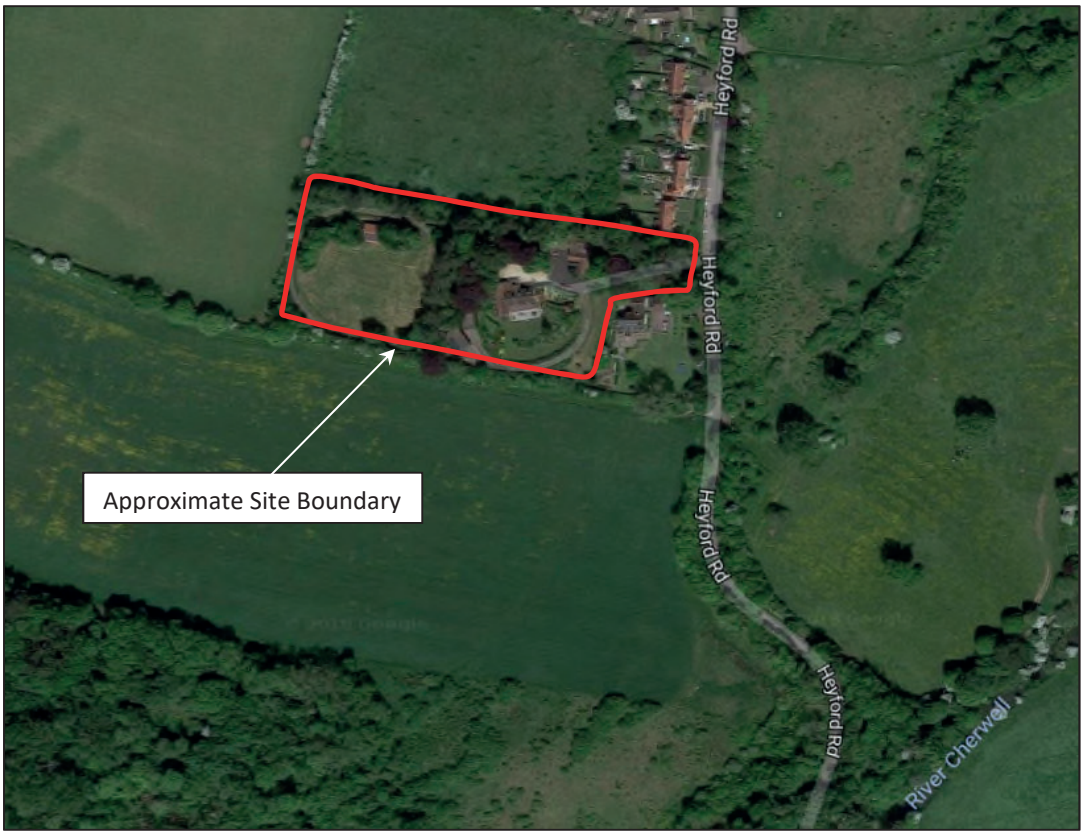

Figure 1: Aerial Image Showing the Approximate Site Boundary (Source: Google - January 2019)

2.1.3 A Topographical Survey was completed by Interlocks Surveys Limited in January 2019, which show levels to vary between approximately 102m AOD towards the east of the site where the access drive is located, rising to approximately 114 AOD, please refer to drawing 190001 for details.

2.2 Proximity to Watercourses

2.2.1 There are no open watercourses or natural water features present within the site boundary. The closest main river to the site is the River Cherwell approximately 300 metres south east from the proposed site boundary flowing south through Oxfordshire.

2.2.2 The Oxford canal is located approximately 800m to the South-East of the Site.

2.3 Geology and Ground Conditions

2.3.1 Online mapping produced by the BGS has been reviewed as part of this report. The mapping indicates that bedrock geology underlying the Site comprises two different types of Sandstone; to the west of the site the Sandstone is Horsehay Sand Formation and to the East (directly underneath the existing building) is Northampton Sand Formation. BGS does not hold records of the Superficial geology of the site. Therefore, the site may have potential for infiltration. See records included in Appendix A.

2.3.2 There is a 15.24m deep borehole near the site boundary (Borehole ref. SP42NE37). There are no details of the soil strata, nonetheless the records described it as '*probably sited on Clypeus Grit*'. The borehole log indicates that water was found at a depth of 26 feet (7.9m). There is another borehole 250m north of the site in the NR.WAR Memorial, this borehole is 46.33m and recorded Lower Estuarine Series, Northampton Sand, Upper Lias and Marlstone Rockbed (Borehole ref. SP42NE36). See records included in Appendix A.

3 ASSESSMENT OF FLOOD RISK

3.1.1 The main sources of flooding identified by the Planning Practice Guidance (PPG) are '…from rivers and the sea, directly from rainfall on the ground (pluvial), surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources'

3.2 Fluvial Flooding

3.2.1 Fluvial (river) flooding occurs when the capacity of watercourses (including streams, brooks and ditches etc.) are exceeded due to intense or prolonged rainfall events. The Environmental Agency have produced mapping to indicate areas which may be at risk of fluvial flooding, called Flood Zones, depicted on the Flood Map for Planning.

3.2.2 According to the Flood Map for Planning, as shown in Figure 2, the Site is located entirely within Flood Zone 1 and as such is at a low probability of flooding from rivers and seas.

