enzygo
environmental consultants

NPPF: Flood Risk Assessment

Banbury 200 Site, Southam Road, Banbury

EirEng Consulting Engineers Ltd

SHF.393.013.HY.R.001.B

Contact Details:

Samuel House
1st Floor
5 Fox Valley Way
Stocksbridge
Sheffield
S36 2AA

tel: 0114 321 5151
www: enzygo.com

Banbury 200 Site, Southam Road, Banbury

Project:	NPPF: Flood Risk Assessment
For:	EirEng Consulting Engineers Ltd
Status:	Issued
Date:	October 2021
Author:	Helena Du-Roe BSc (Hons), MCIWEM - Environmental Consultant
Reviewer:	Eric O'Connor BSc (Hons), MSc, MCIWEM - Senior Hydrologist
Approver:	Dr Paul Hardwick BSc (Hons), PhD, FGS, FRSA - Technical Director

Contents

Executive Summary ..... **iii**
1.0 Introduction **1**
1.1 Background 1
1.2 Scope 2
1.3 Aims 2
1.4 Planning Context 3
1.5 Report Structure 3
2.0 Sources of Information **4**
2.1 Sources of Information 4
2.2 Regulators 5
3.0 Site Location and Description **6**
3.1 Location 6
3.2 Current Land Use 6
3.3 Topographic Information 6
3.4 Soils 6
3.5 Geology 7
3.6 Hydrogeology 7
3.7 Catchment Hydrology 7
3.8 Sewerage Assets 7
3.9 Designated Sites 8
4.0 Flood Risk Assessment **9**
4.1 Potential Sources of Flooding 9
4.2 Fluvial Flooding 9
4.3 Tidal Flooding 10
4.4 Groundwater Flooding 10
4.5 Surface Water Flooding 12
4.6 Sewer Flooding 12
4.7 Flooding from Infrastructure Failure 13
5.0 Flood Risk Mitigation Measures **14**
5.1 Introduction 14
5.2 Mitigation Measures 14
5.3 Summary of Flood Risk 14
5.4 Flood Guidance and Sequential Test 15
6.0 Site Drainage **17**
6.1 Introduction 17
6.2 Existing Drainage Arrangement 17
6.3 Surface Water Drainage 17
6.4 Foul Water Drainage 18
7.0 Summary and Conclusion **19**
7.1 Introduction 19
7.2 Flood Risk 19
7.3 Mitigation Measures 19
7.4 Flood Guidance 19

7.5 Site Drainage 19
7.6 Conclusion 20

Tables & Figures

Figure 3.1: Aerial Image of the Site 6
Table 4.1: Potential Risk Posed by Flooding Sources 9
Table 4.2: Groundwater Flood Risk Classification 11
Table 5.1: Probability and Consequences of All Sources of Flooding 14
Table 5.2: Environment Agency Flood Zones and Appropriate Land Use 15
Table 5.3: Vulnerability and Flood Zone 'Compatibility' as Identified in Table 3 of PPG ID: 7 16

Drawings

Drawing 001 - Site Location Plan
Drawing 002 - Surface Water Features
Drawing 003 - BGS Groundwater Flooding Susceptibility
Drawing 004 - JBA Surface Water Flooding
Drawing 005 - Environment Agency Flood Zones
Drawing 006 - Geosmart Groundwater Flood Risk
Drawing 007 - SuDS Infiltration Potential Map
Drawing 008 - Geological Indicators of Flooding
Drawing 009 - Historical Flood Events
Drawing 010.1 - Environment Agency Complex Surface Water Flood Mapping 1000-year Flow Path
Drawing 010.2 - Environment Agency Complex Surface Water Flood Mapping 1000-year Depth
Drawing 010.3 - Environment Agency Complex Surface Water Flood Mapping 1000-year Velocity
Drawing 010.4 - Environment Agency Complex Surface Water Flood Mapping 1000-year Hazard
Drawing 011 - Flow Pathway Analysis

Appendices

Appendix 1 - Topographic Survey
Appendix 2 - SFRA Mapping Extracts
Appendix 3 - Thames Water Sewer Asset Plans
Appendix 4 - Private Asset Plans

Executive Summary

This report is an FRA in accordance with the NPPF and NPPG ID:7 guidance, for a proposed van storage facility located on land to the west of Southam Road, Banbury, Oxfordshire.

The report details the flood risk and how this can be managed and mitigated to allow the Site to be developed in support of the full planning application; and includes an assessment of the surface water drainage requirements of the Site.

The FRA has demonstrated the following:

- The 5.45ha Site is occupied by a former commercial unit and hardstanding carpark area with sparse mature vegetation on all boundaries.
- The Site slopes gradually east and is underlain by clayey bedrock with low infiltration potential. Made Ground is also likely to be present due to the nature of the Site.
- Watercourse 1 to the north of the Site flows from west to east.
- The risk of flooding was assessed as follows:
    - There is a negligible but residual risk of fluvial flooding from the watercourse to the north of the Site.
    - The risk of surface water flooding is assessed as negligible in the west and south of the Site, with an area of medium to high risk associated with a surface water flow pathway.
    - The risk of flooding from the private sewer network is assessed as low.
    - The risk of flooding from all other sources is assessed as negligible.
- The flood risk from identified sources can be mitigated to a negligible or low and acceptable level through the following approach:
    - Ensure a 4m easement free from development either side of Watercourse 1.
    - Set finished floor levels a minimum of +150mm above external levels.
    - Adoption of a surface water management strategy.
- The proposed development is classified as less vulnerable use, considered acceptable in terms of flood risk when located in Flood Zone 1. As such, the Sequential Test would be passed, and the Exception Test would not be required.

The proposed surface water from the Site will drain via rainwater downpipes and slot drains to gravity sewers and suitably sized attenuation storage, in the form of a new geocellular storage tank. The attenuation tank will provide 456m^3 storage and will intercept all storm runoff from the new van park and has been sized for 100yr plus 20% climate change allowance, with a sensitivity check undertaken using the 100yr plus 40% allowance that resulted in no predicted flooding. This will then convey restricted flows to the existing surface water sewers based on a QBar rate of 7.3 l/s.

Foul flows will be collected in a new foul water drainage network, which will connect into the existing on-site foul water network located in the north western corner. From there the existing foul network flows north and exits the Site on the northern boundary.

The FRA demonstrates that the proposed development would be operated with minimal risk from flooding and would not increase flood risk elsewhere. The development should therefore not be precluded on the grounds of flood risk or surface water and foul drainage.

1.0 Introduction

1.1 Background

1.1.1 Enzygo Ltd was commissioned by EirEng Consulting Engineers Ltd to carry out a site-specific flood risk assessment (FRA) including a surface water drainage strategy in support of a full planning application for a proposed van storage facility located on land to the west of Southam Road, Banbury, Oxfordshire (the 'Site').

1.1.2 The proposed development is for the storage of operational vehicles, together with elevational and site alterations, associated parking, welfare facilities, vehicle barrier and associated infrastructure, with access from Southam Road to the east.

1.1.3 A site-specific FRA assesses the current and future flood risk to and from a development site. It demonstrates how flood risk will be managed now and over the development's lifetime, taking climate change, drainage, and the vulnerability of its intended users into account.

1.1.4 The objectives of a site-specific FRA are to:

- Assess whether a proposed development is likely to be affected by current or future flooding from a range of sources,
- Assess whether the development will increase flood risk elsewhere,
- Decide on measures to deal with these effects and risks and assess their appropriateness,
- Provide enough evidence for the local planning authority to apply (if necessary) the Sequential Test, and
- Decide whether the development will be safe and will pass the Exception Test if applicable.

