30 April 2020

Our Ref: JAG//43386/Lt003

Bloombridge Development Partners
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Venture House
27-29 Glasshouse Street
London
W1B 5DF

For the attention of Mr B Usher

Dear Sirs

Re: Proposed Development at Bicester Gateway: LLFA Response

Further to the correspondence you received from Oxfordshire County Council regarding the Flood Risk and Drainage report that we prepared in support of the planning application reference 20/00293, we have updated the report to Revision D, as attached, and we summarise our response below.

Development and Flood Risk and Drainage Context
The planning application to Cherwell District Council is covered under application reference 20/00293. However, the site is also covered under an extant planning application, reference 16/02586, and Hamill Davies Limited provided a supporting 'Flood Risk Assessment' report and a 'Services, Foul and Surface Water Drainage Strategy' report. No adverse comments were provided by the Consultees and planning was granted, amongst other things, on the basis of the reports' findings.

In addition to the extant planning permission reference 16/02586, subsequent submittals have been made to discharge planning Conditions relevant to Phase 1A (the hotel). Pertinent to this report is application reference 18/00389/DISC, which included the WSP Drainage Technical Note and supporting drainage drawings and calculations. Again, no adverse comments were provided by the Consultees and Condition was discharged.

Therefore, the flood risk and drainage principles of this application have been set by the extant permission and its supporting reports.

Pumping Risk
In relation to the need to pump, the use of shallow SuDS is recommended, however, pumping can not be avoided because the existing ditches are shallow (at less than 1.4m deep) and the upstream sewers that will supplement the shallow SuDS will need to comply with the Building Regulations and be set at 1.2m cover under roads, and need to be laid to falls and be sized to suit the peak 1 in 100 year, plus climate change, flows. We have included a general arrangement section showing the connection to the ditch which can only be done using a pumping station.

We have provided further details in the report and considered the risk of pump failure and mitigation and the residual risk.

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Soakage Tests
The soakaway tests were taken from the extant planning permission and seek to demonstrate that the underlying strata and its groundwater levels preclude the use of infiltration.

The details submitted as part of the extant permission and the discharge of planning Conditions both rule out infiltration, as does our report.

Climate Change
We have updated the calculations and drainage drawing in the report to allow for 40% climate change.

Land Drainage Consent
We note reference to requiring land drainage consent, which will be formally applied for at the right time.

The drainage ditches are riparian owned, and site already discharges rainfall run-off to the surrounding ditches, so we are maintaining the status quo.

With the surface water discharge rate limited to the lowest practicable rate, and in theory this being less than the greenfield equivalent rate for the 1 in 100 year return period, and with us allowing for climate change within the assessment, the flood risk to the existing ditches will be reduced.

This is explained in more detail in the updated report.

Cross Section Drawings
We have provided cross-section drawings of the SuDS and the pumping station in the updated report.

Drainage Drawings
We have updated the calculations and drainage drawings to allow for 40% climate change and updated the SuDS referenced in the report.

Culverting
We have included a section on the ditch culvert in the report and note that the ditch is already culverted on site and in the surrounding area.

Watercourse Modelling
As noted above, surface water from the proposed development will be controlled to the lowest practicable rate, of 3.5l/s, which is less than the existing greenfield equivalent, and less than the ‘long term storage’ requirement run-off rate of 2l/s.ha.

It is reasonable to state therefore that the impact of surface water discharge on the downstream drainage ditch network is minimised, and flood risk, in theory, is reduced.

With the flood risk to the drainage ditches being reduced, we do not see the need to model the watercourses and ditches in the surrounding area.

Modelling would also be disproportionate to the scale of the development and flood risk.

Surface Water Flood Risk and Mitigation
In relation to surface water flood risk the site is shown to be theoretically at risk from flooding up to 900mm, even though it is in Flood Zone 1 (less than 1 in 1000 annual probability of flooding in any year).

The flood depths on the surface water mapping are based on a simple assessment, using the site's topography and assumes no drainage is in place. In reality the drainage ditches provide a mechanism for collection, conveyance and capacity, and these currently manage the surface water on site, and there have been no known instances of the site flooding.