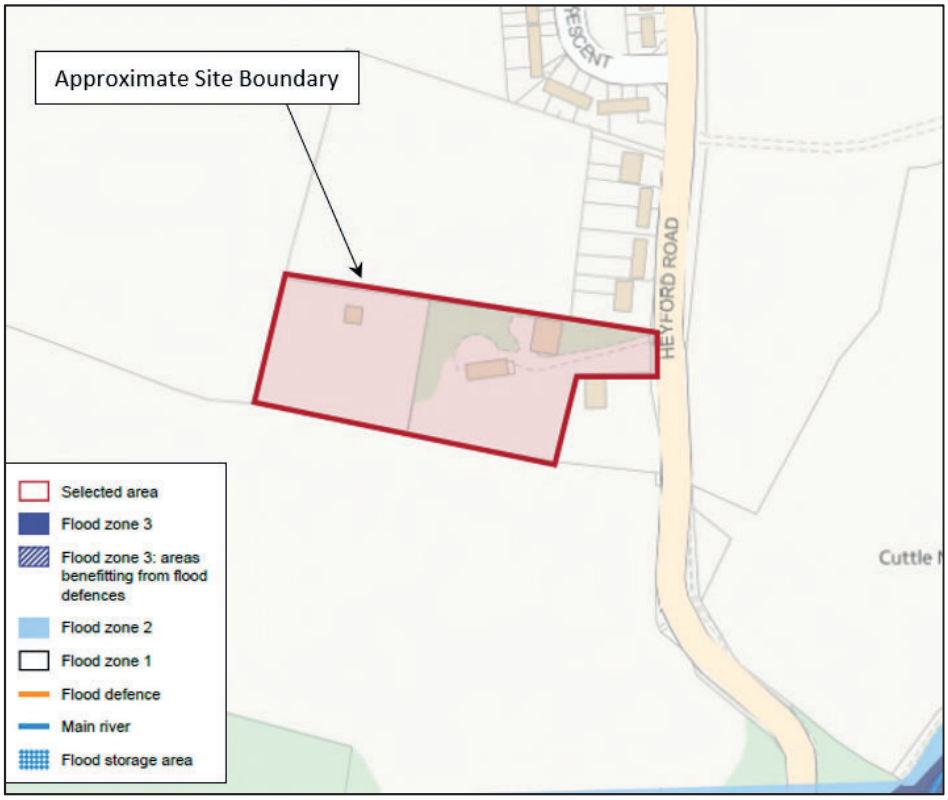

Figure 2 – Flood Map for Planning (Rivers and Sea)
(Source: http://maps.environment-agency.gov.uk)

3.3 Tidal Flooding

3.3.1 Tidal flooding is caused by exceptionally high sea levels and extreme wave heights. Tidal flooding is incorporated into the Environment Agency's Flood Map for Planning and Flood Zone designation.

3.3.2 The Site is not considered to be a risk from tidal flooding.

3.4 Pluvial/Surface Water Flooding

3.4.1 Surface water flooding is caused by rain falling onto surfaces which do not reach watercourses or drainage infrastructure. The Environment Agency's 'Risk of Flooding from Surface Water' Map examines the risk of flooding from surface water.

3.4.2 The likelihood of surface water flooding is split into four categories; 'Very Low', 'Low', 'Medium' and 'High Risk'. The 'Very Low' category indicates areas that have a chance of flooding of less than 1 in 1000 (0.1%) each year. 'Low' risk is defined as an area that has a chance of flooding of between 1 and 1,000 (0.1%) and 1 in 100 (1%) in any year with a depth of water between 0-300mm. The 'Medium' risk category is defined as an area that has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%) with a depth of water between 300mm-900mm, and the 'High' risk category has a chance of flooding of greater than 1 in 30 (3.3%) with a depth of water of over 900mm.

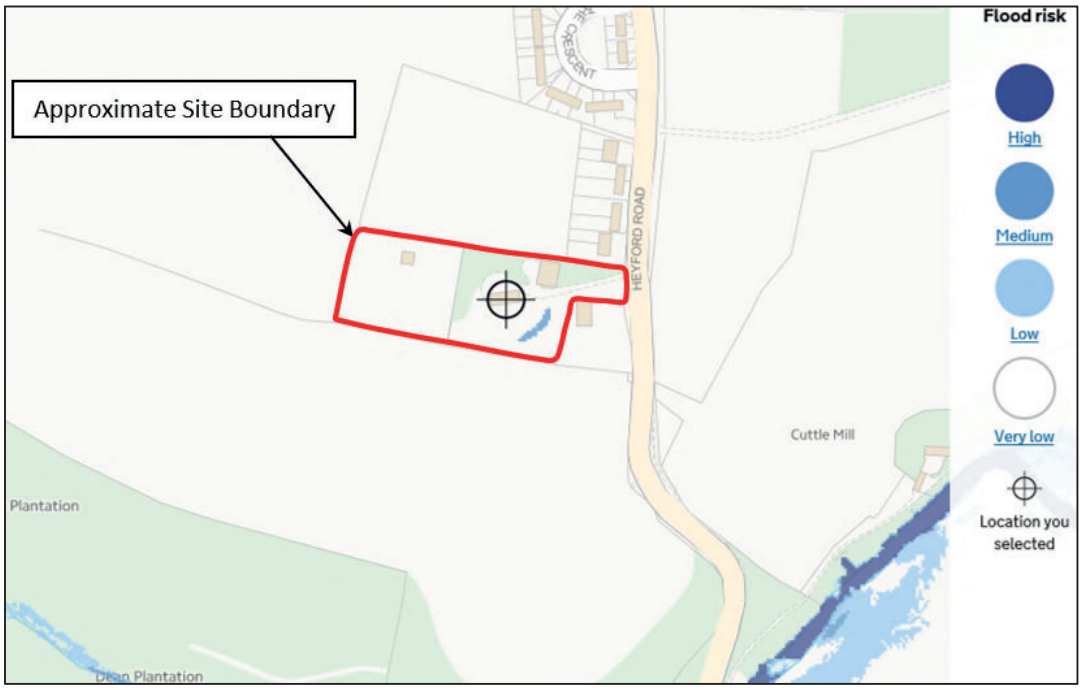

Figure 3 – Risk of Flooding from Surface Water
(*Source:* *flood-warning-information.service.gov.uk/long-term-flood-risk)*

3.4.3 The Environment Agency's 'Risk of Flooding from Surface Water' mapping is shown in Figure 3. Surface water flood risk shown by the Environment Agency mapping identifies the site to be at very low risk. The map shows a small area of localised flooding within the development boundary, just south east of the existing house, it is believed that this is due to a depression on the surface, when the site is developed this will be collected in the surface water network serving the site.