1.1.5 In England, planning applications for development need an FRA[1] for most developments including:

- In Flood Zones 2 and 3 including minor development and change of use,
- Sites of 1ha or larger in Flood Zone 1,
- Sites of less than 1ha in Flood Zone 1, including change of use to a more vulnerable class (for example from commercial to residential), and where they could be affected by sources of flooding other than rivers and the sea,
- Land in Flood Zone 1 in a Critical Drainage Area (CDA) as notified by the Environment Agency,
- Land in Flood Zone 1 identified in a strategic flood risk assessment as being at increased flood risk in future.

1.1.6 An FRA is required for this development, as initial site screening using Environment Agency online indicative flood mapping shows that the Site is in Flood Zone 1 (low risk of fluvial flooding), is at risk of surface water flooding, and is greater than 1ha in area.

1.1.7 The purpose of this FRA is to assess the risk of flooding to the proposed development and where possible provide sufficient mitigation to demonstrate that future users of the development would remain safe throughout its lifetime, that the development would not

[1] https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications 2014 (as updated February 2017)

increase flood risk on Site and elsewhere and, where practicable, would reduce flood risk overall.

1.2 Scope

1.2.1 Government policy on development and flood risk is set out in the National Planning Policy Framework (NPPF) [2] and is supported by National Planning Practice Guidance: Flood Risk and Coastal Change [NPPG ID7] [3].

1.2.2 NPPF paragraphs 148-169 set out the need for an appropriate assessment of flood risk at all levels of the planning process and require the application of a sequential risk-based approach to assess the suitability of land for development in flood risk areas.

1.2.3 The FRA should also make allowances for climate change [4] to minimise vulnerability and provide resilience to flooding and coastal change in the future. The allowances are predictions of anticipated change in

- Peak river flow by river basin district,
- Peak rainfall intensity,
- Sea level rise; and
- Offshore wind speed and extreme wave height.

1.2.4 They are based on climate change projections and different scenarios of carbon dioxide emissions to the atmosphere. There are different allowances for different periods of time over the next century.

1.2.5 Site-specific FRAs are categorised according to level. Simple Level 1 Screening studies give a general indication of the potential flood risk to a site and identify whether more detailed Level 2 assessment is required or not. A Level 2 assessment is a qualitative appraisal to develop understanding of flood risk to a site and the effects of the site on flooding elsewhere including recommended mitigation measures. Level 3 assessments are more detailed quantitative studies, for example modelling to establish flood levels at a site in the absence of Environment Agency or other data or providing detailed drainage designs.

1.2.6 This report is a Level 2 qualitative FRA and includes a Level 3 detailed surface water and foul drainage assessment for the proposed development.

1.3 Aims

1.3.1 This FRA aims to provide enough flood risk information to satisfy the requirements of the NPPF, PPG ID7 and regional/local government plans and policies. It describes the potential for the Site to be impacted by flooding, the impacts of the proposed development on flooding elsewhere near the Site, and the proposed measures that could be incorporated into the development to mitigate the identified risks.

[2] Department for Communities and Local Government (2018) Revised National Planning Policy Framework (as revised July 2021).
[3] Department for Communities and Local Government (2014) Planning Practice Guidance ID7-030-20140306; Flood Risk & Coastal Change.
[4] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

1.4 Planning Context

National Policy

1.4.1 The FRA was prepared in accordance with the NPPF and NPPG ID7.

Regional/Local Policy

1.4.2 The FRA considers and complies with the relevant parts of policies in The Cherwell Local Plan ('Part 1 Adopted 20 July 2015' version) July 2015[5]:

- Policy ESD 1: Mitigating and Adapting to Climate Change
- Policy ESD 6: Sustainable Flood Risk Management
- Policy ESD 7: Sustainable Drainage Systems (SuDS)

1.5 Report Structure

- Section 2 summarises the sources of information that were consulted.
- Section 3 describes the Site and the existing and proposed development.
- Section 4 outlines the flood risk to the existing site and proposed development.
- Section 5 details the proposed mitigation measures against identified flooding sources.
- Section 6 assesses the potential impacts of the proposed development on surface water drainage and proposes mitigation for those effects; and
- Section 7 presents a summary and conclusion.

[5] https://www.cherwell.gov.uk/download/downloads/id/8144/final-adopted-local-plan-2011-2031-incorporating-re-adopted-policy-bicester-13.pdf

2.0 Sources of Information

2.1 Sources of Information

- Ordnance Survey (OS) 1:25,000 online mapping.
- Detailed topographic survey (Appendix 1).
- Environment Agency online mapping (Flood Map for Planning[6], Long Term Flood Risk Assessment for Locations in England[7], Catchment Data Explorer[8], Main River Map[9] and Asset Management[10]).
- River Basin District (RBD) Maps[11] (Thames RBD) together with guidance on climate change allowances[12].
- National River Flow Archive[13].
- Cherwell District Council Level 1 Strategic Flood Risk Assessment (SFRA) Update and associated flood mapping[14] (Appendix 2).
- Cherwell District Council Level 2 Strategic Flood Risk Assessment (SFRA) and associated flood mapping[15] (Appendix 2).
- Catchment Flood Management Plans (CFMP).
- Preliminary Flood Risk Assessment (PFRA).
- Surface Water Management Plan (SWMP).
- Thames River Basin Management Plan 2015 (RBMP).
- Oxfordshire County Council Local Flood Risk Management Strategy[16] (LFRMS).
- British Hydrological Society Chronology of British Hydrological Events[17].
- British Geological Survey [BGS] online mapping: 3D Geology of Britain Viewer[18].
- Landmark's Promap: Flood Data package: Additional flood mapping.
- Geosmart 1 in 100-year groundwater flood risk map.
- Thames Water sewer asset plans (Appendix 3).
- DEFRA's Magic Map[19] for identifying Designated Sites and Groundwater SPZ.

[6] https://flood-map-for-planning.service.gov.uk/
[7] https://flood-warning-information.service.gov.uk/long-term-flood-risk/
[8] http://environment.data.gov.uk/catchment-planning/
[9] https://environment.maps.arcgis.com/apps/webappviewer/index.html?id=17cd53dfc524433980cc333726a56386
[10] https://environment.data.gov.uk/asset-management/index.html
[11] https://www.gov.uk/government/publications/flood-risk-assessments-river-basin-district-maps
[12] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[13] http://nrfa.ceh.ac.uk
[14] https://www.cherwell.gov.uk/download/downloads/id/844/pr31-sfra-level-1---may-2017---report-incl-appendix-a.pdf
[15] https://www.cherwell.gov.uk/download/downloads/id/850/pr32-cherwell-level-2---sfra---may-2017-part-1-of-2.pdf
[16] https://www2.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/flooding/OxfordshireFloodRiskManagementStrategy.pdf
[17] http://www.cbhe.hydrology.org.uk/search.php
[18] http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[19] http://www.natureonthemap.naturalengland.org.uk/

2.2 Regulators

Environment Agency

2.2.1 The Environment Agency is a statutory consultee on flood risk and planning and is directly responsible for the prevention, mitigation, and remediation of flood damage for main rivers and coastal areas; and it has a strategic overview for all forms of flooding.

2.2.2 Environment Agency Standing Advice[20] and the NPPF/PPG ID: 7 was consulted and reviewed.

2.2.3 Environment Agency online flood risk data was consulted and a request for Product 4 Flood Data was made. However, a response from the Environment Agency had not been received before submission of this report.

Lead Local Flood Authority (LLFA)

2.2.4 Oxfordshire County Council is the Lead Local Flood Authority (LLFA), responsible for local flood risk management in its area and for maintaining a register of flood risk assets. It also has lead responsibility for managing the risk of flooding from surface water, groundwater, and ordinary watercourses. Oxfordshire County Council online documentation was reviewed.