Furthermore, the site will have a SuDS system which controls flows to an agreed rate, and excess flows will be balanced up to the 1 in 100 year, plus climate change, allowance, which is an improvement to the current situation, therefore the overall risk from surface water flooding is considered to be low.

However, taking the theoretical flood depth at its highest, the flood level could be 64.90mAOD, based on the ditch invert level of 64mAOD.

The finished floor levels of the proposed buildings will be set at 65.30mAOD, which is above the theoretical flood depth, with 400mm freeboard.

Finished Floor Levels
Setting finished floor levels at 65.30mAOD will also provide mitigation from the residual risk of pumping station failure, overland flows flood risk, surface water flood risk and surface water exceedance flow flood risk.

Summary
The flood risks and mitigation that was recommended in our FRDA report that accompanied the original planning application have not materially changed, and neither have the drainage principles, which were previously established and accepted for the extant permission and Condition discharge submittals.

However, we have clarified the principles and provided further details in the updated report based on the LLFA feedback, confirmed that pumping is unavoidable and confirmed the Finished Floor Levels, which will mitigate residual flood risks.

We trust that this is sufficient for the LLFA to be confident that Outline permission can be granted with suitably worded planning Conditions to control the proposed scheme as it is brought forward to the Reserved Matters stage.

Yours faithfully

James Gibson MEng (Hons), CEng, C.WEM, MCIWEM
Director
For and on behalf of Alan Wood and Partners
Enc.

FLOOD RISK AND DRAINAGE ASSESSMENT FOR A PROPOSED COMMERCIAL DEVELOPMENT ON LAND TO THE WEST OF WENDLEBURY ROAD, BICESTER, OXFORDSHIRE

PROJECT NO.
JAG/AD/JP/43386-Rp001D

APRIL 2020

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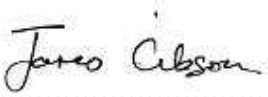
FLOOD RISK AND DRAINAGE ASSESSMENT FOR A PROPOSED DEVELOPMENT ON LAND TO THE WEST OF WENDLEBURY ROAD, BICESTER, OXFORDSHIRE

Prepared by: A Dunn

Signed: ……
Date: 20th December 2019

Approved by: J Gibson, MEng (Hons), CEng, CWEM MCIWEM
Civil Engineering Director



Signed: ……
Date: 20th December 2019

Issue	Revision	Revised by	Approved by	Revised Date
A	Proposed floor level information revised	JP	JAG	14/01/20
B	Revised to further drainage designs	JP	JAG	28/01/20
C	Revised based on LLFA feedback	JAG	JAG	29/04/20
D	Minor Updates	JAG	JAG	30/04/20

For the avoidance of doubt, the parties confirm that these conditions of engagement shall not and the parties do not intend that these conditions of engagement shall confer on any party any rights to enforce any term of this Agreement pursuant of the Contracts (Rights of third Parties) Act 1999.
The Appointment of Alan Wood & Partners shall be governed by and construed in all respects in accordance with the laws of England & Wales and each party submits to the exclusive jurisdiction of the Courts of England & Wales.

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APPENDICES

Appendix A : Topographic Survey Drawings

Appendix B : Soakaway Test Report

Appendix C : Indicative Layout Drawing

Appendix D : Greenfield IH124 Surface Water Runoff Calculations

Appendix E : Hydraulic Model Study

Appendix F : Drainage Layout Drawings and Details

Appendix G : Surface Water Exceedance Flood Routing Drawings

EXECUTIVE SUMMARY

Alan Wood & Partners has prepared this Food Risk and Drainage report to support an Outline planning application for a commercial and residential development by Bicester Gateway Ltd on 3.15 hectares of land to the west of Wendlebury Road, Bicester, Oxfordshire.