3.4.4 Surface water flooding is therefore not considered to be a risk at this Site.

3.5 Groundwater Flooding

3.5.1 Groundwater flooding can occur anywhere where groundwater levels rise above the ground surface. Groundwater flooding can be difficult to predict and identify, and is often mistaken for surface water flooding.

Source Protection Zones

3.5.2 Groundwater provides a third of drinking water in England and Wales, and maintains the flow in many of our rivers. The Environment Agency have identified Source Protection Zones (SPZ's) for 2,000 groundwater sources such as springs, boreholes and wells used for the public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area – the closer the activity the greater the risk. The maps show three main zones - Inner (Zone 1), Outer (Zone 2) and Total Catchment (Zone 3) and a fourth zone of special interest (Zone 4), which occasionally applies to a groundwater source.

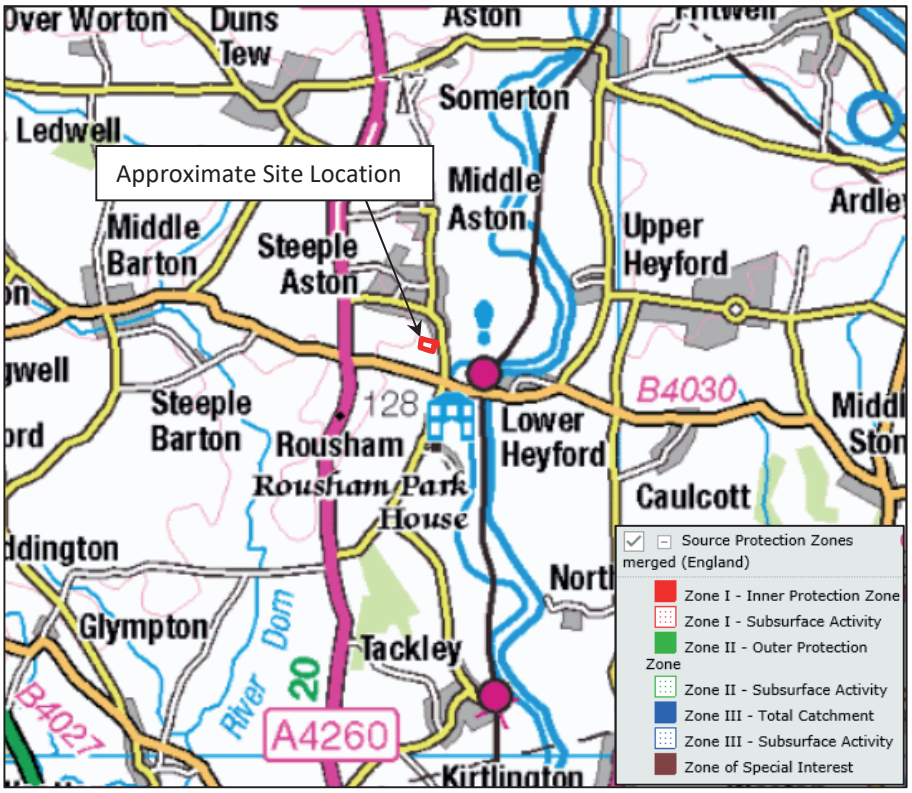

Figure 4 – Groundwater Source Protection Zones
(Source: https://magic.defra.gov.uk/MagicMap.aspx)

3.5.3 According to Environment Agency mapping, the Site is not within an area of groundwater SPZ (Figure 4).

Aquifers

3.5.4 Aquifers are underground layers of water-bearing permeable rock or drift deposits from which groundwater can be extracted. Aquifer designations reflect their importance in terms of groundwater as a resource (drinking water supply), but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data as shown on Environment Agency mapping is based on geological mapping provided by the BGS, which is updated regularly to reflect ongoing improvements.

3.5.5 The vulnerability of an aquifer is based on how contaminants released at the soil surface are transported down to the water table taking account of protective layers such as soils, drifts and unsaturated zones.

3.5.6 Figure 5 shows the aquifer designation bedrock geology for the site. According to the map the site is underlain by a Secondary Aquifers A. This aquifer designation means that is a "*…permeable strata capable of supporting water supplies at a local rather*

than strategic scale and in some cases forming an important source of base flow to rivers".