Water Utility

2.2.5 Thames Water is responsible for sewerage in the region.

2.2.6 All sewerage undertakers maintain the 'DG5 register' of properties and external areas (such as gardens, highways, open spaces) which have suffered flooding from public foul/combined sewers. It does not include flooding caused by blockages.

[20] https://www.gov.uk/guidance/flood-risk-assessment-standing-advice

3.0 Site Location and Description

3.1 Location

3.1.1 The Site is a parcel of land to the west of Southam Road, Banbury, Oxfordshire, OX16 2BN. The Site is centred on National Grid Reference (NGR) 445096, 241477.

3.1.2 The Site location is shown in Drawing 001 and in more detail in Drawing 002, which shows the approximate red line boundary enclosing an area of 5.45ha.

3.2 Current Land Use

3.2.1 The Site is a former commercial unit and hardstanding carpark area.

3.2.2 The Site is bounded by open greenspace and a commercial unit to the north; commercial units to the east with A361 (Southam Road) beyond; residential dwellings and open greenspace to the south with Nursery Drive beyond; and brownfield land and additional open greenspace to the west with Ruscote Avenue beyond.

3.2.3 Vehicular access is currently from an access road off Southam Road to the east of the Site.

Figure 3.1: Aerial Image of the Site

Image © 2021 Digital Globe.

3.3 Topographic Information

3.3.1 A detailed topographic survey was carried out during October 2017 (copy included in Appendix 1). The Site falls east from 103.34 metres Above Ordnance Datum (m AOD) on the western boundary to 94.28m AOD on the eastern boundary). The fall of 9.06m over 390m is a gradient of 1:43.

3.4 Soils

3.4.1 The Soilscapes online map viewer shows that the undeveloped areas in the west of the Site may be underlain by freely draining soils. The east of the Site is underlain by slowly permeable, seasonally wet loamy and clayey soils.

3.5 Geology

3.5.1 The Geology of Britain online map viewer shows there are no superficial deposits beneath the Site. Based on the brownfield nature of the Site, it is likely that Made Ground is present.

3.5.2 The underlying bedrock geology is the Charmouth Mudstone Formation - Mudstone.

3.5.3 The Geology of Britain online map viewer shows there are no records for historical boreholes on site. The nearest record is TQ48SE1988 approx. 150m to the north east of the Site, which is within the same mapped geology. The borehole record confirms the mapped geology (i.e., Mudstone proven to 2.25mbgl). No groundwater was recorded.

3.6 Hydrogeology

3.6.1 There are no superficial deposits and so an infiltration potential can not be assigned.

3.6.2 The infiltration potential of the bedrock is likely to be low.

3.6.3 Defra Magic Map online mapping shows the Site is not located in a groundwater Source Protection Zone (SPZ).

3.6.4 The Site is located above a Secondary (undifferentiated) bedrock aquifer. Indirect inputs of clean surface water to groundwater are permissible, provided the base of the soakaway is above the water table and there is an unsaturated zone in any aquifer unit.

3.7 Catchment Hydrology

3.7.1 The Environment Agency online main river map shows there are no nearby main rivers. A ‘main river’, is a watercourse where flood risk work is carried out by the Environment Agency.

3.7.2 OS mapping (Drawing 002) shows ‘Watercourse 1’ located within the northeast of the Site. Watercourse 1 is likely to be hydraulically linked to the Oxford Canal (650m to the east of the Site) however, this would need to be confirmed. Watercourse 1 is an ‘ordinary watercourse’, where flood risk work is carried out by the local drainage authority.

3.7.3 The Site is in the Cherwell (Cropredy to Nell Bridge) catchment, the Cherwell Operational catchment, the Cherwell and Ray Management Catchment and the Thames River Basin District.

3.7.4 Available online mapping shows that there are no reservoirs in the vicinity of the Site.

3.8 Sewerage Assets

Public Sewers

3.8.1 Thames Water asset plans (Appendix 3) shows a Ø300mm surface water and a Ø150mm foul sewer flowing east along the path outside the southern Site boundary.

Private Drainage

3.8.2 Most of the existing Site is served by an existing private surface water drainage network, which ultimately discharges to Watercourse 1 to the north of the Site via a petrol interceptor (Appendix 4). Where impermeable areas of site are not served by a formal drainage system, it is assumed runoff flows overland following the topography of the Site as per Drawing 011.

3.8.3 A gully to the north west of the Site discharges to the surface water sewer. The gully is not operated or maintained by Thames Water and is likely to fall under the ownership of the local Highways Authority.

3.9 Designated Sites

3.9.1 The DEFRA Magic Map (England and Wales) shows that there are no designated sites in the nearby vicinity of the Site.

3.9.2 The Site is in a Nitrate Vulnerable Zone (NVZ) for surface water:

- Surface Water 472 – Cherwell (Ray to Thames) and Woodeaton Brook NVZ[21].

[21] http://apps.environment-agency.gov.uk/static/documents/nvz/NVZ2017_S472_Datasheet.pdf

4.0 Flood Risk Assessment

4.1 Potential Sources of Flooding

4.1.1 Table 4.1 is a summary of the potential sources of flooding and the potential risk posed by each source at the Site. Each source of flooding and level of risk is then assessed in further detail in this section.

Table 4.1: Potential Risk Posed by Flooding Sources

Flooding Source	Potential Flood Risk at Application Site (Yes/No)	Potential Source	Data Sources
Fluvial	Yes	Watercourse 1	Environment Agency flood mapping (Drawing 005), Historical Flood Events (Drawing 009), Geological Indicators of Flooding (Drawing 008) and SFRA mapping (Appendix 2).
Tidal	No	None Identified	Environment Agency flood mapping (Drawing 005) and SFRA mapping (Appendix 2).
Groundwater	No	Secondary (undifferentiated) Aquifer (bedrock)	BGS mapping (Drawing 003), Geosmart Groundwater (Drawing 006) and SFRA mapping (Appendix 2).
Surface Water	Yes	Poor permeability and Site topography	JBA Surface Water Flooding (Drawing 004), SFRA mapping (Appendix 2) and Environment Agency Complex mapping (Drawing 010.1 to 010.4).
Sewer	No	Public and private sewers	Private utilities plan (Appendix 4) and Thames Water asset plans (Appendix 3).
Infrastructure Failure	No	None Identified	Environment Agency online flood mapping.

4.2 Fluvial Flooding

Environment Agency Flood Zone Mapping

4.2.1 Environment Agency Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, since these can be breached, overtopped and may not be in existence for the lifetime of a development.

4.2.2 The Environment Agency flood map (Drawing 002) shows the Site, including access/egress to Ruscote Avenue is in Flood Zone 1; outside the 1 in 1000-year probability of fluvial (river) and tidal (sea) flooding (0.1% Annual Exceedance Probability [AEP]), and so classified as at low risk.

SFRA Mapping

4.2.3 SFRA mapping in Appendix 2 shows the Site is in Flood Zone 1 and outside the mapped extent of fluvial flooding. There is no fluvial flood outline associated with Watercourse 1 to the north of the Site.

Flood History

4.2.4 Historic flood event mapping (Drawing 009) shows that the Site is not in the mapped extent of historic flood events.

4.2.5 The Geological Indicators of Flooding mapping (Drawing 008) shows that the Site is not in the mapped extent of indicators from inland flooding.

Flood Defences

4.2.6 Environment Agency asset management mapping shows no flood defences in the near vicinity of the Site.

Summary Flood Risk

4.2.7 There is a negligible but residual risk of fluvial flooding from the adjacent watercourse.

4.2.8 Mitigation measures against residual fluvial flooding are discussed in Section 5.

4.3 Tidal Flooding

Environment Agency Flood Zone Mapping

4.3.1 The Environment Agency flood map does not differentiate between fluvial and tidal flooding; however, based on the Site being near no tidal or tidally affected source, the primary source of flooding is fluvial rather than tidal.

