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FLOOD RISK ASSESSMENT AND DRAINAGE STATEMENT

Scheme name:

Carport, Northmoor Park, Northmoor

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Foreword

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Some of the information presented within this report is based on third party information which is believed to be correct; no liability will be accepted for any discrepancies in accuracy, mistakes or omissions in such information. The report also assesses the flood risk in relation to the requirements of the Environment Agency and as such assesses the site for a specific flood event and not all flood events. The contents of this document must not be copied or reproduced in whole or in part without the written consent of Infrastruct CS Ltd

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1.0 Summary

A Flood Risk Assessment (FRA) and drainage strategy has been undertaken to accompany the planning application for a proposed Carport, located on Northmoor Park, Northmoor. This report has been prepared by Infrastruct CS Ltd on behalf of Anderson Orr Architects in accordance with the guidelines set out in the National Planning Policy Framework.

The following table is an overview of the flood risk and drainage strategy for the proposed development of the site, based upon currently available information and finds the following –

ITEM	RESPONSE
Site Location	The site is located in Northmoor Park in the village of Northmoor, The approximate grid reference 442075E, 202695N.
Size and Current Land Usage	The current site is approximately 0.03ha in plan and is currently a grass/shrub area which is within the curtilage of the existing property.
Flood Zone	The development site falls within Flood Zone 2, however, the updated modelled flood levels show the site is at risk from flooding greater than a 1 in 100 year return period.
Fluvial Flood Risk	High – Refer to Section 6.1
Overland Flood Risk	Low – Refer to Section 7.1
Groundwater Flood Risk	High – Refer to Section 7.2
Sewerage Flood Risk	Low – Refer to Section 7.3
Artificial Flood Risk	Low – Refer to Section 7.4
Proposed Development	The proposals are for the development of land are for a carport and gravel parking area which will be designed to flood.
SuDS Features proposed for this scheme	The proposed SuDS features for the development of land are to use shallow infiltration techniques to utilise the capacity within the underlying Northmoor Sands and gravels. See 8.7.

Based on this assessment, it is concluded that in accordance with the Flood risk vulnerability and flood zone compatibility table in Section 6.9 from the Planning Practice Guidance document, the report considers the proposed development appropriate.

2.0 Introduction

2.1 Commission

Anderson Orr Architects has commissioned Infrastruct CS Ltd, to prepare a Flood Risk Assessment (FRA) and drainage statement to support a planning application for a new Carport and parking area in Northmoor Park, Northmoor, Oxfordshire, OX29 5AZ.

2.2 Guidance

This flood risk assessment has been compiled in accordance with the recommendations of the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG).

2.3 Aims and Objectives

The purpose of this flood risk assessment is to assess the potential flood risks by and to the proposed development. It will identify the flood risk zone, potential sources of flood risk, consider the proposed drainage and will be used to support the proposed planning application.

3.0 Site Details

3.1 Location

The development site is located at the western end of the village of Northmoor in West Oxfordshire. Principle access to the site is via an existing access road off Standlake Road, OX29 5SX.

Figure 3.1.1 – Site Context

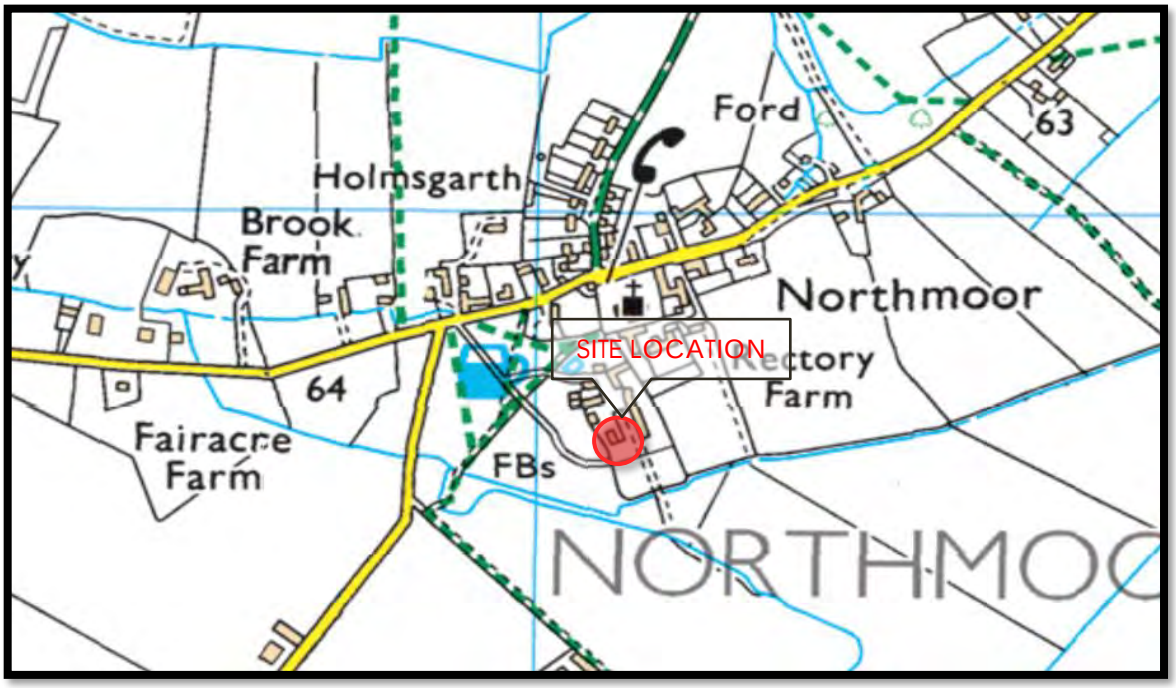


Figure 3.1.2 - Site location

3.2 Grid Reference

The approximate ordnance survey national grid reference for the site is 442075E, 202695N (SP 42075 02695.)

3.3 Topography and Site Description

The development site is within the curtilage of an existing residential property located at the end of the private access road with further buildings located to the east which are currently used for commercial purposes.

The overall area of the development site equates to approximately 320sqm. It is predominantly surfaced with grass and shrubs.

The topography of the site is relatively flat, ranging from approximately 63.10-63.40m AOD, falling predominantly from north to south. See appendix A for topographic survey

3.4 Ground Conditions

To date no intrusive ground investigation has taken place on site, however reference to the Geological Survey of Great Britain indicates the following strata:

Superficial deposits: Northmoor Sand and Gravel Member

Bedrock geology: Oxford Clay Formation And West Walton Formation

Intrusive site investigations carried out adjacent/near the development and shown on the British Geological Survey database (BGS ID: 330355, BGS Ref: SU59NE152, British NGR: 455662,195900) Showed the following strata:

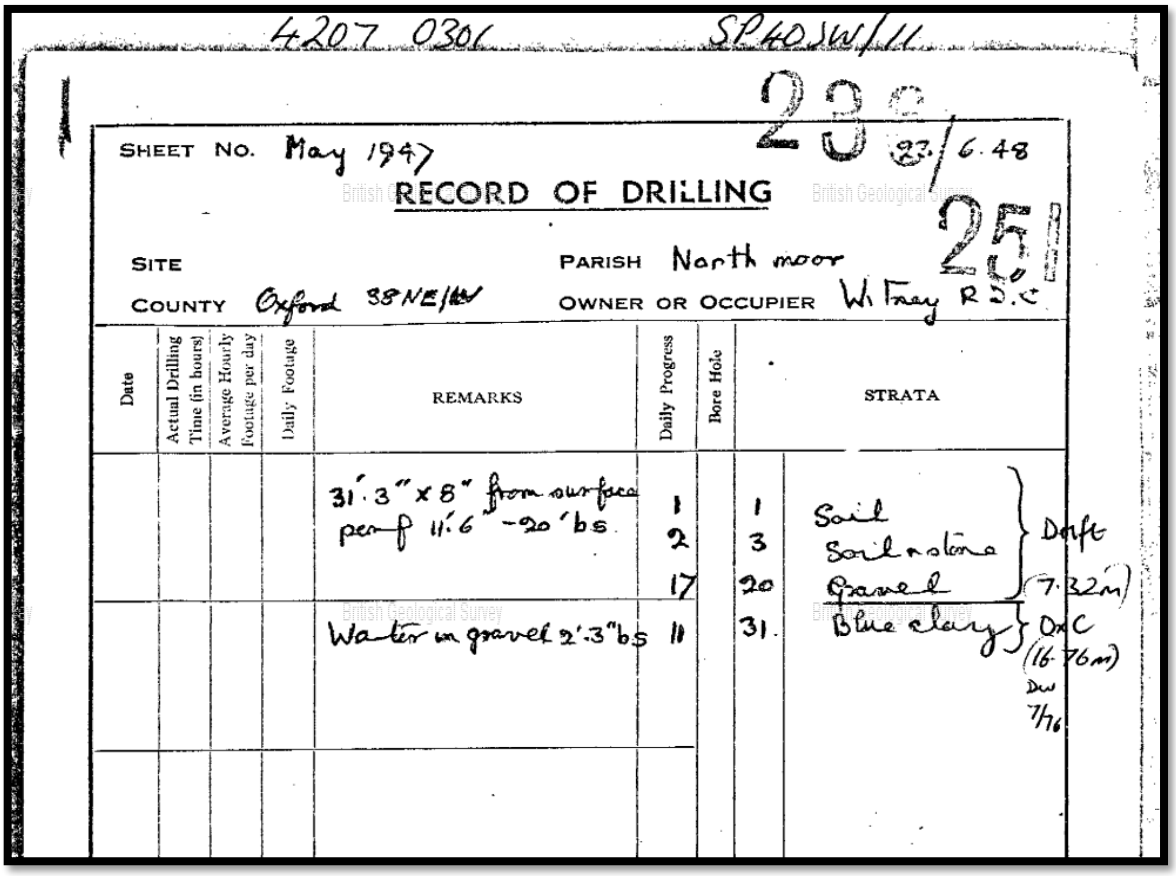


Fig 3.4 –British Geological Survey Data

3.5 Ground Water

Due to the underlying geology and the site being located within the flood plain, it is felt that the risk of flooding from groundwater is high.

3.6 Existing Site Drainage

Within the development site there are signs of a foul water drainage system but this report has been unable to determine whether this outfalls into a treatment plant of a positive piped system connection to the public system within the village to the north of the development.

The existing buildings and hard standing areas use the natural infiltration potential of the underlying ground conditions to disperse surface water from the development site.

3.7 Existing Watercourses

The site falls within the catchment area of both the River Windrush, which runs in a southern direction approximately 1.2km off the western boundary of the site and the River Thames which runs in a north easterly direction approximately 750m to the east of the site.

The Windrush catchment is located south of the Evenlode catchment and North of the Thames. The Windrush flows south eastwards across the West Oxfordshire District through Burford, Swinbrook, Asthall, Minster Lovell and Witney from where it turns southwards to its confluence with the Thames at Newbridge, upstream of Oxford. The total catchment area of the Windrush is 362.6 km2 from its source in the Cotswold Hills.

Other than the main rivers mentioned above, closer to the site lies the Blenheim Ditch which runs in a northwest-southeast orientation approximately 80m to the southwest of the development site. This system is classed as main river and splits to the west of the site with one arm running due east and the other running in a south-easterly direction, with both arms ultimately joining the River Thames. Approximately 100m to the north of the site there is a secondary ditch system which runs parallel to Standlake Road. This feeds into the Blenheim Ditch prior to the watercourse crossing under the road.