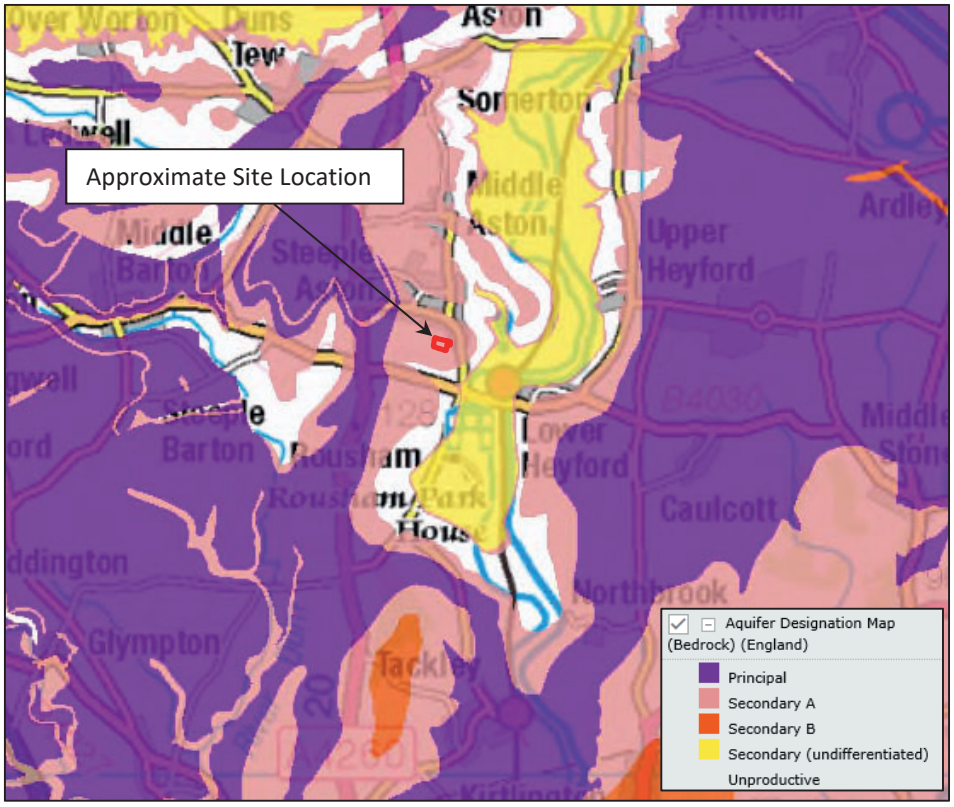

Figure 5 – Aquifer Designation Maps (Bedrock)
(*Source: https://magic.defra.gov.uk/MagicMap.aspx*)

3.5.7 There are no records of groundwater flooding affecting this Site.

3.5.8 Groundwater flooding is not considered to be a risk at this Site.

3.6 Existing Sewers and Drains

3.6.1 Foul and Surface water sewers are at risk of surcharging during extreme rainfall events with flooding occurring principally from manholes and gullies. Surcharging sewers can result in overland flow, which depending on the topography, can potentially pose a flood risk to properties.

3.6.2 Records from Thames Water show that there are no public surface water sewers in the vicinity of the Site.

3.6.3 The closest public foul sewer network is in Hayford Road, approximately 120m north from site the boundary flowing in a north westerly direction towards the Steeple Aston village.

3.6.4 According with Oxfordshire County Council Preliminary Flood Risk Assessment Report, the only site within the Cherwell District that has experienced sewer flooding problems is Spiceball Park Road in Bambury.

3.6.5 The site is considered to be at low risk of flooding from existing sewers and drains.

3.7 Reservoirs, Canals and Lakes

3.7.1 Flooding from reservoirs, canals and lakes occurs when their associated dams, embankments or other retaining structures fail or are breached.

3.7.2 The Oxford canal is located approximately 800m to the south-east of the site in lower lying land and therefore is not considered to pose a risk.

3.7.3 The EA long term risk of flooding from reservoir map in Figure 6 shows that the site is at low risk of flooding from reservoirs, canals and lakes.

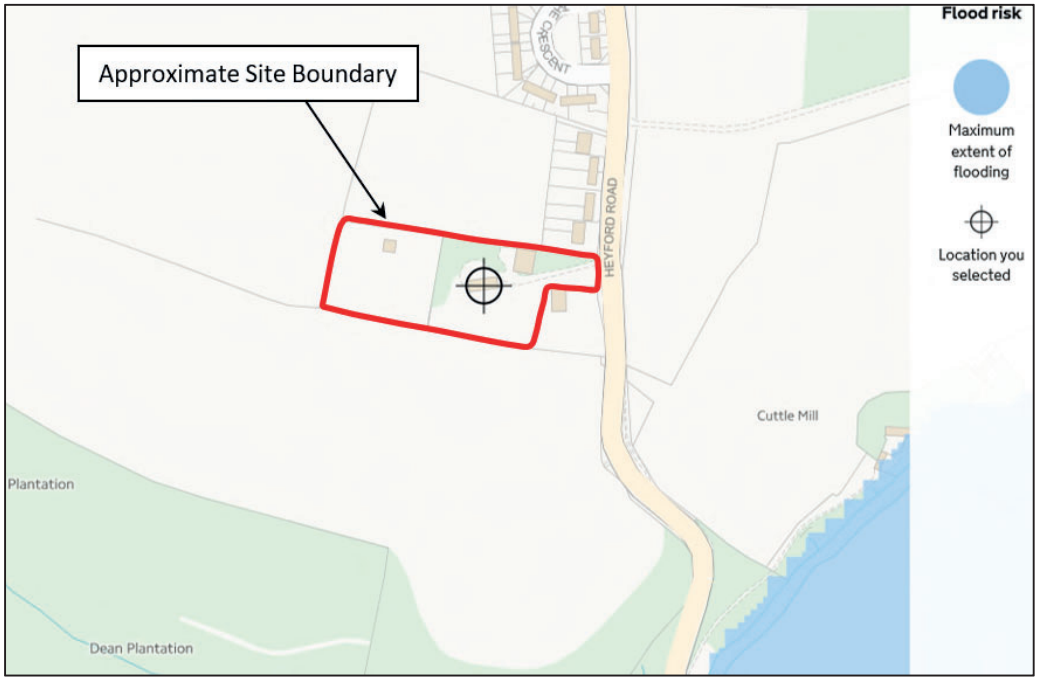

Figure 6 – Risk of Flooding from Reservoirs
(*Source: flood-warning-information.service.gov.uk/long-term-flood-risk)*

3.8 Other Artificial Sources

3.8.1 There are no other artificial sources of flooding in the vicinity of the Site. Therefore, the risk of flooding from other artificial sources in this location is considered to be low.

3.9 Historic Flooding

3.9.1 Maps produced as part of the Oxfordshire Preliminary Flood Risk Assessment were assessed and there are no records of historic flooding on the Site from surface water,

groundwater or the Oxford canal, not even during the July 2007 flooding event which had a major impact in the county and at a wider national scale.