SFRA Mapping

4.3.2 The SFRA mapping (Appendix 2) shows that the Site is not in the mapped extent of tidal flooding, as there are no tidal sources near to the Site.

Summary Flood Risk

4.3.3 The risk of tidal flooding is assessed as negligible.

4.4 Groundwater Flooding

4.4.1 Groundwater flooding occurs when subsurface water emerges either at surface or in made ground or in subsurface structures such as basements and services ducts. It occurs as diffuse seepage, emergence from new point source springs or an increase in flow from existing springs. It results from aquifer recharge from infiltrating rainfall, from sinking streams entering aquifers from adjacent non-aquifers, or from high river levels or tides driving water through near surface deposits. It tends to occur with a delay following rainfall and can last for several weeks or months. Groundwater flooding or shallow water tables also prevent or reduce infiltration and so can worsen surface water flooding.

SFRA Map

4.4.2 SFRA mapping (Appendix 2) shows the Site is outside the mapped extent of groundwater flooding susceptibility.

4.4.3 The SFRA mapping is superseded by the BGS Groundwater Flooding Susceptibility mapping.

BGS Groundwater Flooding Susceptibility

4.4.4 The BGS Groundwater Flooding Susceptibility map (Drawing 003) shows the Site is outside the mapped extent of groundwater flooding.

4.4.5 The BGS susceptibility mapping is coarse and the Geosmart groundwater flood risk map should be given greater weight.

Geosmart Groundwater Flood Risk Map

4.4.6 The groundwater flood risk map (Drawing 006) shows the Site is at negligible risk of groundwater flooding and falls within Risk Class 4 - Negligible risk (Table 4.2).

4.4.7 Mapped classes combine understanding of likelihood, model and data uncertainty, and possible severity. Likelihood is ranked according to whether we expect groundwater flooding at a site due to extreme elevated groundwater levels with an annual probability of occurrence greater than 1%, considering model and data uncertainty. Severity relates to expectations of the amount of property damage or other harm that groundwater flooding at that location might cause (Table 4.2).

Table 4.2: Groundwater Flood Risk Classification

Risk Class	Probability of Groundwater Flooding	Effect
4: Negligible	Annual probability less than 1%.	Negligible unless unusually sensitive use.
3: Low	Annual probability greater than 1%.	Remote possibility of damage to property or harm to sensitive receptors. Flooding likely to be limited to seepages and waterlogged ground, damage to basements and subsurface infrastructure, and should pose no significant risk to life. Surface water flooding may be worsened.
2: Moderate	Annual probability greater than 1%.	Significant possibility of damage to property or harm to other sensitive receptors at or near this location. Flooding is likely to be in the form of shallow pools or streams. Surface water flooding and failure of drainage systems may be worsened when groundwater levels are high.
1: High	Annual probability greater than 1%.	Groundwater flooding will occur which could lead to damage to property or harm to other sensitive receptors at or near this location. Flooding may result in damage to property, road, or rail closures and, in exceptional cases, may pose a risk to life. Surface water flooding and failure of drainage systems may be worsened when groundwater levels are high.

Summary Flood Risk

4.4.8 The risk of groundwater flooding is assessed as negligible.

4.5 Surface Water Flooding

4.5.1 Surface water flooding occurs following rainfall on ground where infiltration rates are less than the rainfall precipitation rate. This can occur when either:

- Soils or ground materials are naturally of low permeability or have been compacted (infiltration excess runoff).
- Soils or ground materials are saturated from previous rainfall either directly or from upslope (saturation excess runoff and return flow) or from high groundwater levels.

SFRA Map

4.5.2 SFRA mapping (Appendix 2) shows most of the Site is outside the mapped extent of surface water flooding. The northern boundary is at a low risk of surface water flooding.

4.5.3 The SFRA mapping is superseded by the JBA Surface Water Flood mapping.

JBA Surface Water Flood Map

4.5.4 The JBA Surface Water Flood Map (Drawing 004) shows the west and south of the Site are outside the mapped extent of surface water flooding. There is surface water flooding within the northwest, east and south of the Site, associated with 1 in 75-year, 1 in 200-year and 1 in 1000-year events.

4.5.5 The JBA Surface Water Flood mapping is superseded by the more detailed Environment Agency Complex Surface Water Flood mapping.

Environment Agency Complex Surface Water Flood Mapping

4.5.6 The Environment Agency Complex Surface Water Flood Mapping (Drawings 010.1 to 010.4) shows the west and south of the Site is outside the mapped extent of surface water flooding.

4.5.7 A surface water flow pathway conveys flow east to west along the reaches of Watercourse 1 along the northern Site boundary and around the south of the building. The flooding is associated with the 1 in 30-year, 1 in 100-year and 1 in 1000-year events. The flow pathway is likely to be associated with fluvial flooding along the surcharged water course and will be mitigated as such.

4.5.8 For the identified surface water flow pathway, the maximum flood depth is greater than 1.20m in the north during the extreme 1 in 1000-year event. The maximum flood velocity is 2.00m/s and the maximum flood hazard is ‘extreme’ (>2.00).

Summary Flood Risk

4.5.9 The risk of surface water flooding is assessed as negligible in the west and south of the Site, with an area of medium to high risk associated with a surface water flow pathway.

4.5.10 Mitigation measures against surface water flooding are discussed in Section 5.

4.6 Sewer Flooding

4.6.1 Sewer flooding occurs when urban drainage networks become overwhelmed after heavy or prolonged rainfall due to restrictions or blockage in the sewer network or if the volume of water draining into the system exceeds the sewer design capacity.

4.6.2 New sewers are built to the guidelines within Design & Construction Guidance – Appendix C[22] and have a design standard to the 1 in 30-year flood event. Older sewers were not designed to any standard. Modern sewer systems will only surcharge during rainstorm events with a return period greater than 1 in 30-years (e.g., 1 in 100-years).

4.6.3 There are no recorded public sewers located within the Site.

4.6.4 Most of the existing Site is served by an existing private surface water drainage network, which ultimately discharges to Watercourse 1 to the north (Appendix 4). There are no recorded surcharged events and is assumed the existing drainage arrangement is sufficient. Any surcharged flow would shed overland towards following the topography of the Site as shallow flows (see Drawing 011).

Summary Flood Risk

4.6.5 The risk of flooding from the private sewer network is assessed as low.

4.6.6 Mitigation measures against sewer flooding are discussed in Section 5.

4.7 Flooding from Infrastructure Failure

Reservoir

4.7.1 The Environment Agency online flood mapping shows that the Site is not located within the extent of flooding sourced from reservoir failure.

4.7.2 The risk of flooding from reservoir failure is assessed as negligible.

[22] Water UK (2021) Design & Construction Guidance – Appendix C.

5.0 Flood Risk Mitigation Measures

5.1 Introduction

5.1.1 The following sources of flooding were identified:

- Residual risk of fluvial flooding (Watercourse 1).
- Surface water flooding.
- Sewer Flooding.

5.2 Mitigation Measures

Residual Risk of Fluvial Flooding

- Ensure a 4m easement free from development either side of Watercourse 1.

Surface Water Flooding

- Adoption of a surface water management strategy.
- Set finished floor levels a minimum of +150mm above external levels.
- Provide an 8m easement from the ordinary watercourse.

Residual Risk of Sewer Flooding

- Set finished floor levels a minimum of +150mm above external levels.