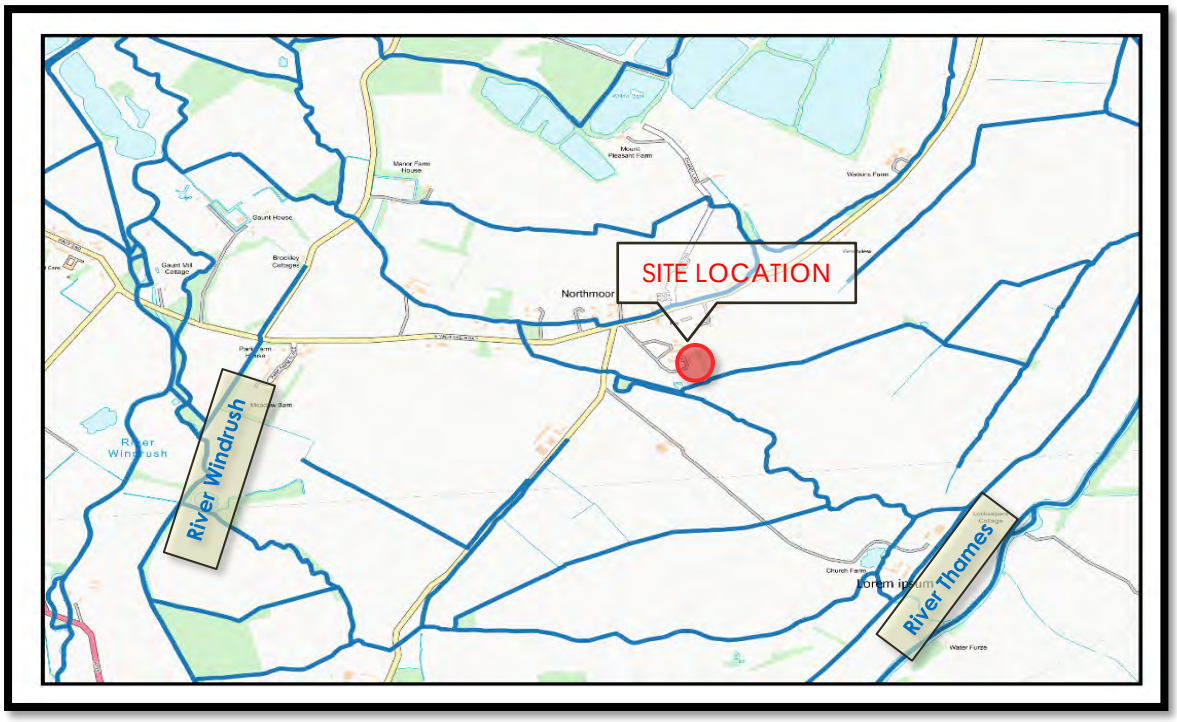


Figure 3.7.1 – Local Rivers

3.8 Environment Agency Groundwater and Aquifer Protection

Reference to the Environment Agency Groundwater protection zone map shows the area is sited outside all groundwater protection zone. The Environment Agency have defined Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes, and springs used for 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.

Figure 3.8.1 – Groundwater Protection Zones

KEY:

- Zone I – Inner Protection Zone
- Zone I – Subsurface Activity
- Zone II – Outer Protection Zone
- Zone II – Subsurface Activity
- Zone III – Total Catchment
- Zone III – Subsurface Activity
- Zone of Special Interest

The Environment Agency use the zones to set up pollution prevention measures in areas which are at a higher risk, and to monitor the activities of potential polluters nearby.

A study of the aquifer maps on the Magic website revealed the site to be located within a Secondary A superficial aquifer which is designated as geology capable. The groundwater Vulnerability in this area is classed as Medium-Low.

Secondary A - permeable layers 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. These are generally aquifers formerly classified as minor aquifers;

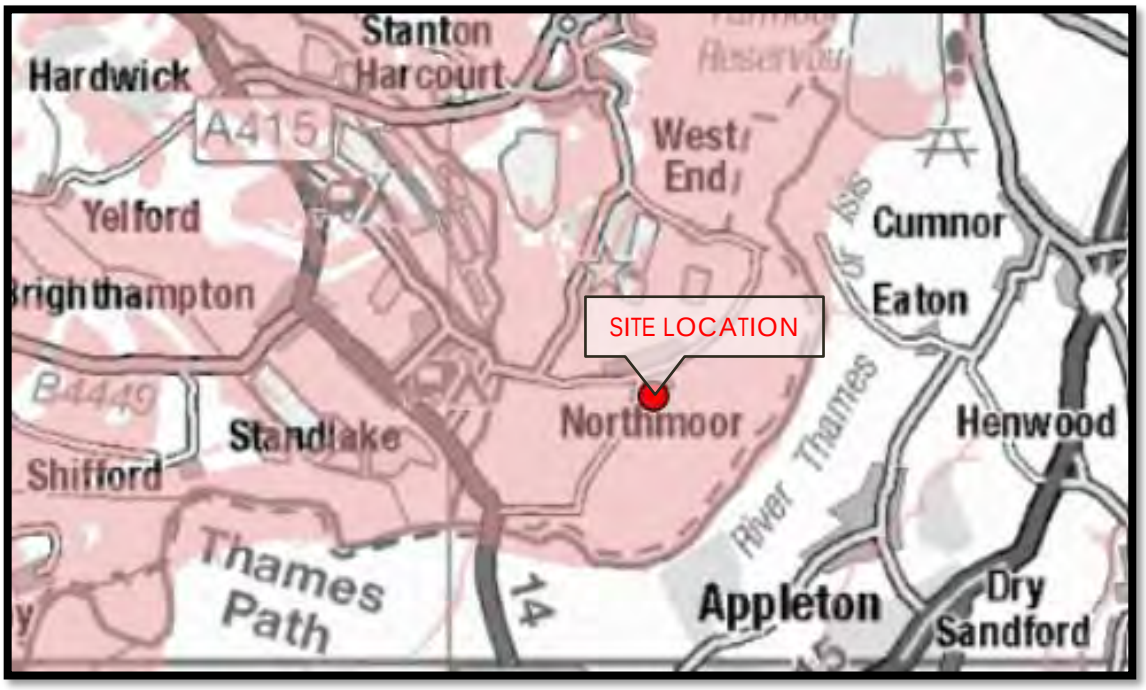


Figure 3.8.2 – Aquifer Designation Map – Superficial

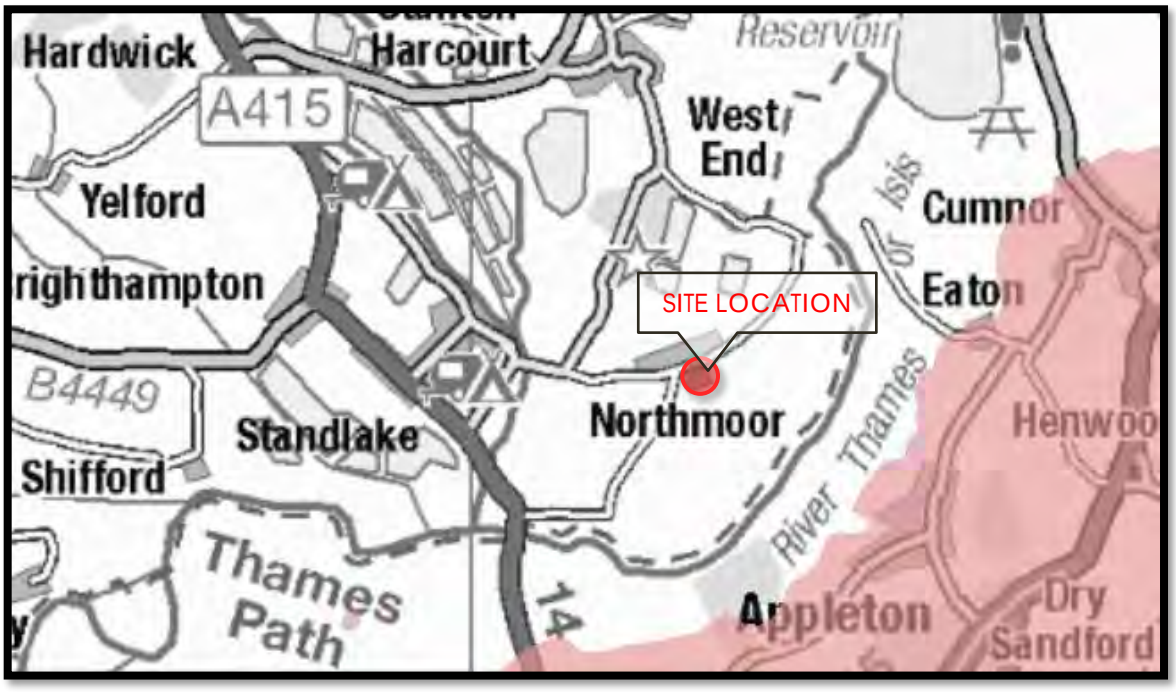


Figure 3.8.3 – Aquifer Designation Map – Bedrock

KEY:

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unknown (Lakes & Landslip)
- Unproductive

4.0 Proposed Development

The current architectural proposals involve the construction of a carport and gravel parking area on an existing greenfield area within the curtilage of an existing residential dwelling.

Existing levels will be retained across the site and the Carport will be designed as a floodable Structure.

The proposed development plan can be found in Appendix B.

5.0 Local Planning Policy and Guidance

5.1 West Oxfordshire Local Plan 2031

POLICY EH7: Flood risk

Flood risk will be managed using the sequential, risk-based approach, set out in the National Planning Policy Framework, of avoiding flood risk to people and property where possible and managing any residual risk (taking account of the impacts of climate change).

In assessing proposals for development:

- the Sequential Test and, if necessary, the Exception Test will be applied;
- all sources of flooding (including sewer flooding and surface water flooding) will need to be addressed and measures to manage or reduce their impacts, onsite and elsewhere, incorporated into the development proposal;
- appropriate flood resilient and resistant measures should be used;
- sustainable drainage systems to manage run-off and support improvements in water quality and pressures on sewer infrastructure will be integrated into the site design, maximising their habitat value and ensuring their long term maintenance;
- a site-specific flood risk assessment will be required for all proposals of 1ha or more and for any proposal in Flood Zone 2 and 3 and Critical Drainage Areas;
- only water compatible uses and essential infrastructure will be allowed in a functional flood plain (Flood Zone 3b);
- land required for flood management will be safeguarded from development and, where applicable, managed as part of the green infrastructure network, including maximising its biodiversity value.

6.0 Flood Risk Policy

6.1 Environment Agency Flood Map

The flood map for the development site shown below suggests that the site wholly falls within Flood Zone 2, which is defined as land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (Land shown in light blue on the Flood Map)

Figure 6.1.1 - Environment Agency © 2021 - Flood Zone map

KEY:

- Flood Zone 3
- Areas Benefiting from flood defences
- Flood Zone 2
- Food Zone 1
- Flood defence
- Main river
- Flood storage area

It is, therefore, the consideration of this FRA that the site has a High risk of flooding from fluvial sources.

6.2 Historic Flood Events

The area associated with Standlake and Northmoor has been subjected to several flood incidents of varying severity since the first recognised 1 in 100yr flood event of 1947. From the information provided by the Environment Agency and WODC SFRA sources these flooding incidents related to water levels within the adjacent watercourses exceeding their capacity which as a result then encroached onto the surrounding low lying areas.

As such the following flood events have been recorded within the area.

March 1947, August 1977, February 1979, September 1992, December 2000 & July 2007.

These are not site specific events, however an indicative outline associated with the 1947 flood event has been provided by the Environment Agency and provided below for clarity.