3.9.2 The Strategic Flood Risk Assessment for the Cherwell District summarises historic flood events in the Cherwell District. The SFRA mentions flooding in the highway in Steeple Aston in Oct-Dec 2012 and Jan-Mar 2013. The specific location of this flooding is not given and therefore is not considered to be a risk for this site.

4 BACKGROUND AND KEY DOCUMENTS

4.1 National Planning Policy

4.1.1 The National Planning Policy Framework (NPPF) was published in 2012 and revised by the Ministry of Housing, Communities and Local Government (MHCLG) in February 2019. It sets out the Government's national policies on flood risk management in relation to land use planning in England.

4.1.2 NPPF is accompanied by Planning Practice Guidance (PPG) 'Flood Risk and Coastal Change' which was published in March 2014. PPG is a web-based resource which advises how planning can take account of the risks associated with flooding and coastal change, both in plan making and the planning application process.

4.1.3 This section will review the risk of flooding at the site from all sources, both pre- and post-development. Reference will be made to local and strategic policies and documents as relevant.

4.2 Flood Zones

4.2.1 The Environment Agency has published various maps identifying areas at risk of flooding from fluvial, tidal, pluvial / overland flow, reservoirs and groundwater. These maps are based on improved hydraulic modelling and detailed local data and are published on the Environment Agency website. 'Flood Zones' are designated based on their predicted flood risk (Table 1).

Table 1: Flood Zones extracted from Table 1 of the PPG: Flood Risk and Coastal Change

Flood Zone	Flood Zone Classification	Description
Flood Zone 1	Low Probability	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%)
Flood Zone 2	Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year
Flood Zone 3	High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability or river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5% in any year
Flood Zone 3b	Functional Floodplain	The zone comprises land where water has to flow or be stored in times of flood

4.2.2 The PPG states that all development within Flood Zones 2 or 3 and/or are over 1 hectare in size must be accompanied by a site-specific FRA undertaken as part of the planning application process.

4.2.3 As previously discussed in Section 3.1.2 Environment Agency mapping indicates that the Proposed Development is located wholly within Flood Zone 1. However, as the Site is over 1 ha, a FRA needs to be undertaken on this basis.

4.3 Description of Proposed Development

4.3.1 The development of The Beeches at Steeple Aston will provide residential accommodation for up to 9 dwellings with associated infrastructure including a footpath and open spaces, car parking and vehicular access. The proposed site plan indicates that six of the properties will be built in the grounds west to the existing property and two more will be located north east of the existing house across the driveway. Refer to drawing 372A01_101 - Indicative Site Plan for details.

4.3.2 Indicative proposed areas are as follows:

- Total Indicative Site Area – 1.34ha
- Existing Property including new double garage Approx. Area – 0.041ha
- Driveway Existing house – 0.045ha
- Residential Properties including drives Approx. Area – 0.162ha
- Access Road Approx. Area – 0.150ha
- Gardens and public open space – 0.942ha

4.4 Flood Risk Vulnerability

4.4.1 Table 2 of the PPG identifies the Flood Risk Vulnerability Classification of development types. Development types are classed as ‘Essential Infrastructure’, ‘Highly Vulnerable’, ‘More Vulnerable’, ‘Less Vulnerable’ and ‘Water Compatible Development’ depending on their use and vulnerability.

4.4.2 ‘More Vulnerable’ development includes ‘Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.’ It also includes ‘Non-residential uses for health services, nurseries and educational establishments.

4.4.3 As residential dwellings are proposed, the Proposed Development is considered to be ‘More Vulnerable’ in accordance with the NPPF.

4.5 The Sequential & Exception Tests

4.5.1 The PPG details the Sequential and Exception Tests. The Sequential Test is a planning tool which aims to steer new development to areas with the lowest probability of flooding (Flood Zone 1, followed by Flood Zone 2). The PPG states that '*Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required'.* The Flood Zones and Strategic Flood Risk Assessments (SFRA's) are the starting point for applying the Sequential Test.

4.5.2 Table 3 of the PPG identifies when the Exception Test should be applied, and is reproduced in Table 2 below:

Table 2: Flood Risk Vulnerability Classification (Department for Local Communities for Local Communities & Local Government, 2015)

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	X	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	X	X	X	✓

Notes
✓ Development is appropriate
× Development should not be permitted

4.5.3 As this 'More Vulnerable' development is located wholly within Flood Zone 1, the Sequential Test is not required and is therefore sequentially preferable. According to PPG Table 3, 'More Vulnerable' uses are considered appropriate for Flood Zone 1 without the need to apply the Exception Test.

4.6 Preliminary Flood Risk Assessment

4.6.1 Preliminary Flood Risk Assessments (PFRA's) were a requirement of the Flood Risk Regulations (2009), and were produced by Lead Local Flood Authorities (LLFA's). Their

purpose is to provide information on significant historical flood events and summarise future flood risk from all sources of flooding.

4.6.1 The PFRA for Oxfordshire County Council was completed in June 2011 by JBA Consulting and reviewed in 2017. The Addendum published By Oxfordshire County Council in 2017 estates that "…there is no change to the assessment of risk following the review". Some key points of the PFRA relevant to this Site include:

- The PFRA for Oxfordshire County Council includes 5 major flooding events with adverse consequences in Oxfordshire: February 2001, October 2006, January 2007, July 2007 and June 2008. During these events 2,824 properties were affected, mainly all of them during the July 2007.
- A review of Indicative Flood Risk Areas in Oxfordshire identified 5 flood risk 'clusters': Reading (a small part of the Reading cluster is in Oxfordshire), Oxford (named Barton by the analysis), Banbury, Witney and Abingdon.
- The PFRA estimates that approximately 37,900 people in Oxfordshire are at risk of flooding during a rainfall event with a 1 in 200 annual chance, with flooding to a depth >0.3m depth.