5.3 Summary of Flood Risk

5.3.1 Table 5.1 summarises the probability and level of risk, both with and without mitigation measures.

Table 5.1: Probability and Consequences of All Sources of Flooding

Flooding Source	Potential Source	Probability	Consequence & Impact Without Mitigation	Consequence & Impact with Mitigation
Fluvial	Watercourse 1	Low	Low	Low
Tidal	None Identified	Negligible	Negligible	Negligible
Groundwater	Shallow Groundwater	Negligible	Negligible	Negligible
Surface Water	Poor permeability and Site topography	Negligible for the west and south of the Site but Medium to High where there a surface water flow pathway	Negligible for the west and south of the Site but Medium to High where there a surface water flow pathway	Low

Flooding Source	Potential Source	Probability	Consequence & Impact Without Mitigation	Consequence & Impact with Mitigation
Sewer	Private sewers	Low	Low	Negligible
Infrastructure Failure	None Identified	Negligible	Negligible	Negligible

Key: *Green - Negligible, Yellow - Low, Orange - Medium and Red - High; based on consequence and impact with mitigation from each flooding source.*

5.4 Flood Guidance and Sequential Test

5.4.1 The current land use is a former commercial unit and hardstanding carpark area.

5.4.2 The proposal is for a van parking site. Table 2 of PPG ID: 7 (not included in this report) classifies the proposed use as 'less vulnerable'.

5.4.3 The proposed use would not increase the vulnerability of the Site. The change of use from a former commercial unit and hardstanding carpark area to a van parking site would reintroduce management of the Site, including the ability to move or secure the onsite vehicles.

5.4.4 The Environment Agency Flood Zones and acceptable development types are listed in Table 5.2. All development types (including less vulnerable uses) are acceptable in Flood Zone 1 (low risk). As such, the Sequential Test would be passed, and the Exception Test would not be required as indicated in Table 5.3.

Table 5.2: Environment Agency Flood Zones and Appropriate Land Use

Flood Zone	Probability	Explanation	Appropriate Land Use
Zone 1	Low	Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).	All development types generally acceptable.
Zone 2	Medium	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.	Most development type are generally acceptable.
Zone 3a	High	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.	Some development types not acceptable.

Flood Zone	Probability	Explanation	Appropriate Land Use
Zone 3b	'Functional Floodplain'	Land where water must flow or be stored in times of flood. SFRAs should identify this zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1% flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).	Some development types not acceptable.

Note: *The Flood Zones are the current best information on the extent of the extreme flood from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. The identified risk of fluvial flooding is highlighted green.*

Table 5.3: Vulnerability and Flood Zone 'Compatibility' as Identified in Table 3 of PPG ID: 7

Flood Risk Vulnerability classification (see Table 1 of PPG ID: 7)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	Yes	Yes	Yes	Yes	Yes
Zone 2	Yes	Yes	Exception test required	Yes	Yes
Zone 3a	Exception test required	Yes	No	Exception test required	Yes
Zone 3b 'Functional Floodplain'	Exception test required	Yes	No	No	No

Key: *Yes: Development is appropriate, No: Development should not be permitted.*
The identified risk of fluvial flooding is highlighted green.

6.0 Site Drainage

6.1 Introduction

6.1.1 Consideration of flood issues is not confined to the floodplain. This is recognised in the NPPF and associated guidance where all proposed development of 1ha or more in Flood Zone 1 and so outside the floodplain nevertheless requires an FRA. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in a catchment, particularly flooding downstream; and replacing permeable vegetated areas with low permeability roofs, roads and other paved areas will increase the speed, volume, and peak flow of surface water runoff.

6.1.2 A surface water management strategy for the development is proposed to manage and reduce the flood risk posed by surface water runoff from the Site. The developer will be required to ensure that any scheme for surface water should build in sufficient capacity for the entire Site.

6.1.3 The surface water drainage arrangements for any development Site should be such that the volume and peak flow rates of surface water leaving a developed Site are no greater than the rates prior to the proposed development unless specific off-Site arrangements are made and result in the same net effect.

6.1.4 A standalone drainage strategy has been prepared by EirEng Consulting Engineers Ltd. For further details of the proposed surface water drainage network, please refer to the EirEng Consulting Engineers Ltd drawings (EirEng Consulting Engineers Ltd Drawing 212088 – C002) and report, included as part of this planning application.

6.1.5 Below is a summary of the drainage principles.

6.2 Existing Drainage Arrangement

6.2.1 Most of the existing Site is served by an existing private surface water drainage network, which ultimately discharges to Watercourse 1 to the north. Any surcharged flow would shed overland towards following the topography of the Site as shallow flows (Drawing 011).

6.3 Surface Water Drainage

Drainage Hierarchy

6.3.1 In accordance with requirement H3 of the Building Regulations 2010[23] rainwater runoff must discharge to one of the following, listed in order of priority:

1. **An adequate soakaway or some other adequate infiltration system:** The SuDS infiltration Potential map (Drawing 007) shows that the Site is located within the extent of 'low potential'. Furthermore, the use of infiltration-based SuDS is not considered feasible based on the presence of low permeable (clayey) bedrock deposits and the presence of Made Ground.
2. **A watercourse:** Watercourse 1 is located to the north of the Site. Surface water from the Site already discharges to Watercourse 1 through a historical connection.
3. **A sewer:** There are no public surface water sewers in the nearby vicinity of the Site. The nearest surface sewer is a Ø1500mm surface water sewer 30m to the north of the Site. The

[23] Office of the Deputy Prime Minister, The Building Regulations 2010, amended 2016.

existing development is served by a private drainage network, which discharges to Watercourse 1.

6.3.2 It is proposed that the existing point of outfall to watercourse is maintained.

Sustainable Drainage Systems (SuDS) and Maintenance

6.3.3 Sustainable water management measures should be used to control the surface water runoff from the proposed development Site, thereby managing the flood risk to the Site and surrounding areas from surface water runoff. These measures will also improve the quality of water discharged from the Site.

6.3.4 Maintenance of the SuDS features would be in line with the SuDS Manual (CIRIA C753, 2015), as detailed. The maintenance would be undertaken by a private maintenance company.

6.3.5 It is standard practice for SuDS features within a new development to be maintained by a private maintenance company unless the council adopt it. If the maintenance company goes into administration, the Site will be contracted to a new maintenance company.

Drainage Design

6.3.6 The proposed surface water from the Site will drain via rainwater downpipes and slot drains to gravity sewers and suitably sized attenuation storage, in the form of a new geocellular storage tank. The attenuation tank will provide 456m^3 storage and will intercept all storm runoff from the new van park and has been sized for 100yr plus 20% climate change allowance, with a sensitivity check undertaken using the 100yr plus 40% allowance that resulted in no predicted flooding. This will then convey restricted flows to the existing surface water sewers based on a QBar rate of 7.3 l/s.

Exceedance Routes

6.3.7 The attenuation will be designed with a capacity up to a 1 in 100-year (plus 40% climate change) event, based on the restricted (1 in 100 greenfield) discharge rate.

6.3.8 A storm event greater than this design standard would be extreme and would cause the attenuation to exceed (with no sudden deluge) and would then shed overland following the topography of the Site, as per existing conditions (Drawing 011).

6.3.9 Finished floor levels will be set above external levels, which will mitigate the residual risk of overtopping.

6.4 Foul Water Drainage

6.4.1 Foul flows will utilise the existing drainage arrangements and convey flows to the existing on-site foul water network located in the south eastern extent of the Site. New foul drainage will be provided for the new welfare facility and sprinkler tanks / pump house, and will connect to the existing on-site foul drainage. From there the existing foul network flows north and exits

6.4.2 All foul sewerage should be designed in accordance with Building Regulations Part H. In areas where sewers are to be adopted by Thames Water, sewerage should be designed in accordance with Design & Construction Guidance – Appendix C and supplemented with additional standards provided by Thames Water.