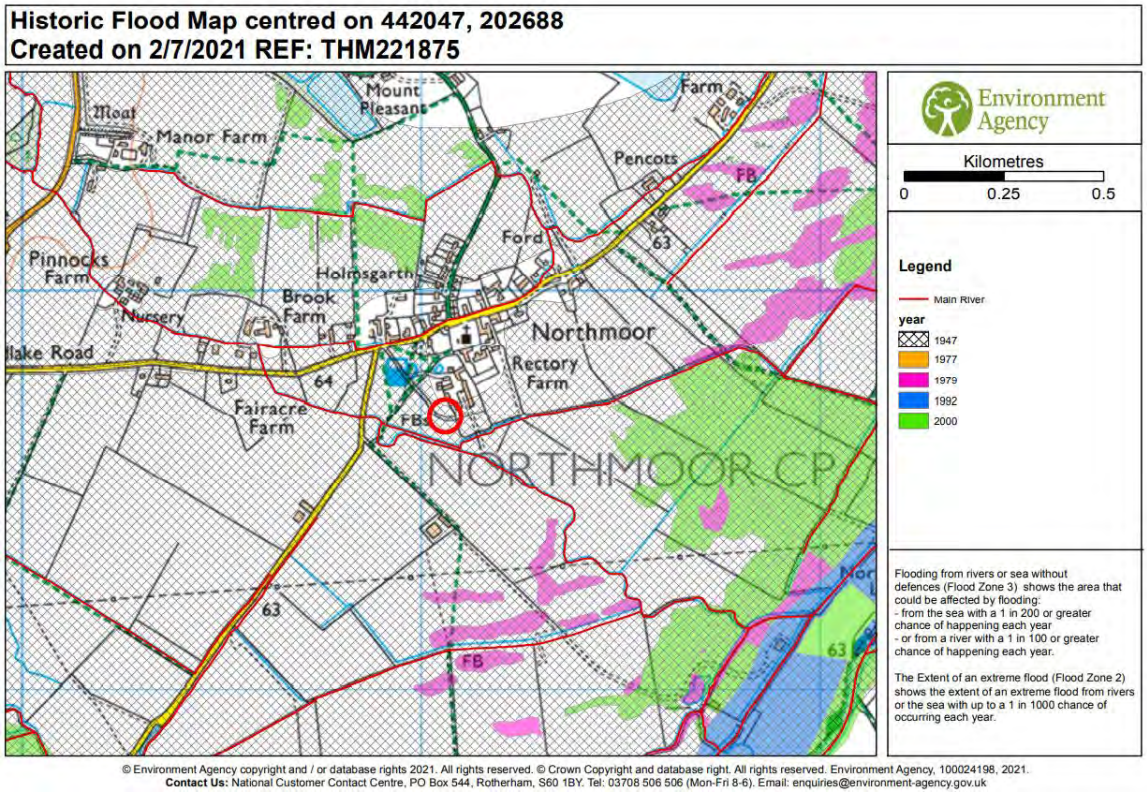


Figure 6.2 - Environment Agency © 2021 – Historic Flood map

6.3 Flood Modelling Results for the Development Site

As part of the information gathering exercise a product 4 flood data request was made from the Environment Agency. This document provided specific flood level nodes close to the development site.

An assessment of these nodes in terms of position and level has been indicated below;

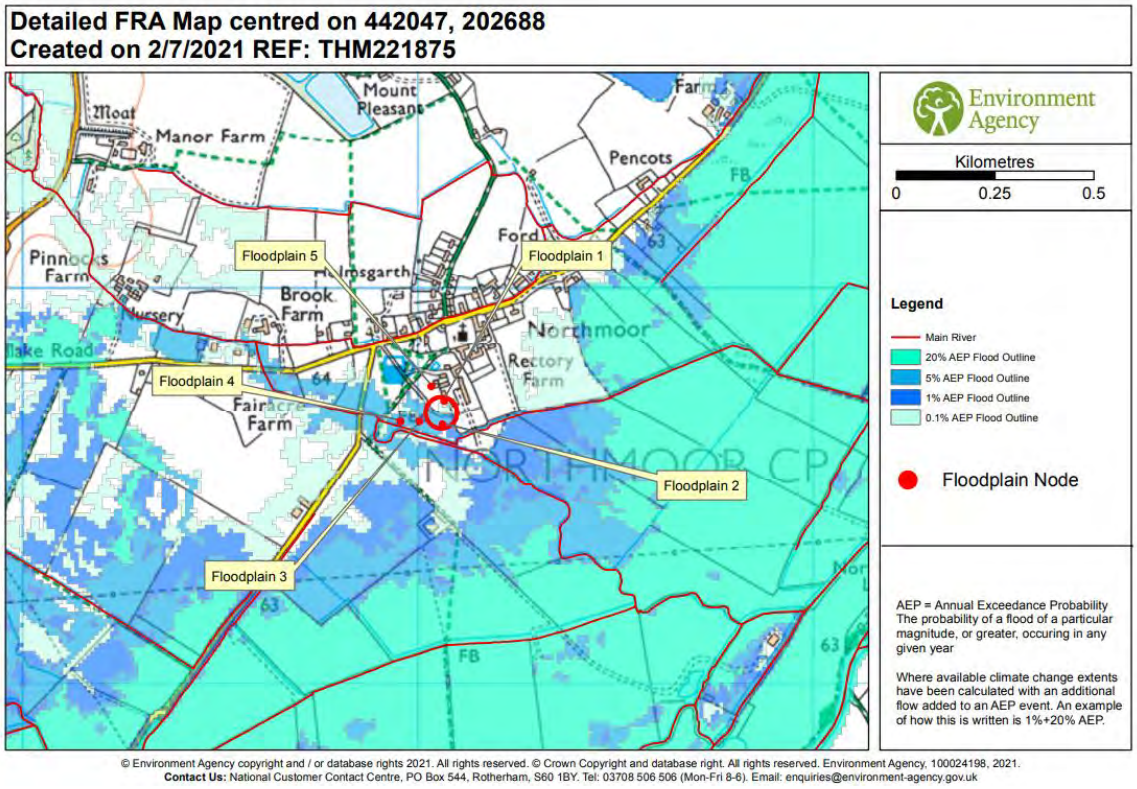


Figure 6.3.1 - Environment Agency © 2021 - Assessment of adjacent flood nodes

Floodplain 1 is located on the site but only the 1 in 100 year plus 70% has been provided for this node. Floodplain 2 is immediately adjacent to the site so this node data has been used to assess the flood depths for the site for other return periods.

Floodplain Reference	1 in 100yr	1 in 100yr + 35% climate change	1 in 100yr + 70% climate change	1 in 1000yr
Floodplain 2	63.39m	63.41m	63.51m	63.42m

A flood outline for the 1 in 100 year plus 35% has been created using lidar data and refined used the topographical survey for the site, included in Appendix A.

An assessment of the flood depths has been carried out at the site access, the proposed parking area and the proposed Carport based on the existing site levels from the topographical survey.

6.4 Flood Zone for the Development site

Based on the assessment above, the modelled flood level for Floodplain 1 (appendix D) within the site demonstrates the site is classed as being within the 1 in 100 year plus 70% climate change flood outline. It is, therefore, the consideration of this FRA that the site has a High risk of flooding from fluvial sources and will be considered as being located within Flood zone 3a for this assessment.

6.5 The National Planning Policy Framework

The National Planning Policy Framework (NPPF) and the accompanying Planning Practice Guidance (PPG) gives direction for development with respect to flooding. These documents promote a sequential approach to encourage development away from areas that may be or are susceptible to flooding. In doing so it categorizes flood zones in the context of their probability of flooding, as shown in the table within Section 6.6 below.

6.6 Flood Zone Definition

The National Planning Policy Framework Definition of Flood Zones

Flood zone	Fluvial	Tidal	Probability of flooding
1	< 1 in 1000 year	<1 in 1000 year	Low probability
2	Between < 1 in 1000 year and 1 in 100 year	Between <1 in 1000 year and 1 in 200 year	Medium Probability
3a	> 1 in 100 year	> 1 in 200 year	High probability
3b	Either > 1 in 20 or as agreed between the EA and the LPA	Either > 1 in 20 or as agreed between the EA and the LPA	Functional flood plain

6.7 Flood Zones – Table 1 PPG

(Note: These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Zone 3a - High Probability
Definition
This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Appropriate uses
The water-compatible and less vulnerable uses of land in (Table.2 NPPF) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable uses and essential infrastructure permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in time of flood.
FRA requirements
All development proposals in this zone should be accompanied by a FRA.
Policy aims
In this zone, developers and local authorities should seek opportunities to: reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and relocate existing development to land with a lower probability of flooding.

6.8 Flood Risk Vulnerability Classification - Extract from Table 2 PPG

More Vulnerable

- Hospitals.
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels.
- Non–residential uses for health services, nurseries, and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

6.9 Flood Risk Vulnerability & Flood Zone Compatibility Table

Vulnerability classification flood zone	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
1	√	√	√	√	√
2	√	√	Exception test required	√	√
3a	Exception test required	√	x	Exception test required	√
3b	Exception test required	√	x	x	x

√ Development is appropriate x development is not appropriate

The above table, taken from PPG (Table 3), confirms that associated residential buildings within flood zones 3 will be appropriate subject to an exception test however, the development is classed as minor development and therefore the exception test is not required as stated in the notes to table 3.

- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;

6.10 Other Flooding Mechanisms

In addition to the potential for assessing flooding from fluvial and tidal sources NPPF also requires that consideration is given to other mechanisms for flooding:

- Flooding from land – intense rainfall, often in short duration, that is unable to soak into the ground or enter drainage systems, can run rapidly off land and result in local flooding.
- Flooding from groundwater – occurs when water levels in the ground rise above the surface elevations.
- Flooding from sewers – In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and wastewater sewers known as combined sewers. Flooding can result causing surcharging when the sewer is overwhelmed by heavy rainfall.
- Flooding from reservoirs, canals and other artificial sources – Non-natural or artificial sources of flooding can result from sources such as reservoirs, canals lakes etc, where water is held above natural ground levels.

7.0 Other Sources of Flood Risk to The Development

7.1 Flooding from Overland Flows

The risk of flooding due to overland flood flows is considered very low by the Environment Agency. The surface water flood data for the site, shown below, indicates that there is no significant flood risk from surface water in close proximity to the site.

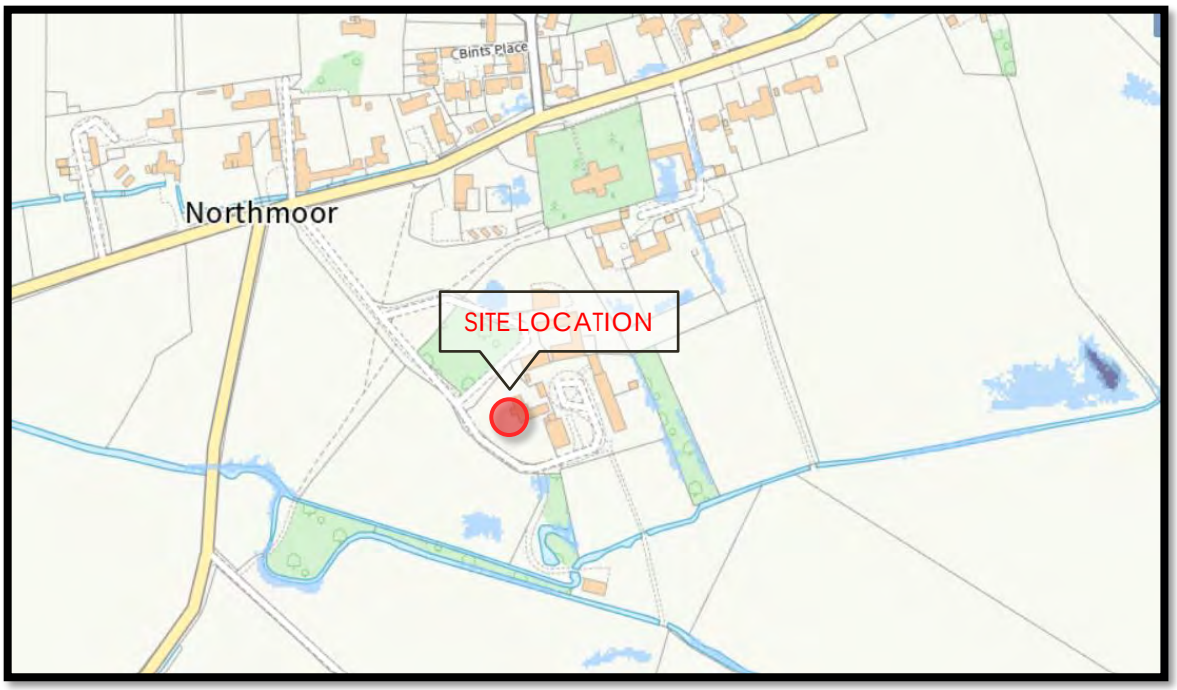


Fig7.1.1 – Environment Agency © 2021 - Flood Risk from Surface Water map

KEY:

- **High** (Greater than 3.3% chance of flooding)
- **Medium** (Between 1% and 3.3% chance of flooding)
- **Low** (Between 0.1% and 1% chance of flooding)
- **Very Low** (Less than 0.1% chance of flooding)

It is, therefore, the consideration of this FRA that the site has a very low risk of flooding from overland flows.