The land has an extant planning permission (reference 16/02586), which was supported by formal flood risk and drainage assessments, and the initial phase of the extant permission has had condition discharge submittals (reference 18/00389/DISC) which also included formal drainage submittals. No objections were raised for the extant permitted site, nor for the condition discharge application, therefore the principles of flood risk and drainage mitigation have been set and agreed, and this report follows these agreed principles.

The site falls in Flood Zone 1 (low flood risk), and overall the site is assessed at having a low and acceptable risk of flooding, especially when mitigation is taken into account. The focus of the flood risk elements is therefore associated with surface water disposal from the scheme, and the flood risk from surface water based on the published flood maps.

In relation to surface water discharge from the development, the site is underlain by shallow groundwater with poor infiltration characteristics therefore infiltration is not viable. The site is surrounded by shallow drainage ditches, which is where rainfall run-off current discharges at the equivalent greenfield rate, of up to 4l/s for the 1 in 100 year event. Surface water from the proposed development will be controlled to the lowest practicable rate of 3.5l/s, which is less than the existing greenfield equivalent, and less than the ‘long term storage’ requirement run-off rate of 2l/s.ha. It is reasonable to state therefore that the impact of surface water discharge on the downstream drainage ditch network is minimised, and flood risk, in theory, is reduced.

Excess flows, up to the 1 in 100 year, plus 40% increase in rainfall intensity due to the impact of climate change, will be balanced on site in Sustainable Drainage Systems, which will also provide water quality benefits.

Due to the shallow ditches, the requirements of the Building Regulations in relation to cover to pipes, pipe gradients and pipe sizes and the large balancing volume, the surface water flows will need to be pumped. This is not preferred, but it is unavoidable and the risks need to be assessed within this report. Pumping failure can be mitigated, and the residual risk of its failure has been assessed as low and acceptable due to the recommended flood mitigation.

In relation to surface water flood risk the site is shown to be at risk from flooding up to 900mm, event though it is in Flood Zone 1 (less than 1 in 1000 annual probability of flooding in any year). The flood depths on the mapping is based on a simple assessment, using the site's topography and assumes no drainage is in place. In reality the drainage ditches provide a mechanism for collection, conveyance and capacity, and these currently manage the surface water on site, and there have been no known instances of the site flooding. Furthermore, as noted above, the site will have a SuDS system which controls flows to an agreed rate, and excess flows will be balanced up to the 1 in 100 year, plus climate change, allowance, which is an improvement to the current situation, therefore the risk from surface water flooding is considered to be low.

However, taking the theoretical flood depth at its highest, the flood level could be 64.90mAOD. The finished floor levels of the proposed buildings will be set at 65.30mAOD, which is above the theoretical flood depth, with freeboard.

Based on the flood risk mitigation proposed within this report and the recommended SuDS and drainage principles, we consider that the assessment and its conclusions are reasonable, proportional, practicable and acceptable, in keeping with the extant permission and previous submissions and in line with local and national policies.

We consider therefore that Outline permission can be granted with suitably worded planning Conditions to control the proposed scheme as it is brought forward to a Reserved Matters application and detailed design in the future.

1.0 INTRODUCTION

1.1 Background

1.1.1 Alan Wood & Partners were commissioned by Bicester Gateway Ltd to prepare a Flood Risk and Drainage Assessment for a proposed residential and commercial development on land to the west of Wendlebury Road, Bicester, Oxfordshire in support of an Outline planning application.

1.1.2 A Flood Risk and Drainage Assessment (FRDA) for the proposed development is required to assess the development's risk from flooding and the suitability of the site in terms of drainage. This updated revision of the report is provided in response to the Lead Local Planning Authority, Oxfordshire County Council, comments on the initial report.

1.1.3 The planning application to Cherwell District Council is covered under application reference 20/00293 (Outline application (Phase 1B) including access (all other matters reserved) for approximately 4,413 sqm B1 office space (47,502 sqft) GIA, approximately 273 residential units (Use Class C3) including ancillary gym, approximately 177 sqm GIA of café space (Use Class A3), with an ancillary, mixed use co-working hub (794 sqm/ 8,550 sqft GIA), multi-storey car park, multi-use games area (MUGA), amenity space, associated infrastructure, parking and marketing boards).