7.0 Summary and Conclusion

7.1 Introduction

7.1.1 A site-specific Flood Risk Assessment (FRA) has been undertaken for a proposed van storage site, located on a 5.45ha Site on land to the west of Southam Road, Banbury, Oxfordshire.

7.2 Flood Risk

7.2.1 There is a negligible but residual risk of fluvial flooding from the watercourse to the north of the Site.

7.2.2 The risk of surface water flooding is assessed as negligible in the west and south of the Site, with an area of medium to high risk associated with a surface water flow pathway.

7.2.3 The risk of flooding from the private sewer network is assessed as low.

7.2.4 The risk of flooding from all other sources is assessed as negligible.

7.3 Mitigation Measures

7.3.1 The flood risk can be mitigated to a negligible or low and acceptable level through the following approach:

- Ensure a 4m easement free from development either side of Watercourse 1.
- Set finished floor levels a minimum of +150mm above external levels.
- Adoption of a surface water management strategy.

7.4 Flood Guidance

7.4.1 The proposed use is classified as less vulnerable. Less vulnerable uses are considered acceptable in terms of flood risk in Flood Zone 1. As such, the Sequential Test would be passed, and the Exception Test would not be required.

7.5 Site Drainage

Surface Water

7.5.1 The proposed surface water from the Site will drain via rainwater downpipes and slot drains to gravity sewers and suitably sized attenuation storage, in the form of a new geocellular storage tank. The attenuation tank will provide 456m^3 storage and will intercept all storm runoff from the new van park and has been sized for 100yr plus 20% climate change allowance, with a sensitivity check undertaken using the 100yr plus 40% allowance that resulted in no predicted flooding. This will then convey restricted flows to the existing surface water sewers based on a QBAR rate of 7.3 l/s.

Foul Water

7.5.2 It is proposed that foul flows will utilise the existing drainage arrangements and convey flows to the existing on-site foul water network located in the southeast of the Site. New foul drainage will be provided for the new welfare facility sprinkler tanks / pump house, and will

connect to the existing on-site foul drainage. From here the existing foul network flows north alongside Southam Road.

7.6 Conclusion

7.6.1 This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of national and local policy and guidance.

7.6.2 The development should therefore not be precluded on the grounds of flood risk or surface water and foul drainage.

DRAWINGS

Key

Site Location
(SP 44995 41455)

enzygo
environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT:
EirEng Consulting Engineers

SCALE: 1:20,000@A3

PROJECT REF: SHF.393.013

DRAWN: MG

CHECKED: HDR

DATE: April 2021

PROJECT:
Ruscote Avenue, Banbury

TITLE:
Site Location Plan

DRAWING NO:
SHF.393.013.HY.D.001.A

Key

- Site Boundary
- Surface Water Features

enzygo
environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: EirEng Consulting Engineers

SCALE: 1:5,000@A3

PROJECT REF: SHF.393.013

DRAWN: MG

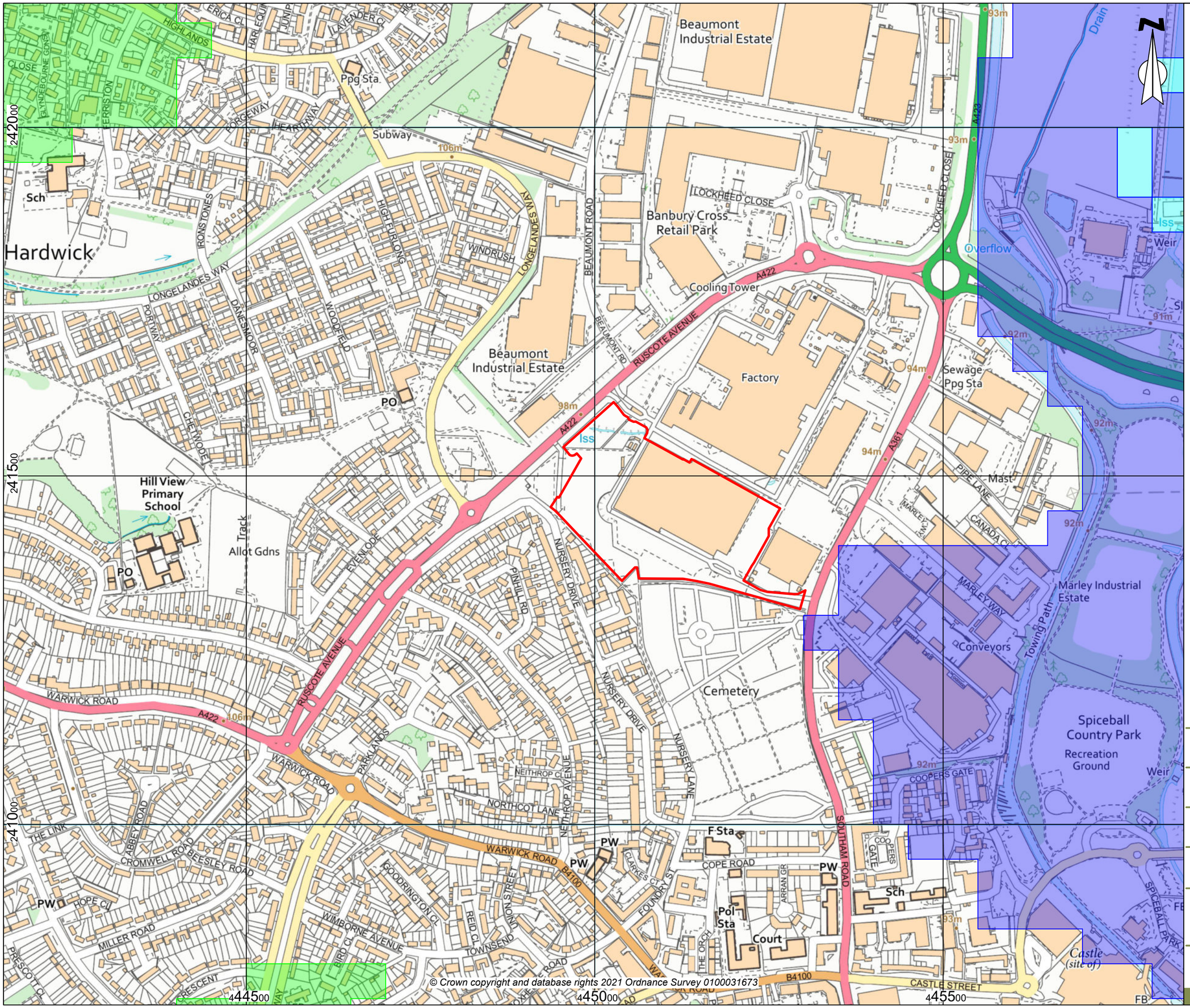
CHECKED: HDR

DATE: April 2021

PROJECT: Ruscote Avenue, Banbury

TITLE: Surface Water Features

DRAWING NO: SHF.393.013.HY.D.002.A



Key

- Site Boundary
- Potential for Groundwater Flooding to Occur at Surface
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Limited Potential for Groundwater Flooding to Occur

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: EirEng Consulting Engineers

SCALE: 1:5,000@A3

PROJECT REF: SHF.393.013

DRAWN: MG

CHECKED: HDR

DATE: April 2021

PROJECT: Ruscote Avenue, Banbury

TITLE: BGS Groundwater Flooding Susceptibility

DRAWING NO: SHF.393.013.HY.D.003.A

Key

- Site Boundary
- Search Extent
- 1 in 75 Year Surface Water Flooding
- 1 in 200 Year Surface Water Flooding
- 1 in 1000 Year Surface Water Flooding

enzygo
environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: EirEng Consulting Engineers