7.2 Flooding from Rising Groundwater

The underlying ground strata within this area are typically part of the Northmoor Sand and Gravel Member. As such these permeable ground conditions are highly likely to retain the ground water table which is likely to be represented by the levels of the adjacent watercourses. As such the ground water table in times of flooding is likely to be represented by the level of water within the adjacent watercourse.

It is the consideration of this FRA that the site has a High risk of flooding from rising groundwater levels, however this potential flood mechanism is likely to mirror the same flood plain associated with fluvial flooding and therefore as a result this risk has also been quantified and mitigated in the same manner as fluvial flooding.

7.3 Flooding from the Local Sewerage Network

Sewer flooding generally results in localised short-term flooding caused by intense rainfall events overloading the capacity of sewers. Flooding from sewers can also occur as a result of blockage, poor maintenance or structural failure.

There are no surface water sewers near the site and therefore, it is the consideration of this FRA that the site has a low risk of flooding by surcharging of the local sewer network.

7.4 Flooding from Reservoirs, Canals & Other Artificial Sources

Review of location plans for the development site show there to be no signs of manmade water sources within the immediate area. There are flooded lakes to the north associated with historic gravel extraction pits however the water level within these is representative of the ground water table and therefore flooding via this possible mechanism has been discounted.

It is the consideration of this FRA that the site has a low risk of flooding by reservoirs, canals or other artificial sources

8.0 Flood Risk as a Result of the Development

8.1 Effect of The Development Generally

Development by its nature usually has the potential to increase the impermeable area with a resultant increased risk of causing rapid surface water runoff to watercourses and sewers, thereby causing surcharging and potential flooding. There is also the potential for pollutants to be mobilised and consequently flushed into the receiving surface water system.

Increases in both the peak runoff rate (usually measured in litres per second l/s) and runoff volume (cubic metres m^3) can result.

8.2 Surface Water Drainage & Sustainable Drainage Systems

Sustainable Drainage techniques (SuDS) covers a range of approaches to manage surface water runoff so that-

'Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account. This should be demonstrated as part of the flood risk assessment.'

8.3 Peak Storm Design Criteria

The proposed sustainable drainage techniques for the development should accommodate the peak rainfall event for a 1 in 100 year storm event with an additional allowance for climate change. Table 5 of NPPG recommends for developments that have a life expectancy beyond 2085, that an additional factor of 40% is applied to the peak volume of runoff.

8.4 Existing Surface Water Runoff Rates

The development site area is approximately 0.03ha, mostly impermeable. The neighbouring building to the site currently drain via soakaways into the ground. The existing greenfield runoff rates calculated for site are highlighted below:

Return Period	Greenfield Runoff Rate l/s / Hectare
1 in 1 year	1.37
Qbar	1.61
1 in 30 year	3.71
1 in 100 year	5.15

Table 8.4 Existing Runoff rates

Greenfield runoff rates were calculated using the HR Wallingford UK SuDS website https://www.uksuds.com/drainage-tools-members/greenfield-runoff-rate-tool.html

8.5 Infiltration Testing

The existing site currently drains via soakaways and permeable surfaces which is feasible due to the underlying sands and gravels. Detailed infiltration testing to BRE 365 will need to be carried out to inform the detailed design.

8.6 Sustainable Drainage Hierarchy

A hierarchical approach has been undertaken in consideration of the application of SuDS in relation to the development. This is in order to meet the design philosophy of ensuring that surface water run-off is managed as close to its source as possible and the existing situation is replicated as closely as possible.

The following drainage hierarchy has been undertaken with reference to the procedures set out in the SuDS Manual (CIRIA C753, 2015) to assess the viability of the application of SuDS techniques to this scheme:

Store rainwater for later use: There is potential for water buts to be installed to take the roof water and store it for reuse

- Use infiltration techniques, such as porous surfaces in permeable strata areas: Infiltration techniques such as permeable paving, swales, trenches, etc. are suitable to reduce the runoff leaving the site and addressing it at source. Drainage will be predominantly managed by an infiltration subbase under the permeable parking surface.

- Attenuate rainwater in ponds or open water features for gradual release to a watercourse. N/A. There are no watercourses in the vicinity. Moreover, infiltration techniques are sufficient to deal with the runoff on site.

- Attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse. N/A. Above solutions are sufficient to manage runoff.

- Attenuate rainwater by storing in tanks or sealed water features for gradual release to a surface water drain. N/A. Above solutions are sufficient to manage runoff.

- Attenuate rainwater by storing in tanks or sealed water features for gradual release to a combined water drain. N/A. Above solutions are sufficient to manage runoff.

- Discharge rainwater to the combined sewer. Not applicable to the proposed development.

The sustainable drainage hierarchy shown above is intended to ensure that all practical and reasonable measures are taken to manage surface water higher up the hierarchy (1 being the highest) and that the amount of surface water managed at the bottom of the hierarchy is minimised.

Storing rainwater for later use might be an option but it is not sufficient to accommodate the runoff from the whole development.

The site-specific drainage hierarchy checklist considered for the drainage design for this development is detailed in Table 8.6.

SUDS OPTIONS	Comments	Potential for flow rate control	Volume reduction	Maintenance requirement	Space requirement	Cost	Included in final detailed design
Rainwater harvesting	Rainwater from roof runoff collected for re-use. Cost-benefit considerations	L	M	H	L	H	Pos
Water butts	Rainwater collection from roof runoff. Included in final design	L	L	L	L	L	Pos
Living roofs	Vegetated roofs that reduce runoff volume and rate	M	L	M	L	H	N
Bio-retention	Shallow vegetated areas to retain and treat runoff.	L	L	M	M	L	N
Constructed wetlands	Waterlogged areas that can support aquatic vegetation. Replicates existing conditions and provides ecological benefit.	M	L	H	H/M	M	N
Swales	Shallow grassed drainage channels. Replicates existing conditions	H	M	L	M/H	L	N
Soakaways	Subsurface structures that dispose of water via infiltration.	H	H	L	L	M	Y
Permeable pavements	Surface that infiltrate through surface. Retains pollutants.	H	H	M	L	M	Y
Tanked storage systems	Oversized pipes or cellular storage.	H	L	L	M	M/H	N
Infiltration basins	Depressions in the ground to store and release water through infiltration	H	H	H/M	H	M/L	N
Detention basins	Temporary retention of runoff with controlled discharge	H	L	M	H	M/L	N

Table 8.6 Drainage design hierarchy (SuDS techniques considered for use in this scheme)

8.7 SUDS Techniques Employed

The proposed sustainable drainage techniques for the development will accommodate the peak rainfall event for a 1 in 100 year storm event with an additional allowance for climate change, when the site isn't inundated with fluvial flood water. Table 2 of NPPG recommends for developments that have a life expectancy beyond 2085 and that an additional factor of 40% is applied to the peak volume of runoff, which is in line with the local LLFA guidance

The parking areas will be permeable paved surfaces because this is where oil spillage is most likely to occur, and with adequate aggregate sub-bases, permeable paving can provide water quality treatment as it breaks down hydrocarbons.

The proposals will ensure all water falling on the site percolates into the ground. This arrangement replicates the existing situation.

8.8 Residual Flood Risk & Exceedance

The proposed surface water drainage measures will be designed to contain the peak storm event that can be expected for a 1 in 100 year situation. A 40% allowance has already been applied to the site to account for future climate change. However, the shallow the shallow permeable systems will become inundated when the fluvial flood levels and groundwater is high, as the site is assessed as being located in flood zone 3.

Existing levels are to be retained and the site will be designed to flood in fluvial flood events. The extent of flooding on the site is shown in Appendix D.

8.9 Flood Risk Management

Unlike conventional drainage systems, SuDS features are visible, and their function should be easily understood by those responsible for maintenance. When problems occur, they are generally obvious and can be remedied simply, using standard landscaping practice. During the first year of operation of all types of SuDS, inspections should usually be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident. A full SuDS maintenance guidance will be provided at detailed design.

8.10 Water Quality

According to the CIRIA SUDS Manual, see below, the pollution hazard level for car parks and low traffic roads is low, and the simple index approach should be used. Residential roofs have a very low hazard level and periodic sediment removal is sufficient.

TABLE 4.3 Minimum water quality management requirements for discharges to receiving surface waters and groundwater

Land use	Pollution hazard level	Requirements for discharge to surface waters, including coasts and estuaries[2]	Requirements for discharge to groundwater
Residential roofs	Very low	Removal of gross solids and sediments only	
Individual property driveways, roofs (excluding residential), residential car parks, low traffic roads (eg cul de sacs, home zones, general access roads), non-residential car parking with infrequent change (eg schools, offices)	Low	Simple index approach[3] *Note: extra measures may be required for discharges to protected resources[1]*	
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	Medium	Simple index approach[3] *Note: extra measures may be required for discharges to protected resources[1]*	Simple index approach[3] *Note: extra measures may be required for discharges to protected resources1* In England and Wales, Risk Screening[4] must be undertaken first to determine whether consultation with the environmental regulator is required. In Northern Ireland, the need for risk screening should be agreed with the environmental regulator.
Trunk roads and motorways	High	Follow the guidance and risk assessment process set out in HA (2009)	
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured, industrial sites	High	Discharges may require an environmental licence or permit[3]. Obtain pre-permitting advice from the environmental regulator. Risk assessment is likely to be required[5].	

Table 4.3 of the SUDS Manual CIRIA C753. Page 63.

The method is guided by the land use and SuDS performance evidence. The steps to be followed are outlined below.

BOX 26.2 Steps of the simple index approach

Step 1 – Allocate suitable pollution hazard indices for the proposed land use

Step 2 – Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index

Step 3 – Where the discharge is to protected[1] surface waters or groundwater, consider the need for a more precautionary approach

Note:

1 Designated as those protected for the supply of drinking water (Table 4.3).

Box 26.2 of the SUDS Manual CIRIA C753. Page 567.

Step 1: Pollution hazard indices are presented in table 26.2 below. These indices range from 0 (no pollution hazard for this contaminant) to 1 (high pollution hazard for this contaminant type).

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
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Table 26.2 of the SUDS Manual CIRIA C753. Page 568.

Step 2: 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. In this case the principal destination of the runoff is the groundwater, so table 26.4 should be used.

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates[1]	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.		

Table 26.4 of the SUDS Manual CIRIA C753. Page 570.

In this case, the mitigation indices are above the hazard indices which means the water quality treatment is adequate.

Step 3: Where the discharge is to protected groundwater, a more precautionary approach is needed. As stated in 3.8, the site falls outside the Source Protection Zones and therefore no extra protection measures are needed.

8.11 Flood plain compensation

Existing site levels are to be retained and the development, including the Carport structure will be designed to flood. Therefore, no Flood Compensation will be required.

9.0 Flood Warning and Dry Route of Escape

9.1 Flood warning in relation to the Site

As a precautionary measure, it is recommended that the owner of the property signs up to the Environment Agency's Flood line service for either telephone, mobile, email SMS text message which gives warning of potential flooding events. Environment Agency operates a flood watch scheme called Floodline 0345 988 1188 (24-hour service).

The site is in close proximity to a river level station at Northmoor Lock which can give up to date readings and show when there is likely to be flooding. This can be viewed at https://flood-warning-information.service.gov.uk/station/7046?direction=u

9.2 Dry Access, Egress, and Escape

The existing road that accesses the site and the existing dwelling is shown to be affected by the 1 in 100 year flood extent. This is assessed to have a flood depth of approximately 160mm in a 1 in 100 year plus 35% climate change flood and 260mm in a 1 in 100 year plus 70% climate change flood.

The parking area is worst affected and shown in the lowest point to have a flood depth of approximately 320mm in a 1 in 100 year plus 35% climate change flood and 420mm in a 1 in 100 year plus 70% climate change flood.

The carport is assessed to have a flood depth of approximately 210mm in a 1 in 100 year plus 35% climate change flood and 310mm in a 1 in 100 year plus 70% climate change flood.