1.1.4 However, the site is also covered under an extant planning application, reference 16/02586 for Phase 1 of the proposed new business park ("Bicester Gateway") comprising up to 14,972 sq m (Gross External Area) of B1 employment based buildings, plus a hotel (up to 149 bedrooms), with associated infrastructure, car parking and marketing boards.

1.1.5 Hamill Davies Limited provided a supporting 'Flood Risk Assessment' report and a 'Services, Foul and Surface Water Drainage Strategy' report, both of which are included in the approved planning application 16/02586. No adverse comments were provided by the Consultees and planning was granted, amongst other things, on the basis of the reports' findings.

1.1.6 In addition to the extant planning permission reference 16/02586, subsequent submittals have been made to discharge planning Conditions relevant to Phase 1A (the hotel). Pertinent to this report is application reference 18/00389/DISC (Discharge of condition 11 (CMP) 15 (Surface water drainage

scheme) 16 (Water supply impact studies) 17 (foul drainage strategy) 28 (Footway/cycle details) 29 (Bus stop layby) 31 (Details of pedestrian crossing) of 16/02586/OUT). Within this submittal is the WSP Drainage Technical Note and supporting drainage drawings and calculations. Again, no adverse comments were provided by the Consultees and Condition was discharged with the following comment:

> *"The details of the proposed surface water drainage scheme as set out ……. are considered to set out an appropriate scheme for managing rainwater to ensure that it does not increase surface water discharge from the site or lead to increased risk of flooding in accordance with relevant local and national planning policy……"*

1.1.7 Therefore, the flood risk and drainage principles of this application have been set by the extant permission and its supporting reports.

1.2 Layout of Report

1.2.1 Section 1 provides an introduction to the FRDA, explains the layout of this FRDA and provides an introduction to flood risk and the latest guidance on development and flood risk in England.

1.2.2 Section 2 provides an introduction to the site. The site description is based upon a desktop study and information provided by the developer. In order to obtain further information on flood risk, consultation was undertaken with the Environment Agency.

1.2.3 Section 3 of this report details the information gathered through the consultation.

1.2.4 Section 4 of this report details the development proposals and considers the development proposals in relation to the current planning policy on development and flood risk in England (and what type of development is considered appropriate in different flood risk zones). National Planning Policy Framework (NPPF): and its associated Technical Guidance (Communities and Local Government, March 2012) is the current planning policy on flood risk in England, and an introduction to NPPF is provided below.

1.2.5 Section 5 considers the drainage arrangements for the proposed development.

1.2.6 Section 6 of this report considers the flood risk to site, and the potential for the development proposals to impact on flood risk. The assessment of flood risk is based on the latest planning policy and utilises all the information gathered in the preparation of the report.

1.2.7 Section 7 of this report provides details of any recommendations for further work to mitigate against possible flooding.

1.2.8 Section 8 of this report provides a summary of the report.

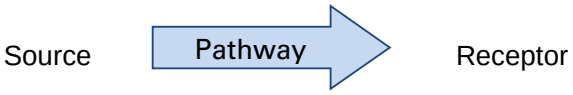
1.3 Flood Risk

1.3.1 Flood risk takes account of both the probability and the consequences of flooding.

1.3.2 Flood risk = probability of flooding x consequences of flooding

1.3.3 Probability is usually interpreted in terms of the return period, e.g. 1 in 100 and 1 in 200-year event, etc. In terms of probability, there is a 1 in 100 (1%) chance of one or more 1 in 100-year floods occurring in a given year. The consequences of flooding depends on how vulnerable a receptor is to flooding.

The components of flood risk can be considered using a source-pathway-receptor model.



1.3.4 Sources constitute flood hazards, which are anything with the potential to cause harm through flooding (e.g. rainfall extreme sea levels, river flows and canals). Pathways represent the mechanism by which the flood hazard would cause harm to a receptor (e.g. overtopping and failure of embankments and flood defences, inadequate drainage and inundation of floodplains). Receptors comprise the people, property, infrastructure and ecosystems that could potentially be affected should a flood occur.