SCALE: 1:5,000@A3

PROJECT REF: SHF.393.013

DRAWN: MG

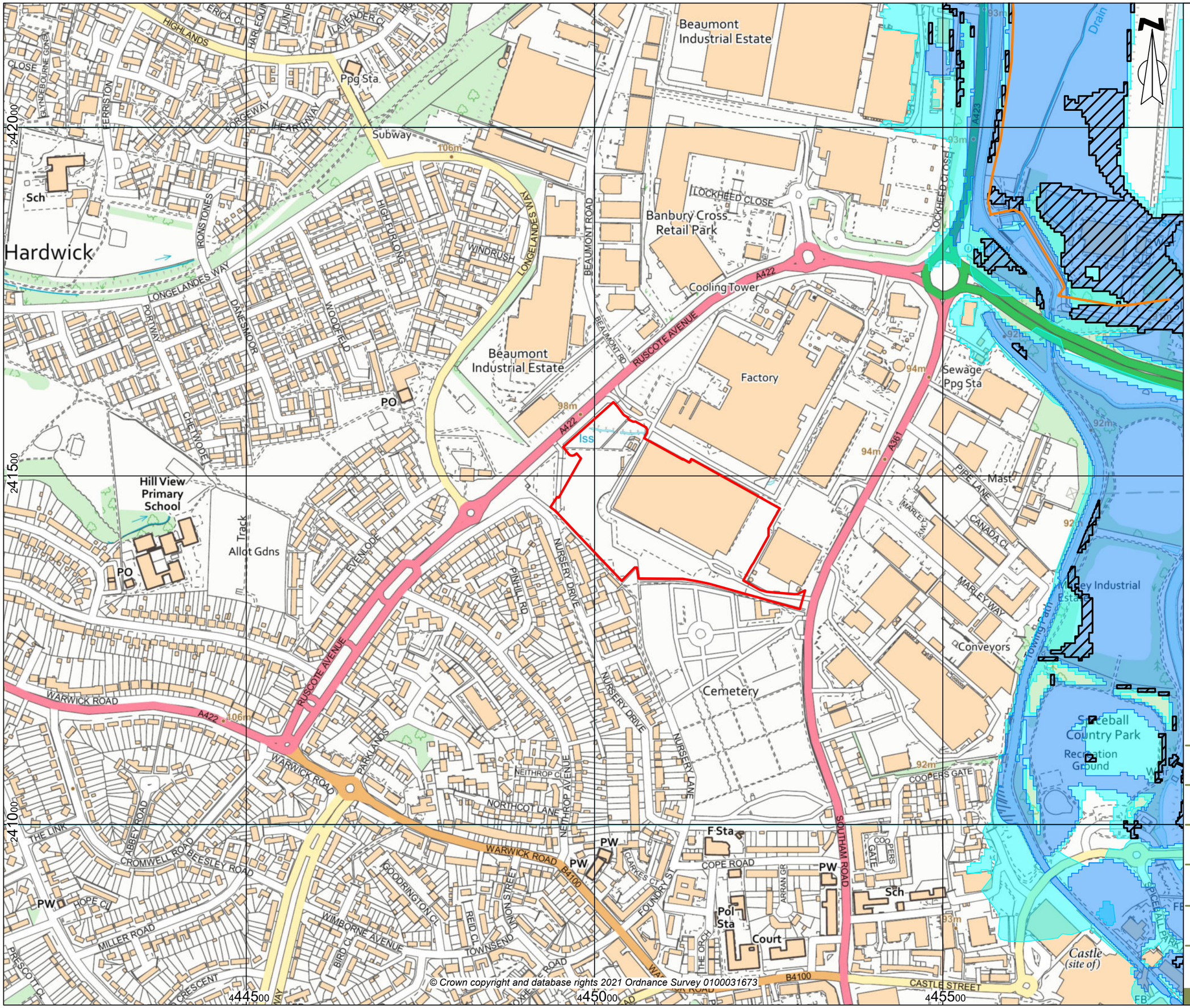
CHECKED: HDR

DATE: April 2021

PROJECT: Ruscote Avenue, Banbury

TITLE: JBA Surface Water Flooding

DRAWING NO: SHF.393.013.HY.D.004.A



enzygo
environmental consultants

Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: EirEng Consulting Engineers

SCALE: 1:5,000@A3

PROJECT REF: SHF.393.013

DRAWN: MG

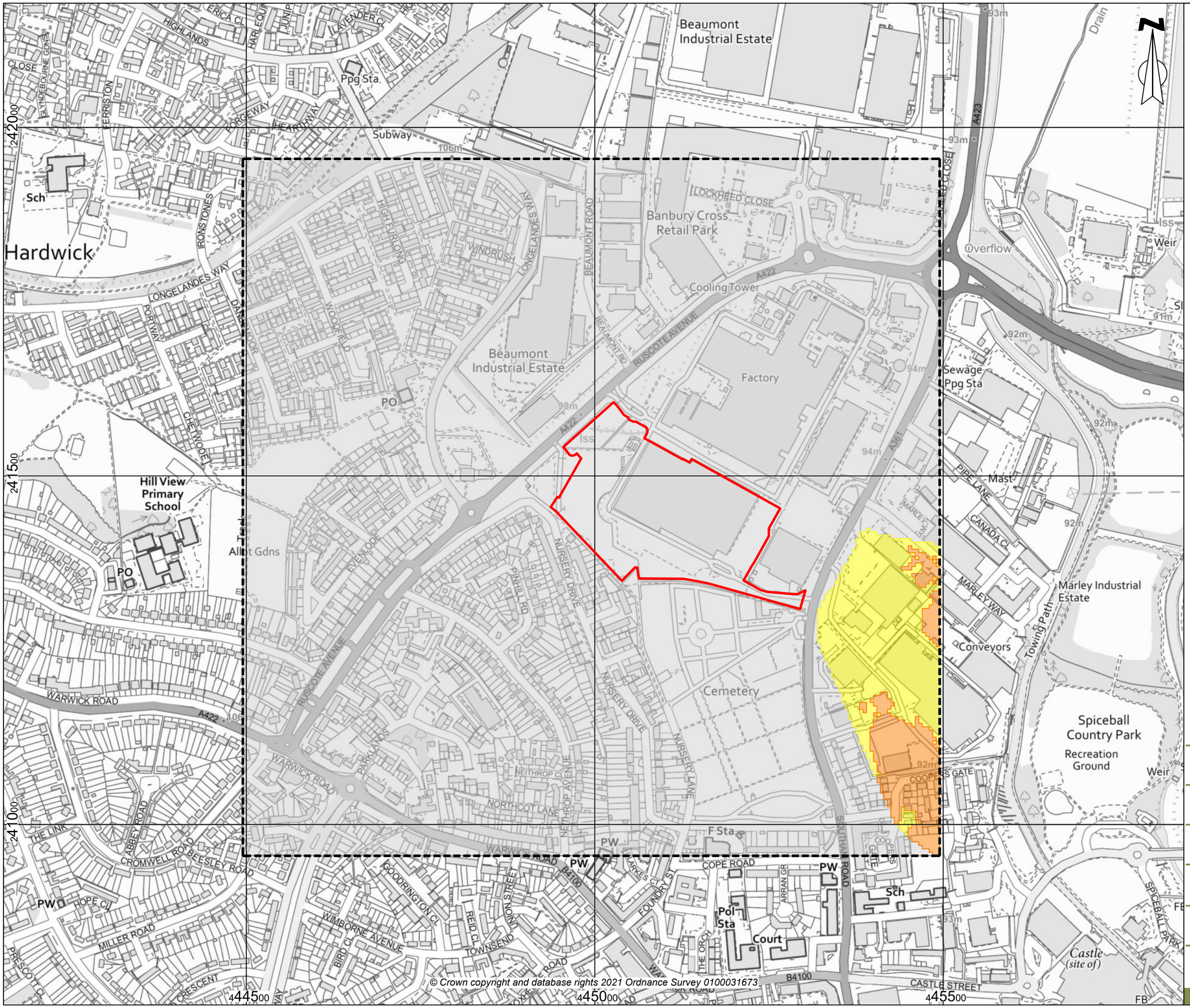
CHECKED: HDR

DATE: April 2021

PROJECT: Ruscote Avenue, Banbury

TITLE: Environment Agency Flood Zones

DRAWING NO: SHF.393.013.HY.D.005.A



Key

- Site Boundary
- Search Extent
- Class 1 - High Risk
- Class 2 - Moderate Risk
- Class 3 - Low Risk
- Class 4 - Negligible Risk