The Environment Agency Hazard Map for the site is shown below for the 1 in 100 +35% climate change scenario.

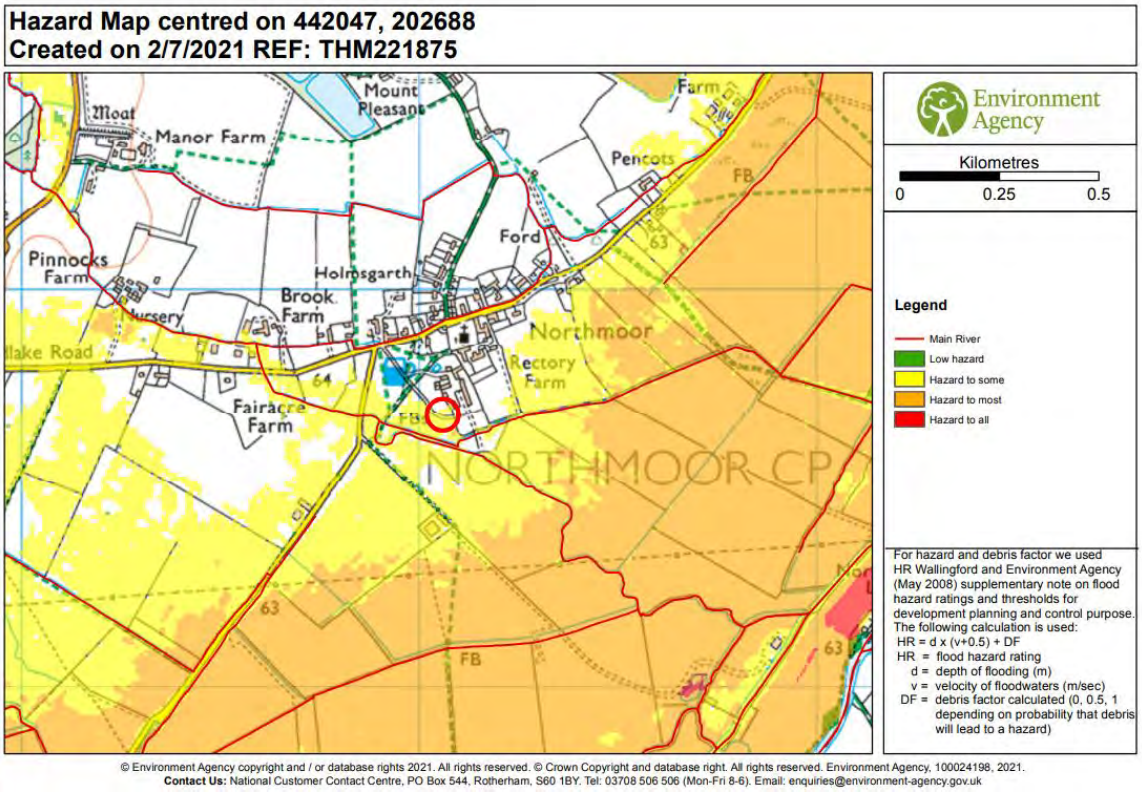


Fig 9.2.1 – Environment Agency © 2021 - Hazard map

This has classified the area to be Danger for some - includes children, the elderly and the infirm.

It is therefore proposed to provide a safe pedestrian route from the parking area to Flood Zone 1. The suggested route is shown below

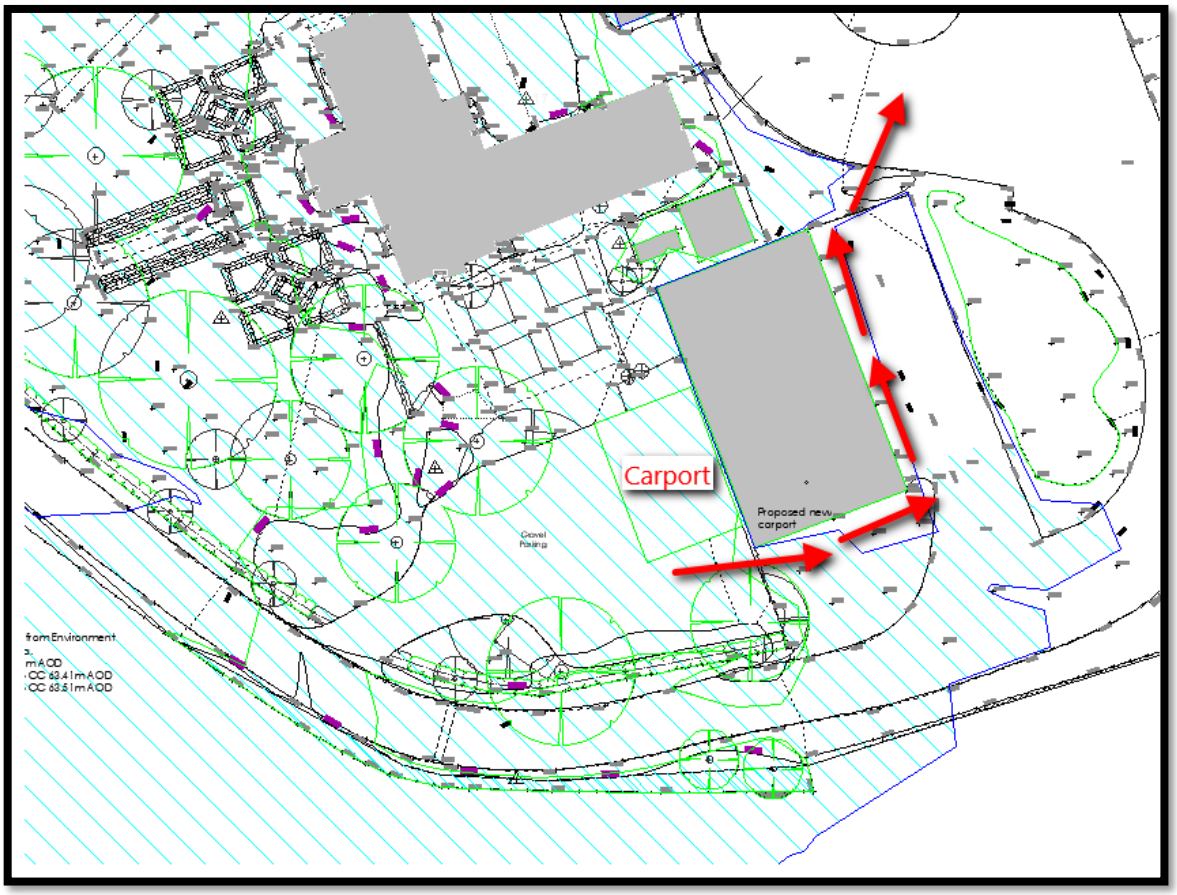


Fig 9.2. – Escape Route map

10.0 Emergency Planning

10.1 Awareness

The development is identified by the EA as subject to potential flooding for storms greater than the 1 in 100 plus climate change storm event. The Agency operates a flood watch scheme called Floodline as discussed in section 9.1. In many places, the Agency can warn interested parties by either telephone, mobile, email, SMS text message or fax of a potential flood up to six hours in advance.

10.2 Equipment

The preparation of a flood kit is essential for instances when evacuation is required. This kit will also be useful for general emergency situations and should be stored for general emergency situations and be easily accessible if flooding occurs. These items should include:

- A torch
- Blankets or a sleeping bag, warm clothing and waterproofs
- A first-aid kit, including a supply of any essential medication

- A list of useful telephone numbers
- A supply of bottled water
- A stock of non-perishable food items
- A portable radio and supply of batteries
- Children's essentials (milk, baby food, sterilised bottles and spoons, nappies, wipes, nappy bags, clothing, comforter, teddy).
- Food and accommodation (cages) for pets, if resident
- Wellington boots or similar waterproof boots
- Check your insurance cover – ensure it covers flood damage
- Know how to turn off the gas, electricity, and water mains supplies
- Think about what items you would want to move to safety during a flood

10.3 Flood Watch

On receipt of the Flood Watch warning from the Environment Agency, or from other sources, e.g. TV, Radio, local contacts.

- Flooding is possible, and the situation could worsen.
- Flood watch means – "Flooding of low lying land is expected. Be aware,
- Be prepared, Watch out.

When a flood watch warning is issued, residents should:

- Be aware of water levels and whether the river is rising or falling
- Reconsider travel plans
- Listen and watch for weather and flood warnings on local radio and television stations
- Contact Floodline on 0345 988 1188
- Check that the flood kit has been prepared
- Copy vital hard copy and electronic records and store them in a safe place. This includes financial and insurance records.
- Keep a store of plastic bags (grocery bags are fine) to place around the legs of furniture when you receive a flood warning.
- At this stage, residents should ensure that their neighbours are aware of the Flood Watch alert in case they are not subscribed or did not receive the alert.

10.4 Severe Flood Warning

A flood evacuation should be implemented as a matter of urgency when a Severe Flood Warning is issued. Severe Flood Warning means severe flooding is now expected. There is extreme danger to life and property and people are advised to act immediately, i.e. evacuate.

The Agency aim to provide at least 2 hours warning between the Flood Warning alert being issued and the commencement of flooding. The Agency recommends that residents should evacuate when a Flood Warning or Severe Flood Warning status is issued.

If flood levels continue to rise, residents are advised to evacuate before safe access is lost. At this level driving through flood water may become hazardous and residents must evacuate beforehand.

Residents should monitor the flood progression and evacuate, on foot, as soon as possible.

10.5 All Clear

All clear means that flood watches or warning are no longer in force in this area.

- Keep listening to weather reports
- Only return to evacuated buildings if you are told it is safe
- Beware sharp objects and pollution in flood water.

Residents should contact the local authority to check that it is safe to return to their property. Residents should be aware that if floodwaters have entered the property it will need to be cleaned, disinfected and repaired and fully dried out prior to reoccupation. Check that the building is safe before entering, and if there are any doubts professional opinion should be sought. If there is any doubt that appliances may be water damaged they must be checked before switching the power or gas back on. Contact your insurance company as soon as possible to get their approval before arranging any clean-up or repairs.

11.0 Flood Resistant & Resilient Measures

11.1 Flood Resistant measures

The carport will be designed to flood when the site is affected by fluvial flooding.

11.2 Flood Resilient measures

It is the recommendation of this report that flood resilient measures are used within the design to minimize the impact an extreme flood event would have on the property. If a power supply is to be installed in the structure, the siting of sockets and fuse boxes must be installed well above the predicted flood levels. More information can be gained from the CIRIA document 'Improving the flood performance of new buildings'.

12.0 Recommendations and Conclusion

The development proposals together with the site layout have been assessed in relation to the provision of SuDS drainage associated with the works.

The report has assessed the feasibility of implementing the SuDS hierarchal approach and has confirmed that this development is likely to be able to install suitable drainage measures into the design proposals.

The fluvial flood risk to the site has been assessed, and by carrying out the recommendations in this report, the associated risks can be managed appropriately for the lifetime of the development in line with the NPPF, NPPG and West Oxfordshire Local Plan 2031. The recommendations are summarised below.

- Existing site levels to be retained post development
- The proposed structure will be designed to flood
- Resilient measures identified in Section 11 carried out
- The occupants sign up to the Environment Agency Floodline service
- A safe pedestrian route is to be provided from the site to Flood Zone 1.