1.4 National Planning Policy Framework

1.4.1 General

1.4.1.1 NPPF and its associated Technical Guidance replaces Planning Policy Statement 25 and provides guidance on how to evaluate sites with respect to flood risk.

1.4.1.2 A summary of the requirements of NPPF is provided below.

1.4.2 Sources of Flooding

1.4.2.1 NPPF requires an assessment to flood risk to consider all forms of flooding and lists six forms of flooding that should be considered as part of a flood risk assessment. These forms of flooding are listed in Table 1, along with an explanation of each form of flooding.

Table1: Forms of Flooding

Flooding From Rivers (Fluvial Flooding)
Watercourses flood when the amount of water in them exceeds the flow capacity of the river channel. Flooding can either develop gradually or rapidly, depending on the characteristics of the catchment. Land use, topography and the development can have a strong influence on flooding from rivers.
Flooding From the Sea (Tidal Flooding)
Flooding to low-lying land from the sea and tidal estuaries is caused by storm surges and high tides. Where tidal defences exist, they can be overtopped or breached during a severe storm, which may be more likely with climate change.
Flooding from Land (Pluvial Flooding)
Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding. In developed areas this flood water can be polluted with domestic sewage where foul sewers surcharge and overflow. Local topography and built form can have a strong influence on the direction and depth of flow. The design of development down to a micro-level can influence or exacerbate this. Overland flow paths should be taken into account in spatial planning for urban developments. Flooding can be exacerbated if development increases the percentage of impervious area.

Flooding from Groundwater
Groundwater flooding occurs when groundwater levels rise above ground levels (i.e. groundwater issues). Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). Chalk is the most extensive source of groundwater flooding.
Flooding from Sewers
In urban areas, rainwater is frequently drained into sewers. Flooding can occur when sewers are overwhelmed by heavy rainfall and become blocked. Sewer flooding continues until the water drains away.
Flooding from Other Artificial Sources (i.e. reservoirs, canals, lakes and ponds)
Non-natural or artificial sources of flooding can include reservoirs, canals and lakes. Reservoir or canal flooding may occur as a result of the facility being overwhelmed and /or as a result of dam or bank failure.

1.4.3 Flood Zones

1.4.3.1 For river and sea flooding, NPPF uses four Flood Zones to characterise flood risk. These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and are detailed in Table 2.

Table 2: Flood Zones

Flood Zone	Definition
1	Low probability (less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%).
2	Medium probability (between 1 in 100 and 1 in 1,000 annual probability of river flooding (1%-0.1%) or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5%-0.1%) in any year).
3a	High probability (1 in 100 or greater annual probability of river flooding (>1%) in any year or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any given year).
3b	This zone comprises land where water has to flow or be stored in times flood. Land which would flood with an annual probability of 1 in 20 (5%) or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

1.4.4 Vulnerability

1.4.4.1 NPPF classifies the vulnerability of developments to flooding into five categories. These categories are detailed in Table 3.

Table 3: Flood Risk Vulnerability Classification

Flood Risk Vulnerability Classification	Examples of Development Types
Essential Infrastructure	- Essential utility infrastructure including electricity generating power stations and grid and primary substations
Highly Vulnerable	- Police stations, ambulance stations, fire stations, command centres and telecommunications installations required to be operational during flooding. - Emergency dispersal points. - Basement dwellings. - Caravans, mobile homes and park homes intended for permanent residential use.
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. - Sites used for holiday or short-let caravans and camping.
Less Vulnerable	- Building used for shops, financial, professional and other services, restaurants and cafes, hot foot takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable" and assembly and leisure. - Land and buildings used for agriculture and forestry.
Water Compatible	- Docks, marinas and wharves. - Water based recreation (excluding sleeping accommodation). - Lifeguard and coastguard stations. - Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.