4.6.2 The PFRA does not highlight Steeple Aston as a site at risk of flooding.

4.7 Strategic Flood Risk Assessment

4.7.1 The NPPF states that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA), which refines information regarding the probability of flooding, taking other sources of flooding and the impacts of climate change into account. SFRA's provide the foundation for applying the Sequential Test, on the basis of the flood zones.

4.7.2 Level 1 SFRA's examine flood risk issues at a borough wide scale. They also identify the requirement for a more detailed analysis of flood risk at key locations as part of a Level 2 SFRA. Level 2 SFRA's provide a more detailed analysis of flood risk at key locations, building on the work of the Level 1 SFRA, it also identifies sites for potential allocation within the emerging District Plan.

4.7.3 The Level 1 and 2 SFRA for Cherwell District Council was completed by AECOM Infrastructure & Environment UK Limited in May 2017. Some key points relevant to this Site include:

- The summary of historic flood events in the Cherwell District contains records of flooding in the highway in Steeple Aston in Oct-Dec 2012 and Jan-Mar 2013.

4.7.4 The SFRA does not raise any concerns for the Site.

4.8 Local Flood Risk Management Strategy for Oxfordshire

4.8.1 Local Flood Risk Management Strategies (LFRMS) are produced by LLFA's. The strategy should assess local flood risk, set out objectives to manage local flooding, list costs and benefits of measures proposed to meet those objectives, and detail how the measures will be funded.

4.8.2 The LFRMS for Oxfordshire was developed by Oxfordshire County Council in partnership with the City and District Councils and the EA. However, Oxfordshire County Council remains the lead authority in developing and delivering the strategy. The key principles of the OCC LFRMS include:

- Oxfordshire largely falls within the areas of low to moderate flood risk.
- Oxfordshire County Council will understand and manage flood risk by:
  - Working in partnership with other risk management authorities.
  - Having an appreciation of where flooding is likely to occur, how often and its potential impact.
  - Taking reasonable steps to reduce the probability of events occurring.
  - Identifying and implementing (where funding permits) measures that reduce the consequences of flooding when this does occur.
  - Building on the information prepared for the Preliminary Flood Risk Assessment.
  - Developing a clear picture of the flooding caused by different sources and how they interact.
  - Understanding the causes of historic flood events and understanding likely impacts in the future.

4.9 Local Development Framework

4.9.1 A Local Development Framework (LDF) is a spatial planning strategy for district councils in England and Wales. The LDF comprises of Local Development Documents (including Local Plans), Supplementary Planning Documents (SPD's), Statements of Community Involvement, and other documents as required.

Cherwell District Council Local Plan

4.9.2 The Cherwell Local Plan sets out the Council's planning framework for the district. It identifies how the district will grow and develop. The Cherwell District Local Plan was adopted in July 2015 and is valid until 2031 and sets out the long-term special vision for the District and contains policies to help deliver that vision. Planning policies for Cherwell are grouped around three themes: Developing a Sustainable local Economy (DSC), Building Sustainable Communities (BSC) and Ensuring Sustainable Development (ESD).

4.9.3 Policy ESD 1: *Mitigating and Adapting to Climate Change; The incorporation of suitable adaptation measures in new development to ensure that development is more resilient to climate change impacts will include consideration of the following:*

- *Taking into account the known physical and environmental constraints when identifying locations for development.*
- *Demonstration of design approaches that are resilient to climate change impacts including the use of passive solar design for heating and cooling.*
- *Minimising the risk of flooding and making use of sustainable drainage methods and*
- *Reducing the effects of development on the microclimate (through the provision of green infrastructure including open space and water, planting, and green roofs).*

4.9.4 Policy ESD 6: Sustainable Flood Risk Management: *The Council will manage and reduce flood risk in the District through using a sequential approach to development; locating vulnerable developments in areas at lower risk of flooding. Development proposals will be assessed according to the sequential approach and where necessary the exceptions test as set out in the NPPF and NPPG. Development will only be permitted in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and the benefits of the development outweigh the risks from flooding.*

- *In addition to safeguarding floodplains from development, opportunities will be sought to restore natural river flows and floodplains, increasing their amenity and biodiversity value. Building over or culverting of watercourses should be avoided and the removal of existing culverts will be encouraged.*
- *Existing flood defences will be protected from damaging development and where development is considered appropriate in areas protected by such defences it must*

allow for the maintenance and management of the defences and be designed to be resilient to flooding.

- *Site specific flood risk assessments will be required to accompany development proposals in the following situations:*
  - *a) All development proposals located in flood zones 2 or 3*
  - *b) Development proposals of 1 hectare or more located in flood zone 1*
  - *c) Development sites located in an area known to have experienced flooding problems*
  - *d) Development sites located within 9m of any watercourses.*
- *Flood risk assessments should assess all sources of flood risk and demonstrate that:*
  - *a) There will be no increase in surface water discharge rates or volumes during storm events up to and including the 1 in 100 year storm event with an allowance for climate change (the design storm event)*
  - *b) Developments will not flood from surface water up to and including the design storm event or any surface water flooding beyond the 1 in 30 year storm event, up to and including the design storm event will be safely contained on site.*
- *Development should be safe and remain operational (where necessary) and proposals should demonstrate that surface water will be managed effectively on site and that the development will not increase flood risk elsewhere, including sewer flooding.*

4.9.5 Policy ESD 7: Sustainable Drainage Systems (SuDS)

- *All development will be required to use sustainable drainage systems (SuDS) for the management of surface water run-off.*

  Where site specific Flood Risk Assessments are required in association with development proposals, they should be used to determine how SuDS can be used on particular sites and to design appropriate systems.