13.0 References & Bibliography

- The National Planning Policy Framework June 2019
- Planning Practice Guidance.
- Environment Agency - Rainfall-Runoff Management for Developments
- Environment Agency indicative flood maps https://flood-map-for-planning.service.gov.uk/
- Environment Agency indicative groundwater source protection zone maps http://www.natureonthemap.naturalengland.org.uk/MagicMap.aspx
- Environment Agency indicative Aquifer designation maps http://www.natureonthemap.naturalengland.org.uk/MagicMap.aspx
- CIRIA 2015, The Sustainable Drainage Systems (SUDS) Manual C753
- Sewers for adoption Code 8
- West Oxfordshire District Council Strategic Flood Risk Assessment.
- West Oxfordshire District Council Local Plan 2031
- Flood Estimation Handbook
- Environment Agency - Adapting to Climate Change: Advice for the Flood and Coastal Erosion Management Authorities March 2016

Appendix A - Topographic Survey

SURVEY STATIONS

Name	Easting	Northing	Height
1	442115.419	202698.800	63.411
2	442096.831	202731.105	63.438
3	442066.794	202678.450	63.269
4	442139.453	202709.533	63.176
5	442061.027	202744.880	63.378
6	442119.571	202748.065	63.325
7	442020.387	202711.222	63.353
8	441971.103	202776.663	63.800
9	441904.155	202849.424	63.749
10	441910.633	202860.397	63.779
11	441724.955	202795.383	63.960
12	441679.813	202782.543	64.022
13	441300.584	202812.697	64.664
14	441345.307	202812.567	64.648
17	442067.428	202723.509	63.202
15	441419.835	202798.683	64.556
16	441375.431	202804.511	64.786
18	442062.752	202732.844	63.347
19	442046.766	202732.556	63.319
20	442047.214	202708.951	63.344
21	442061.410	202699.037	63.285
22	442073.628	202713.910	63.240

Shyres Rural Ltd.
CHARTERED SURVEYORS
MAPPING CONSULTANTS

RICS

Shyres Rural Ltd Registered in England and Wales No. 6635142
Foxhaven,1A,Grays Grove,Little Staughton,Bedford MK44 2BT
TEL:Office 01234 376959 Mobile 07860540125
e-mail: shyresrural@talktalk.net

JOB TITLE:-
LEVEL SURVEY AT NORTHMOOR PARK
survey to OS grid and datum using gps

CLIENT:

DATA SHOWN ON THIS PLAN PREPARED TO CLIENT SPECIFICATIONS

ORDNANCE SURVEY DIGITAL COPYRIGHT LICENCE No:100048487

DATE: 15/07/14
SCALE: 1:200
DRAWN BY: taff

DRAWING NUMBER: SRL.92.14

REVISION

survey data correct at date of survey only.
symbols representing tree spread and trunk dimensions are indicative only
all service detail must be considered approximate and its full location must be verified by details obtained from the relevant provider and/or authority
digital copies of this plan can only be considered accurate if supplied directly by Shyres Rural Ltd.
do not scale from plots

Appendix B - Development Proposals

0 2 4 6 8 10

VISUAL SCALE (m) 1:200

NOTE:
ALL DIMENSIONS MUST BE CHECKED ON SITE AND NOT SCALED FROM THIS DRAWING.

Key	Description
	1:100 year (35% cc) flood envelope - 63.41m AOD
	Existing buildings

revision date description

status

PLANNING

project title
PROPOSED CARPORT, NORTHMOOR PARK, NORTHMOOR

drawing title
SITE PLAN AS PROPOSED

first issued	drawn	scale @ A2
05/11/21	LH	1:200

job/drawing no/revision
20004 - PP0010 -

The Studio, 70 Church Road, Wheatley, Oxford, OX33 1LZ
01865 873936 | info@andersonorr.com | www.andersonorr.com

Anderson Orr
Architects

D:\Nimbox Vault\AOP JOBS\2020 JOBS\20004 Northmoor Park, Northmoor Witney\AOA\DOCUMENTS\05 PLANNING\02_CARPORT\20004 - P - SITE.rvt

Appendix C - Environment Agency Product 4 Data

Product 4 (Detailed Flood Risk) for 442047, 202688
Our Ref: THM221875

Product 4 is designed for developers where Flood Risk Standing Advice FRA (Flood Risk Assessment) Guidance Note 3 Applies. This is:

i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq metres; and all domestic extensions", and
ii) "all applications with a site area greater than 1 ha" in Flood Zone 2.

Product 4 includes the following information:

Ordnance Survey 1:25k colour raster base mapping;
Flood Zone 2 and Flood Zone 3;
Relevant model node locations and unique identifiers (for cross referencing to the water levels, depths and flows table);
Model extents showing *defended* scenarios;
FRA site boundary (where a suitable GIS layer is supplied);
Flood defence locations (where available/relevant) and unique identifiers; (supplied separately)
Flood Map areas benefiting from defences (where available/relevant);
Flood Map flood storage areas (where available/relevant);
Historic flood events outlines (where available/relevant, not the Historic Flood Map) and unique identifiers;
Statutory (Sealed) Main River (where available within map extents);

A table showing:

i) Model node X/Y coordinate locations, unique identifiers, and levels and flows for *defended* scenarios.
ii) Flood defence locations unique identifiers and attributes; (supplied seperately)
iii) Historic flood events outlines unique identifiers and attributes; and
iv) Local flood history data (where available/relevant).

Please note:

If you will be carrying out computer modelling as part of your Flood Risk Assessment, please request our guidance which sets out the requirements and best practice for computer river modelling.

This information is based on that currently available as of the date of this letter. You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements have been made. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

This information is provided subject to the enclosed notice which you should read.

This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance regarding Flood Risk Assessments can be found on our website at:

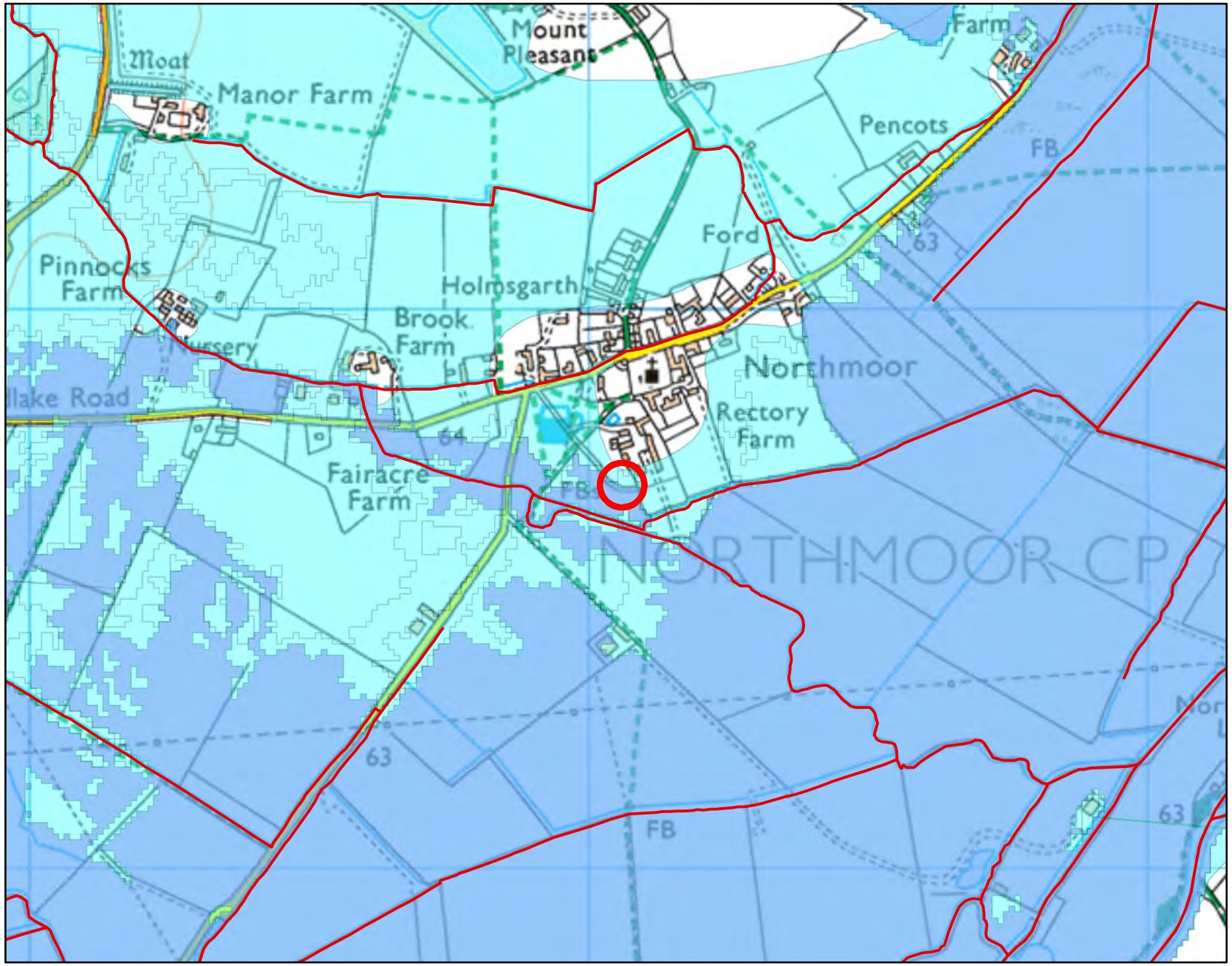
https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities

If you would like advice from us regarding your development proposals you can complete our pre application enquiry form which can be found at:

https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Red Kite House, Howbery Park, Wallingford, Oxon OX10 8BD
Customer services line: 08708 506 506
Email: enquiries_THM@environment-agency.gov.uk

Flood Map for Planning centred on 442047, 202688
Created on 2/7/2021 REF: THM221875



Environment Agency

Kilometres

0 0.25 0.5

Legend

- Main River
- Flood defences
- Areas benefiting from flood defences
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- Flood Map - flood storage areas

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Defence information

THM221875

Defence Location:	No defences on Main River
Description:	This location is not currently protected by any formal defences and we do not currently have any flood alleviation works planned for the area. However we continue to maintain certain watercourses and the schedule of these can be found on our internet pages.

Model information

THM221875

Model: Thames (Shifford to Eynsham) & Windrush (A40 to Thames confluence) 2011

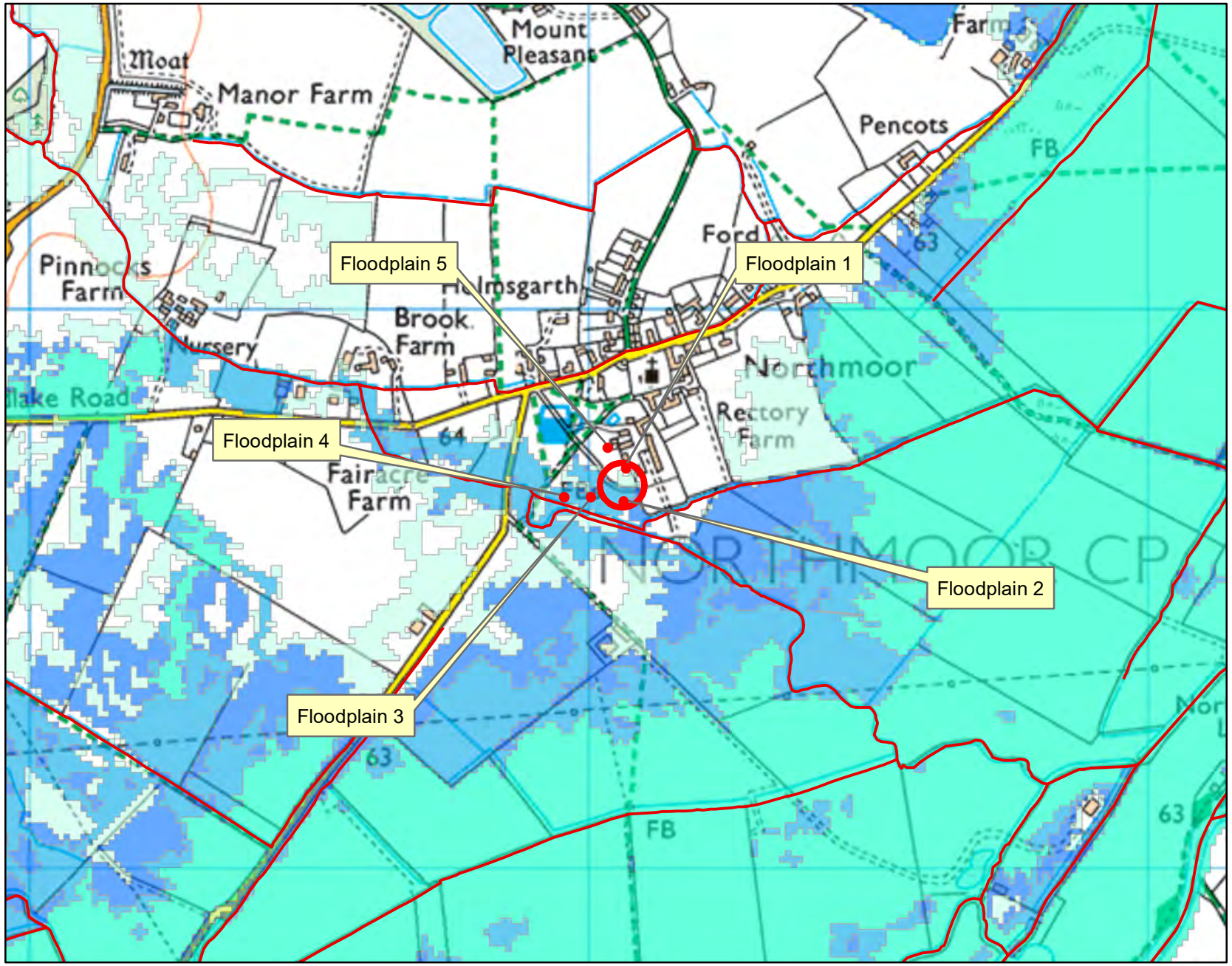
Description: The information provided is taken from the Thames (St Johns to Eynsham) including Windrush (Worsham to Thames confluence) 2011 Detailed Mapping project. The study was carried out using 1D-2D modelling software (ISIS-Tuflow). Model re-run to include new climate change allowances in July 2017.