Notes:

GEOSMART GROUNDWATER FLOOD RISK MAP GW5
Version 2.3© - www.geosmartinfo.co.uk

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: EirEng Consulting Engineers

SCALE: 1:5,000@A3

PROJECT REF: SHF.393.013

DRAWN: MG

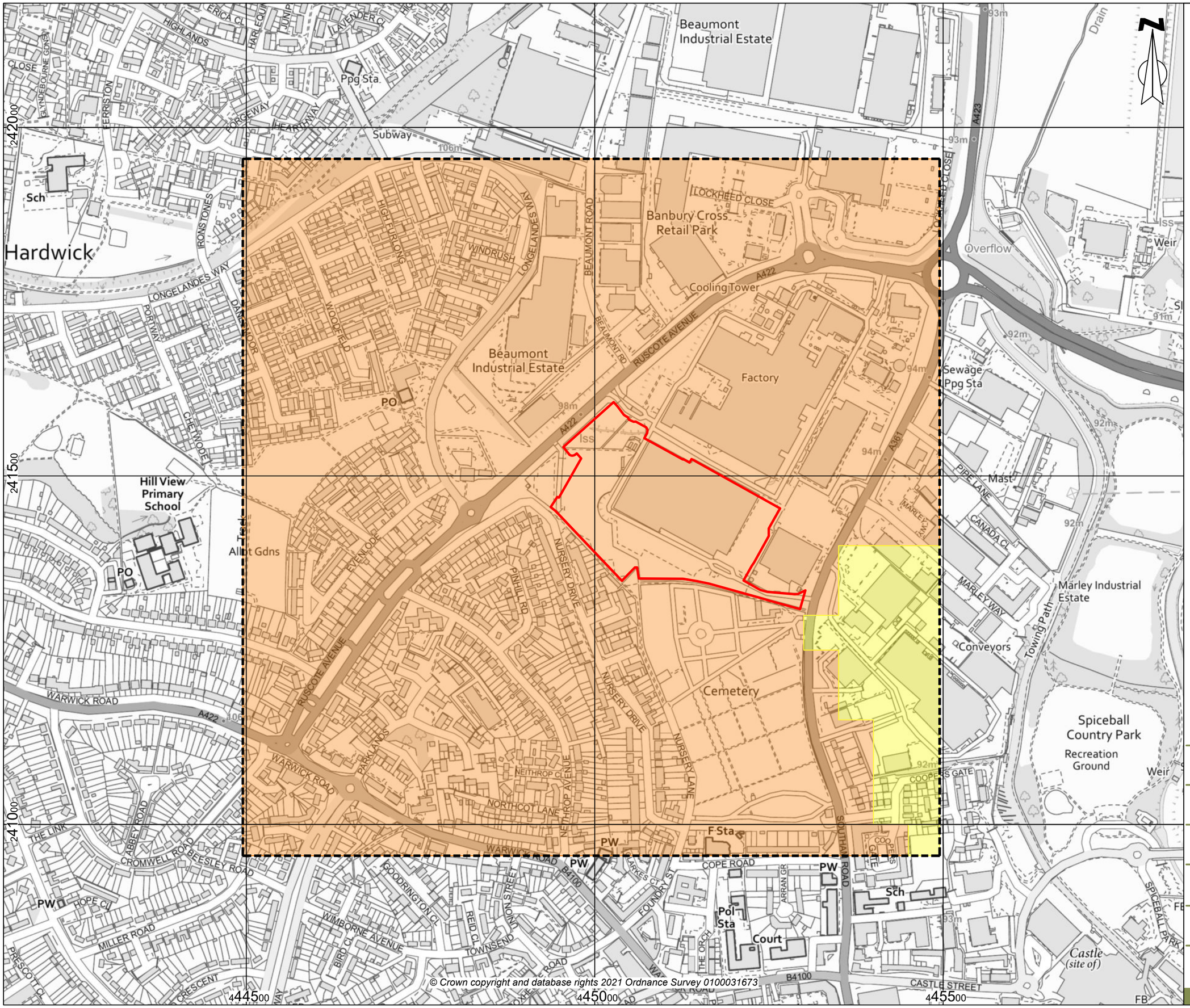
CHECKED: HDR

DATE: April 2021

PROJECT: Ruscote Avenue, Banbury

TITLE: Groundwater Flood Risk Map

DRAWING NO: SHF.393.013.HY.D.006.A



Key

- Site Boundary
- Search Extent
- High Potential
- Moderate Potential
- Low Potential

Notes:

GEOSMART SUDS INFILTRATION POTENTIAL MAP SD50
Version 1.0© - www.geosmartinfo.co.uk

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: EirEng Consulting Engineers

SCALE: 1:5,000@A3

PROJECT REF: SHF.393.013

DRAWN: MG

CHECKED: HDR

DATE: April 2021

PROJECT: Ruscote Avenue, Banbury

TITLE: SuDS Infiltration Potential Map

DRAWING NO: SHF.393.013.HY.D.007.A

Key

- Site Boundary
- Geological Indicators of Flooding *from Inland Flooding*

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: EirEng Consulting Engineers

SCALE: 1:5,000@A3

PROJECT REF: SHF.393.013

DRAWN: MG

CHECKED: HDR

DATE: April 2021

PROJECT: Ruscote Avenue, Banbury

TITLE: Geological Indicators of Flooding (based on geological deposits)

DRAWING NO: SHF.393.013.HY.D.008.A

Key

- Site Boundary
- Historic Flood Zone (Date of flood 12/12/1947 - 12/12/1947)
- Historic Flood Zone (Date of flood 01/01/1979 - 12/12/1979)
- Historic Flood Zone (Date of flood 01/01/1992 - 12/12/1992)
- Historic Flood Zone (Date of flood 01/04/1998 - 30/04/1998)
- Historic Flood Zone (Date of flood 19/07/2007 - 29/07/2007)

enzygo environmental consultants

Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT:
EirEng Consulting Engineers

SCALE:
1:10,000@A3

PROJECT REF:
SHF.393.013

DRAWN:
MG

CHECKED:
HDR

DATE:
April 2021

PROJECT:
Ruscote Avenue, Banbury

TITLE:
Historic Flood Events

DRAWING NO:
SHF.393.013.HY.D.009.A

Key

- Site Boundary
- Search Extent
- 30 Year Extent
- 100 Year Extent
- 1000 Year Extent
- Flow Direction

enzygo
environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: EirEng Consulting Engineers

SCALE: 1:5,000@A3

PROJECT REF: SHF.393.013

DRAWN: MG

CHECKED: HDR

DATE: April 2021

PROJECT: Ruscote Avenue, Banbury

TITLE: Environment Agency Surface Water Flow Paths

DRAWING NO: SHF.393.013.HY.D.010.1.A