1.4.4.2 Based on the vulnerability of a development, NPPF states within what Flood Zones(s) the development is appropriate. The flood risk vulnerability and Flood Zone 'compatibility' of developments is summarised in Table 4.

Table 4: Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test	✓	✓
	3a	Exception Test	✓	x	Exception Test	✓
	3b	Exception Test	✓	x	x	x

1.4.5 The Sequential Test, Exception Test and Sequential Approach

1.4.5.1 The Sequential Test is a risk-based test that should be applied at all stages of development and aims to steer new development to areas with the lowest probability of flooding (Zone 1). This is applied by the Local Planning Authority by means of a Strategic Flood Assessment (SFRA).

1.4.5.2 The SFRA and NPPF may require the Exception Test to be applied to certain forms of new development. The test considers the vulnerability of the new development to flood risk and, to be passed, must demonstrate that:

- There are sustainability benefits that outweigh the flood risk and;
- The new development is safe and does not increase flood risk elsewhere.

1.4.5.3 The Sequential Approach is also a risk-based approach to development. In a development site located in several Flood Zones or with other flood risk, the sequential approach directs the most vulnerable types of development towards areas of least risk within the site.

1.4.6 Climate Change

1.4.6.1 This is a planning requirement to account for climate change in the proposed design. The recommended allowances should be based on the most relevant guidance from the Environment Agency and the Lead Local Flood Authority.

1.4.7 Sustainable Drainage

1.4.7.1 The key planning objectives in NPPF are to appraise, manage and where possible, reduce flood risk. Sustainable Drainage Systems (SuDS) provide an effective way of achieving some of these objectives, and NPPF and Part H of the Building Regulations (DTLR 2002) direct developers towards the use of SuDS wherever possible.

1.4.7.2 The surface water drainage has been designed in accordance with current CIRIA C753 SuDS Manual guidelines.

2.0 EXISTING SITE DESCRIPTION

2.1 Location

2.1.1 The site is located on the south western outskirts of Bicester, Oxfordshire,

2.1.2 The site lies to the east of the A41 and to the west of Wendlebury Road.

2.1.3 An aerial photograph is included in Figure 1, which identifies the location of the site. The Ordnance Survey grid reference for the centre of the site development is approximately 457240, 221030.

Figure 1: Aerial Photograph

2.2 Surrounding Features

2.2.1 The site is bounded to the north by Vendee Drive, beyond which lies an area of land which has been granted consent for a new hotel complex.

2.2.2 The site is bounded to the east by Wendlebury Road, beyond which lies a poultry development and an area of agricultural land which will be the subject of a further application for future development.

2.2.3 To the south of the site lies a small wood copse, beyond which lies a small caravan park development fronting the A41, to the east of which is an agricultural field

2.2.4 The site is bounded to the west by the A41 highway, beyond which lies an area of agricultural land and a park and ride.

2.2.5 There are a number of small storage ponds in the locality of the site.

2.2.6 There is a small open watercourse located to the east of the site and one also to the south west of the site (Gagle Brook).

2.2.7 To the north east of the site is the local sewage works.

2.3 Topography

2.3.1 A topographic survey of the site has been undertaken which shows that the existing ground levels over the full area of the development site vary from approximately 63.8m to approximately 66.2m OD(N). Copies of the survey drawings are included in Appendix A.

2.3.2 The drainage ditches that are present on the site boundaries are shallow (less than 1.4m).

2.4 Ground Conditions

2.4.1 Soakaway testing has been undertaken in order to assess whether the soil conditions are suitable for soakaways/infiltration trenches to be used as a means of disposal for the surface water run-off from the development.

2.4.2 The investigation revealed that there is a shallow band of silty sand overlaying glacial clays.

2.4.3 The results of the infiltration testing show that the underlying soils and high ground water level are unsuitable for soakaways to be utilised.

2.4.4 A copy of the test results is included in Appendix B. These were included submitted as part of the extant planning permission submission and no adverse comments were provided on their suitability.

2.4.5 A desktop study of the British Geological Survey map reveals that the local geology to comprise bedrock of Kellaways Sand Member- Sandstone and Siltstone, Interbedded, with no superficial deposits.