The project was split into three models:
[T] - Thames (St Johns to Shifford)
[TW] - Thames (Shifford to Eynsham) including Windrush (A40 to Thames confluence)
[W] - Windrush (Worsham to A40)

Model design runs and Mapped Outputs:
• 1 in 5 / 20% AEP
• 1 in 20 / 5% AEP
• 1 in 100 / 1% AEP;
• 1 in 100+15% / 1% AEP with 15% AEP climate change allowance
• 1 in 100+25% / 1% AEP with 20% AEP climate change allowance
• 1 in 100+35% / 1% AEP with 25% AEP climate change allowance
• 1 in 100+35% / 1% AEP with 35% AEP climate change allowance
• 1 in 100+70% / 1% AEP with 70% AEP climate change allowance
• 1 in 1000 / 0.1% AEP

Model accuracy:
Levels ± 250mm

Detailed FRA Map centred on 442047, 202688
Created on 2/7/2021 REF: THM221875



Environment Agency

Kilometres

0 0.25 0.5

Legend

- Main River
- 20% AEP Flood Outline
- 5% AEP Flood Outline
- 1% AEP Flood Outline
- 0.1% AEP Flood Outline
- Floodplain Node

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occuring in any given year

Where available climate change extents have been calculated with an additional flow added to an AEP event. An example of how this is written is 1%+20% AEP.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Modelled floodplain flood levels

THM221875

The modelled flood levels for the closest most appropriate model grid cells for your site are provided below:

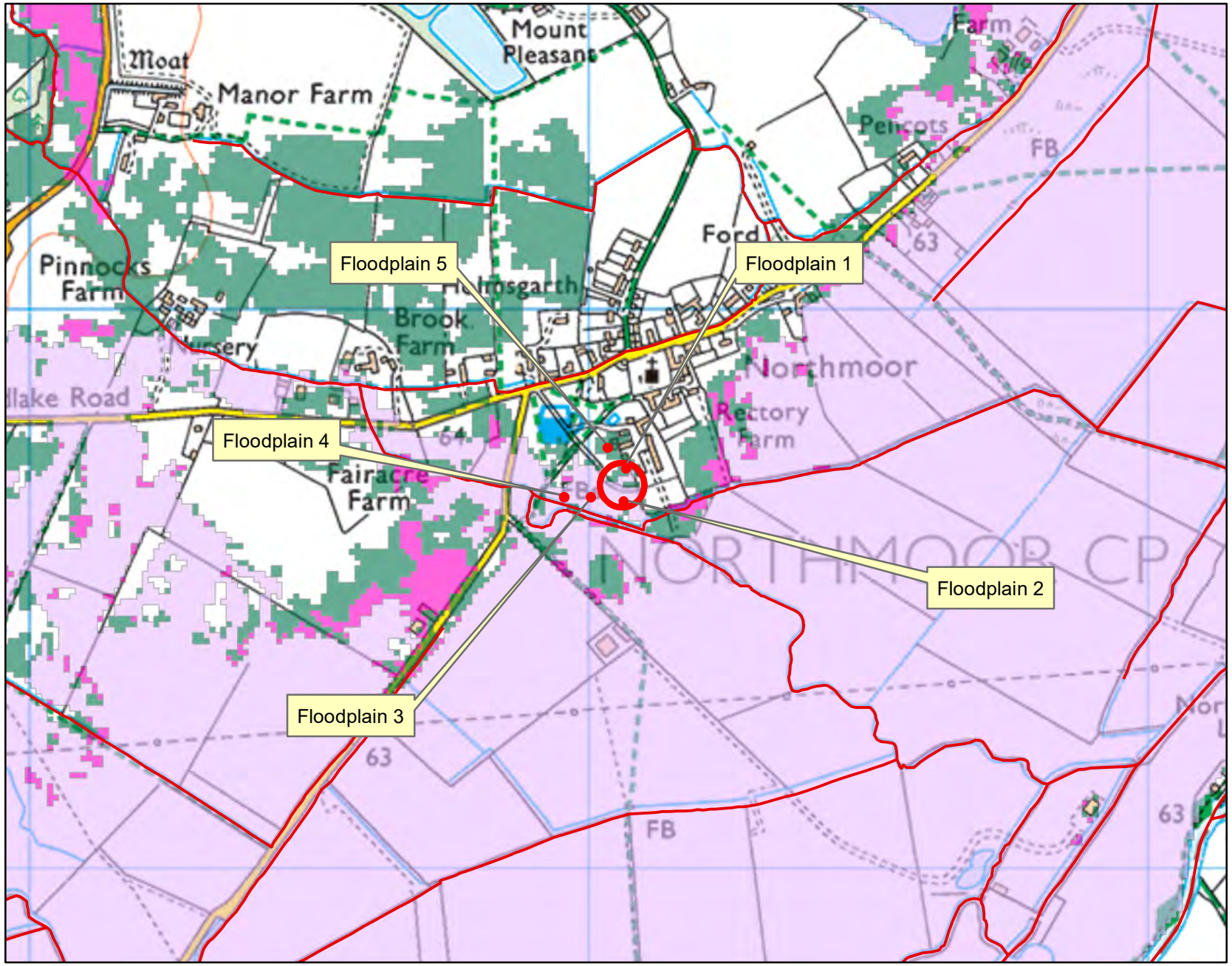
				flood levels (mAOD)						
2D grid cell reference	Model	Easting	Northing	20% AEP	5% AEP	1% AEP	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
Floodplain 1	mes (Shifford to Eynsham) & Windrush (A40 to Thames confluence) 2	442,065	202,721	no data	no data	no data	no data	no data	63.51	no data
Floodplain 2	mes (Shifford to Eynsham) & Windrush (A40 to Thames confluence) 2	442,058	202,654	no data	63.38	63.39	63.40	63.41	63.51	63.42
Floodplain 3	mes (Shifford to Eynsham) & Windrush (A40 to Thames confluence) 2	442,006	202,665	no data	63.38	63.39	63.40	63.41	63.51	63.42
Floodplain 4	mes (Shifford to Eynsham) & Windrush (A40 to Thames confluence) 2	441,954	202,665	no data	63.38	63.39	63.40	63.41	63.52	63.43
Floodplain 5	mes (Shifford to Eynsham) & Windrush (A40 to Thames confluence) 2	442,043	202,761	no data	no data	no data	no data	no data	63.51	no data

This flood model has represented the floodplain as a grid.
The flood water levels have been calculated for each grid cell.

Note:
Due to changes in guidance on the allowances for climate change, the 20% increase in river flows should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

For further advice on the new allowances please visit
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Detailed FRA Map 2 centred on 442047, 202688
Created on 2/7/2021 REF: THM221875



Environment Agency

Kilometres

0 0.25 0.5

Legend

- Main River
- 1%+25% AEP Flood Outline
- 1%+35% AEP Flood Outline
- 1%+70% AEP Flood Outline
- Floodplain Node

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occuring in any given year

Where available climate change extents have been calculated with an additional flow added to an AEP event. An example of how this is written is 1%+20% AEP.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Historic flood data

THM221875

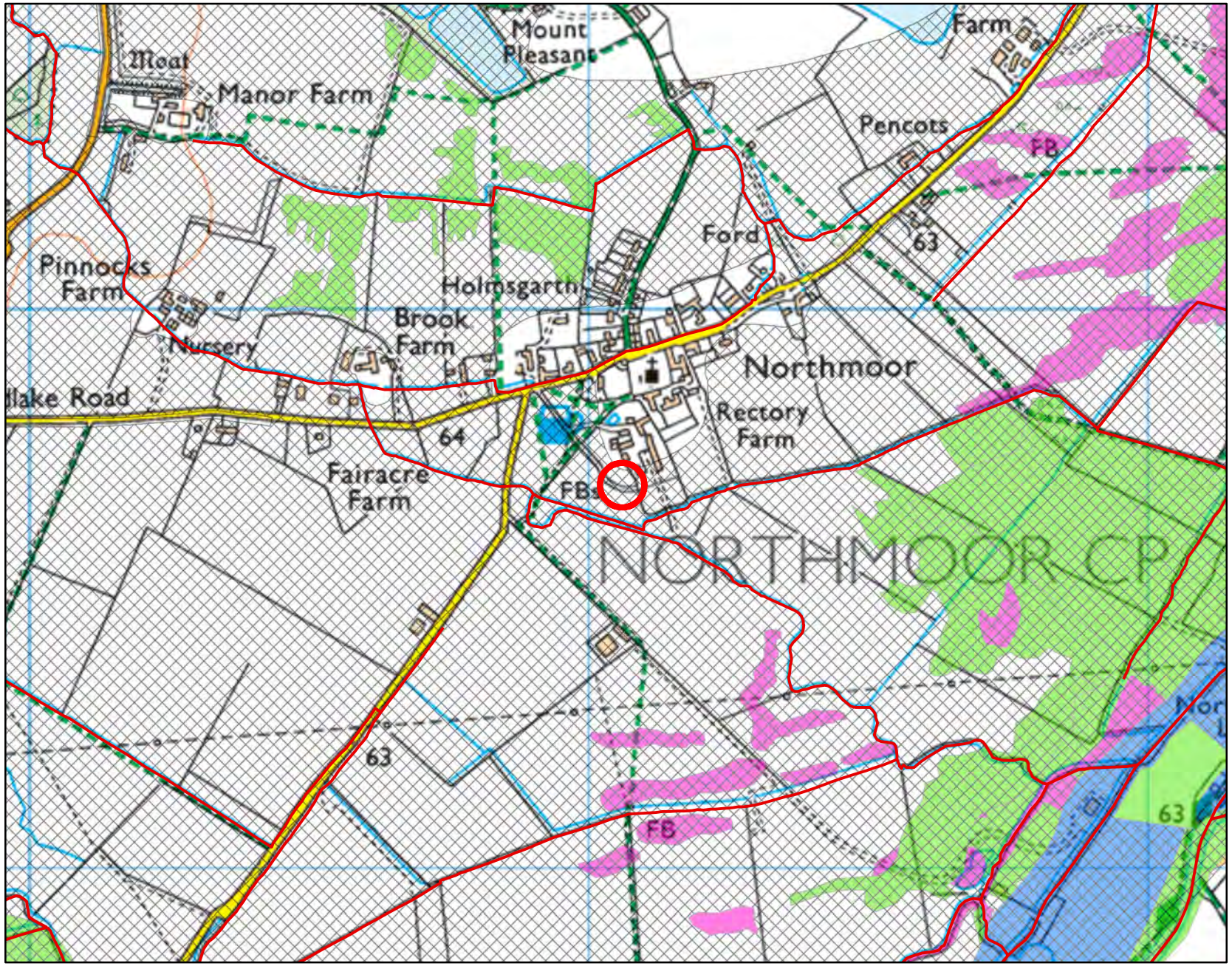
Our records show that the area of your site has been affected by flooding.
Information on the floods that have affected your site is provided in the table below:

Flood Event Code	Flood Event Name	Start Date	End Date	Source of Flooding	Cause of Flooding
EA061947	06MarchSpring1947	01/01/1947	12/12/1947	main river	channel capacity exceeded (no raised defences)

Please note the Environment Agency maps flooding to land not individual properties. Floodplain extents are an indication of the geographical extent of a historic flood. They do not provide information regarding levels of individual properties, nor do they imply that a property has flooded internally.