  In considering SuDS solutions, the need to protect ground water quality must be taken into account, especially where infiltration techniques are proposed. Where possible, SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. SuDS will require the approval of Oxfordshire County Council as LLFA and SuDS Approval Body, and proposals must include an

agreement on the future management, maintenance and replacement of the SuDS features.

5 PROPOSED SURFACE WATER DRAINAGE

5.1 Principles of the Surface Water Management Strategy

5.1.1 Site-specific surface water drainage infrastructure will need to be installed to serve the development.

5.1.2 PPG requires that SuDS measures are implemented to manage surface water runoff within new developments.

5.1.3 The Non-Statutory Technical Standards for Sustainable Drainage Systems sets out general recommendations for the control of development runoff, including the requirement to ensure that runoff from the site is not increased by the development, and the requirement to manage surface water runoff from events up to and including the 1 in 100 year (including an allowance for the projected impacts of climate change).

5.1.4 PPG advises that climate change allowances should be determined with reference to the guidance provided in the Environment Agency document 'Flood Risk Assessment: Climate Change Allowances' (February 2016). As the Site is proposed for residential dwellings, the development is assumed to have a design life of 100 years.

5.1.5 In accordance with Table 2 of the February 2016 guidance, for developments with a design life extending beyond the year 2070, climate change allowances of 20% and 40% should be considered against design rainfall intensities.

5.1.6 As such it is proposed that the surface water drainage strategy will be based on a provision of surface water attenuation on site which will accommodate the 1 in 100 year plus 40% climate change rainfall event.

5.1.7 All new drainage systems will be designed and constructed in accordance with the latest version of Sewers for Adoption (SfA), currently 7th edition.

5.2 Method of Surface Water Disposal

5.2.1 The most appropriate method of surface water discharge is determined based on the hierarchy of surface water disposal as set out in Building Regulations – Approved Document H, as listed below in order of priority:

1) Infiltration;
2) Watercourse; and
3) Public Sewer.

5.2.2 Based on the geological context described in Section 2.3, infiltration is considered a viable method of surface water disposal for this site. Therefore, the drainage strategy for the development is to dispose of surface water through infiltration. Infiltration test will be required at detailed design stage to confirm the infiltration rate of the site.

5.3 Attenuation Requirements

5.3.1 An infiltration rate of $5X10^{-5}$m/s has been assumed for the purpose of this assessment.

5.3.2 To ensure that the development does not have any adverse offsite impacts and does not increase flood risk elsewhere surface water runoff will be sustainably managed and disposed of via infiltration. To achieve predeveloped conditions, the use of on plot lined soakaways and permeable access roads are proposed. This storage volume has been determined using MicroDrainage (Appendix B).

5.4 Lined Soakaways Requirements

5.4.1 The on-plot lined soakaways have been designed using MicroDrainage. Dimensions have been calculated as shown in Table 3. These provide the required storage volume based on a 100 Yr + 40% climate change return period storm event. Refer to the strategy drawing BM11730-002 for details.

Table 3: On-Plot Soakaways Dimensions

Location	Drainage Area (m2)	Pit Depth (m)	Ring Diameter (m)	Pit Width (m)
Plots 1 & 6	100	1.5	1.2	2.4
Plots 7 to 9	340	1.8	2.1	4.2
Garage Existing House	40	1	1	2

5.4.2 This design does not consider any storage within the pipe network and therefore additional storage volume would be attenuated on site above the 1 in 100-year + 40% climate change event.

5.5 Permeable Access Road - Infiltration Blanket Requirements

5.5.1 Infiltration blankets are proposed for access roads and the existing house driveway, these have been designed using MicroDrainage. Please refer to the drainage strategy drawing BM11730-002 for details.

5.5.2 The infiltration blankets will run under all the access road, visitor's car park spaces and the driveway of the existing house and will be 150mm deep. These will provide the

required storage volume based on a Q100 Yr + 40% climate change return period storm event.

Table 4: Infiltration Blankets Dimensions		
Location	**Drainage Area (m2)**	**Depth (m)**
Access Road	1500	0.15
Existing House Driveway	450	0.15

5.6 Sustainable Drainage Systems

5.6.1 It is a requirement of the NPPF that SuDS are used in all major development if feasible. The LLFA also strongly advocate the use of SuDS within new development as demonstrated through '*Water.People.Places A guide for master planning sustainable drainage into developments*' in the South East (2013).

5.6.2 CIRIA report C753 'The SuDS Manual' outlines the various types of SuDS, their benefits and limitations and design considerations associated with each. Not all SuDS components/methods are feasible or appropriate for all developments due to factors such as ground conditions, available space and site levels, which will influence the different methods adopted as part of a particular development.

5.6.3 Source control SuDS (e.g. water butts and/or rainwater recycling) will be considered (as appropriate). Such features will provide further betterment in terms of surface water runoff rates and volumes not accounted for in the drainage design.

5.7 Water Quality

5.7.1 The surface water drainage system which will incorporate SuDs will ensure that a sufficient level of water quality treatment is provided to ensure that the proposed development does not have any adverse impact on of the receiving network.

5.7.2 According to CIRIA C753, runoff from residential developments (roof and highway runoff) is considered to present a 'medium' source of runoff pollution, therefore at least two treatment stages will be provided within the SuDS system. The first 5mm of rainfall is known as the 'first flush' and generally has a higher pollutant load than subsequent runoff. This flow will be contained within the Site, through provision of the SuDs techniques outlined above.

5.7.3 Effective upstream pre-treatment should be provided to prevent sediments and silt loads from clogging the soakaways.

6 PROPOSED FOUL DRAINAGE STRATEGY

6.1.1 This section outlines how foul flows from the proposed development will be managed in accordance with national and regional policy requirements and best practice guidance.