Start and End Dates shown above may represent a wider range where the exact dates are not available.

Historic Flood Map centred on 442047, 202688
Created on 2/7/2021 REF: THM221875



Environment Agency

Kilometres

0 0.25 0.5

Legend

Main River

year

- 1947
- 1977
- 1979
- 1992
- 2000

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Hazard Mapping (for the 1%+35% climate change scenario) THM22187

Hazard Mapping methodology:

To calculate flood hazard with the debris factor we have used the supplementary note to Flood Risk to People Methodology (see below).
The following calculation is used:

HR = d x (v+0.5) + DF

Where HR = flood hazard rating
d = depth of flooding (m)
v = velocity of floodwaters (m/sec)
DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

The resultant hazard rating is then classified according to:

Flood Hazard	Colour	Hazard to People Classification	
Less than 0.75		Very low hazard	- Caution
0.75 to 1.25		Danger for some	- includes children, the elderly and the infirm
1.25 to 2.0		Danger for most	- includes the general public
More than 2.0		Danger for all	- includes the emergency services

REF: HR Wallingford and Environment Agency (May 2008) Supplementary note of flood hazard ratings and thresholds for development planning and control purpose – Clarification of the Table 113.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1

Red Kite House, Howbery Park, Wallingford, Oxon OX10 8BD
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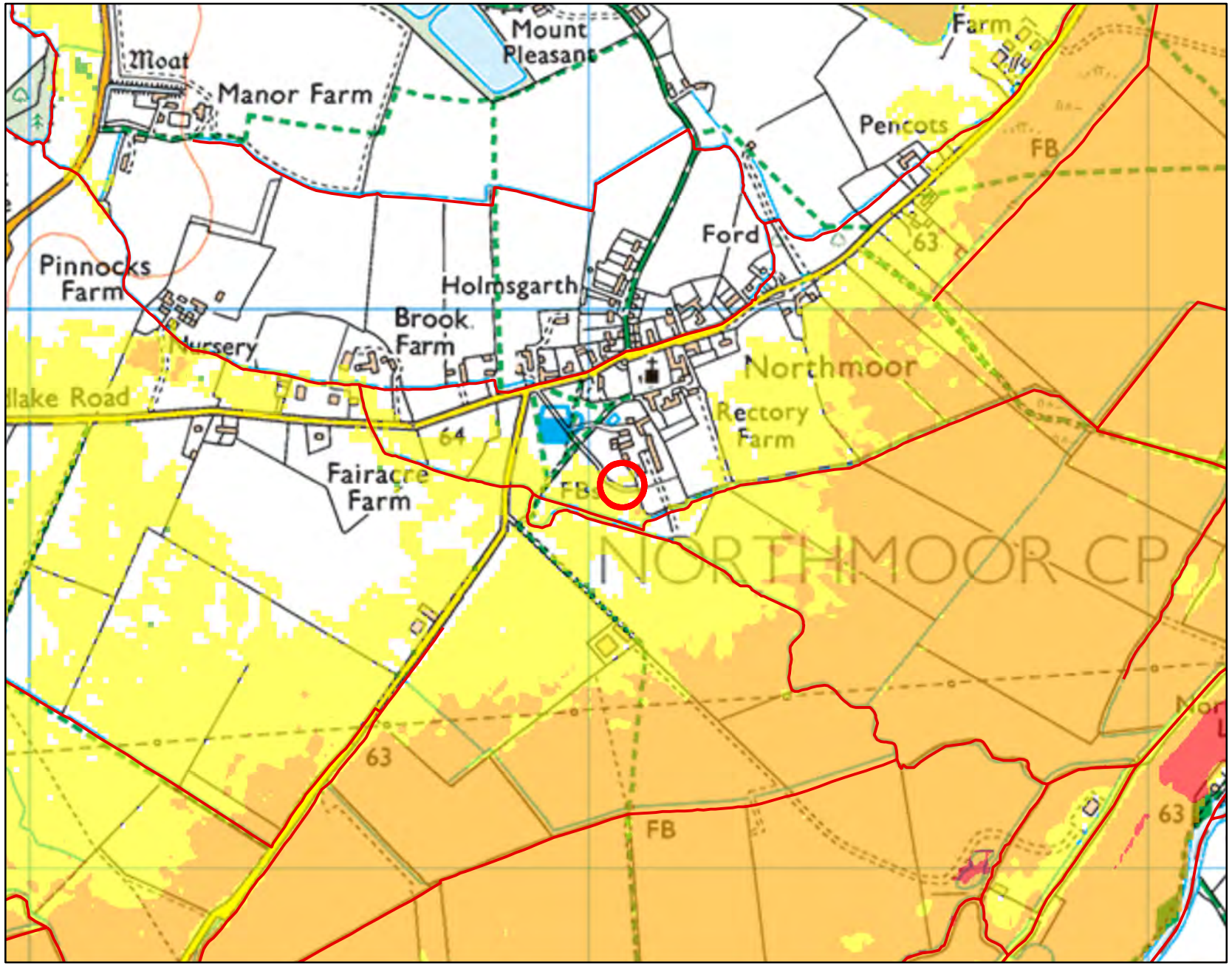
Email: WTenquiries@environment-agency.gov.uk

Hazard Map centred on 442047, 202688
Created on 2/7/2021 REF: THM221875



Environment Agency

Kilometres

0 0.25 0.5

Legend

- Main River
- Low hazard
- Hazard to some
- Hazard to most
- Hazard to all

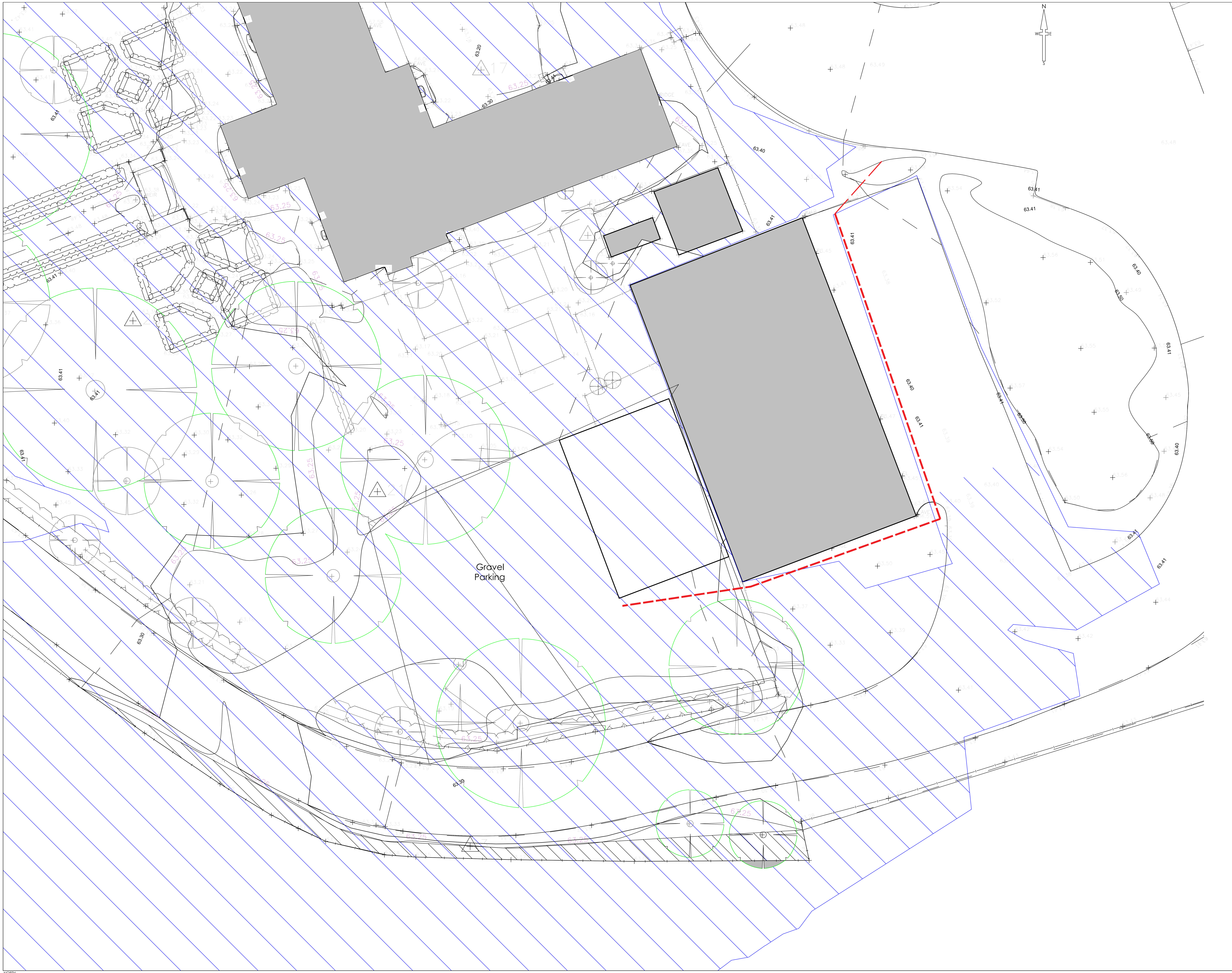
For hazard and debris factor we used HR Wallingford and Environment Agency (May 2008) supplementary note on flood hazard ratings and thresholds for development planning and control purpose. The following calculation is used:

HR = d x (v+0.5) + DF

HR = flood hazard rating
d = depth of flooding (m)
v = velocity of floodwaters (m/sec)
DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Appendix D - Modelled Flood Map



NOTES

1. All dimensions and levels are in metres unless otherwise noted
2. This drawing is to be read in conjunction with the relevant Architect's/Engineer's drawings, specifications and CDM documentation
3. This drawing has been produced electronically and may have been photo reduced or enlarged when copied. Work to figured dimensions only (DO NOT SCALE - EXCEPT FOR PLANNING PURPOSES). All dimensions to be checked on site. Any errors or omissions to be reported to the engineer immediately.
4. This drawing contains coloured lines / information that may not be clear if reproduced in black and white.
5. Digital copies of this plan can only be considered accurate if supplied directly by Infrastruct CS Ltd.

Key	Description
(blue outline with hatching)	1:100 year (35% cc) flood envelope - 63.41m AOD
(grey fill)	Existing buildings
(red dashed line)	Pedestrian emergency evacuation route

REV	DRAWN	CHECK	REVISION COMMENTS	ISSUE DATE
P01	RB	APL	Initial issue	30/07/21

DRAWING TITLE: Modelled Flood Map

SHEET NO.: 1/1

PROJECT: Proposed carport, Northmoor Park, Northmoor

CLIENT: Anderson Orr Architects

Infrastruct CS Ltd

The Stables, High Cogges Farm, High Cogges, Witney, OX29 6UN - Tel: 01993 709709: info@infrastructcs.co.uk

SCALE @ A1: 1:100 (0m – 2.5m – 5.0m)

ENGINEER: APL
DRAFT: RB
APPROVED: MBD

PROJECT NUMBER	STATUS	ISSUE PURPOSE
4502	S2	INFORMATION

PROJECT	ORIGIN	PHASE	LEVEL	TYPE	ROLE	NO.	REVISION
NORTH	ICS	01	XX	DR	C	0001	P01