6.2 Existing Foul Water Drainage

6.2.1 The closest public foul sewer is located on Heyford Road north of the site flowing in a northerly direction.

6.3 Design Foul Flows Strategy

6.3.1 The design of the foul drainage network was based on *Sewers for Adoption (7th Ed. Pre-Implementation)*. A peak flow rate of 4,000 litres per dwelling per day has been used, this equates to **0.46l/s** for 10 dwellings (9 new dwellings and the existing property).

6.3.2 The preferred point of connection is manhole 7301 located in Heyford Road. However, due to the topography of the site a pumping station (PS) will be required. According to SFA 7th edition this would be a Type 2 and would require a 10m easement from the wet well to habitable dwellings (refer to drawing BM11730-002).

6.3.3 Using actual water consumption rates, the peak flow rate has been calculated to be **0.33l/s**. This is based on the following:

- 10 dwellings;
- Water consumption of 160 litres per person per day;
- 2.7 people per property; and
- 6 Dry Weather Flow (DWF) (typical diurnal profile).
- 10% infiltration rate

6.4 Public Sewer Capacity

6.4.1 A developer enquiry has been submitted to Thames Water to confirm capacity within the existing foul water network. A response was received on 4th February 2019 and confirmed that there is sufficient sewer capacity in the network to accept the foul flows from the proposed development, therefore a point of discharge is available. their response is included in Appendix C.

7 ADOPTION AND MAINTENANCE

7.1.1 As of 6th April 2015, SuDS are a planning requirement for all 'Major Developments'. In addition, LLFA became Statutory Consultees with effect from 15th April 2015. LPA's, in considering planning applications, will consult the relevant LLFA on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate; and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for the ongoing maintenance of SuDS over the lifetime of the Proposed Development.

7.2 Thames Water

7.2.1 Thames Water is the appointed water company for this area and are responsible for the operation and maintenance of existing public foul drainage and public surface water drainage network.

7.3 Oxfordshire County Council

7.3.1 OCC is the LLFA for Cherwell District Council and as such, is responsible for and has a duty to:

- Promote SuDS on all new developments;
- Review and approve all proposed SuDS;
- Ensure all proposed SuDS have appropriate adoption and maintenance arrangements;
- Comply with the Flood and Water Management Act (2010);
- Investigate significant flood events in Oxfordshire (Section 19 investigations);
- Designate structures and assets which have significant flood risk implications;
- Maintain a public register of adopted SuDS;
- Maintain a public register of designated flood risk assets;
- Consent to works affecting ordinary watercourses; and
- Carry out enforcement concerning ordinary watercourses.

7.4 Adoption and Maintenance Arrangements

7.4.1 All drainage on site, including the on-plot soakaways and drives will remain private and the access road will be offered to OCC or Cherwell District Council for adoption

subject to a Section 106 agreement and provision of a commuted sum. Alternatively, a Private Management Company may be appointed to maintain the effective operation of any SuDS features on site the funding of which will be provided through a service charge arrangement.

7.4.2 A typical maintenance schedule for on plot soakaways and permeable paving can be seen in Appendix D.

8 RESIDUAL FLOOD RISK & MITIGATION MEASURES

8.1 Finished Floor Levels

8.1.1 In accordance with Building Regulations, FFL's of new residential properties should be set at least 150mm above surrounding ground levels. This will provide some protection to properties from extreme flood events or flooding of the drainage system due to blockages or collapse etc.

8.2 Safe Access & Egress

8.2.1 All residential units will be located within Flood Zone 1 and will therefore have dry access and egress to Heyford Road during fluvial flood events up to and including up to the 1 in 1,000-year flood event.

8.3 Designing for Exceedance

8.3.1 The surface water drainage system has been designed to minimise the risk of flooding to properties in the event of exceedance of the system capacity during storm events in in excess of the design storm of 1 in 100 years including an allowance for climate change.

8.3.2 Overland flood routing during extreme rainfall events (such as the 1 in 1,000-year event) could generate shallow depths of water. Excess rainfall will be directed away from the dwellings towards rear gardens and access road following the site topography. A drop in the kerb will allow for extreme rainfall to be directed to a scrape of ground located south of the access road close to the site entrance, see Drainage Strategy Plan BM11730-002 for details, with any excess directed south to the existing drainage in Heyford Road.

9 CONCLUSIONS

9.1 Conclusions

9.1.1 This FRA and Drainage Strategy has been prepared by Wardell Armstrong to support an outline planning application for a proposed development of up to 9 properties on 1.34ha of undeveloped land in the curtilage of the Beeches.

9.1.2 Environment Agency mapping indicates that the Site is located wholly in Flood Zone 1. The Site is at low risk of flooding from all other sources. The flood risk to the development is considered to be low overall. As this 'More Vulnerable' development is located wholly within Flood Zone 1, the Sequential Test is not required and the Site is therefore sequentially preferable. According to PPG Table 3, 'More Vulnerable' uses are considered appropriate for Flood Zone 1 without the need to apply the Exception Test.

9.1.3 To ensure that the development does not have any adverse offsite impacts and increases flood risk elsewhere surface water runoff will be sustainably managed and disposed of via infiltration. On site Infiltration tests have not been carried out at this stage. However, based on the geology of the site it is anticipated that infiltration is a viable option. Nevertheless, it is recommended that infiltration tests are carried out at detail design stage to confirm onsite infiltration rates.

9.1.4 In order to achieve predeveloped conditions, the use of on plot lined soakaways and infiltration blanket on access roads and drives is proposed. This has been calculated for the 1 in 100year + 40% rainfall event.

9.1.5 A Thames Water sewer capacity check has confirmed there is capacity available in the existing network to accommodate the flows from the proposed development. Foul flows will require pumping to reach the Thames Water closest manhole located in Heyford Road.

9.1.6 In conclusion, it is demonstrated that the proposals within this report are compliant with NPPF, PPG and local planning policy. It is therefore considered that on implementation of this strategy, the Proposed Development will remain safe from flood risk and can be suitably drained for the lifetime of the development.