2.4.6 A study of the groundwater maps shows that the site overlays a Secondary A Aquifer but does not lie within a Groundwater Vulnerability Zone.

2.4.7 A study of local borehole records in proximity to the development site reveals that glacial clays and alluvium extend to a depth in excess of 6m below ground level.

2.4.8 The ground conditions will consequently be unsuitable for soakaways/infiltration methods to be utilised for the disposal of surface water run-off from the development.

2.5 Archaeology

2.5.1 Detailed Heritage Assessment, Geophysical Survey and archaeological evaluation has determined an area around the south-east end of the site which is likely to contain remnants relating to Alchester Roman Town.

2.5.2 The work has identified this area should be preserved in situ, and as such an archaeological constraints plan has been produced with determines a ‘no-dig’ area where no excavations beyond initial topsoil strip should take place.

2.5.3 The archaeology constraints plan is available as part of the separately submitted planning documents.

2.5.4 Very few archaeological features were identified elsewhere within the site, so far.

2.5.5 Proposals for how drainage will be dealt with within the ‘no-dig’ area are detailed within the drainage section of this report.

3.0 CONSULTATION

3.1 Consultation has taken place with the design team in order to obtain relevant information pertaining to the development.

3.2 Consultation has taken place with the Environment Agency in order to obtain relevant information in respect of flood mapping data, details of which are incorporated within this report.

3.3 Consultation has taken place with Oxfordshire County Council in their role as Lead Local Flood Authority in respect of surface water drainage run-off from the development (SuDS Guidance). Their requirements have been taken into account in the design of the surface water drainage network.

3.4 As referred to in Section 1, the site is also covered under an extant planning application, reference 16/02586, for which Hamill Davies Limited provided a supporting 'Flood Risk Assessment' report and a 'Services, Foul and Surface Water Drainage Strategy' report. These have been consulted and form the basis of the flood risk and drainage principles for this scheme, and in summary:

- Surface water run-off will be attenuated via permeable paving and discharged to the existing surface wate drainage ditch in a controlled manner
- A climate change allowance of 30% was applicable
- Groundwater was struck up to 0.8m below ground level

3.5 As also referred to in Section 1, in addition to the extant planning permission reference 16/02586, subsequent submittals have been made to discharge planning Conditions relevant to Phase 1A (the hotel) and the condition discharge application reference 18/00389/DISC (Discharge of condition 11 (CMP) 15 (Surface water drainage scheme) 16 (Water supply impact studies) 17 (foul drainage strategy) 28 (Footway/cycle details) 29 (Bus stop layby) 31 (Details of pedestrian crossing) of 16/02586/OUT). Within this submittal is the WSP Drainage Technical Note and supporting drainage drawings and calculations. In summary of the submission:

- Infiltration was not viable

- Surface water discharge should be to the local drainage ditch
- Surface water should be discharged at an agreed rate and excess flows balanced in SuDS

3.6 The principles of the extant permission and the conclusion of the Hamill Davies Limited and WSP reports and submittals therefore form the basis of the site's flood risk and drainage related proposals, updated to suit the revised proposals.

3.7 In all submittals no obvious objections were received from the Consultees in relation to flood risk and drainage and there were no requirements to model existing ditches and watercourses.

4.0 PROPOSED DEVELOPMENT

4.1 The proposals include the construction of a commercial development to include the following:-

- Commercial office blocks
- Residential blocks
- Car parking and site roadways
- Multi-Use Sports Area
- Footpaths and Paved Areas
- Street Furniture
- Landscaping
- Culverts for ditch crossings
- Sustainable Drainage Systems, in the form of:
    - Permeable paving
    - Filter trenches
    - Permeable surfacing
    - Interception
    - Flow control
    - Attenuation

4.2 The overall area of the proposed development has been calculation at approximately 3.15 hectares.

4.3 An indicative layout drawing of the proposed development is included in Appendix C.

4.4 In terms of flood risk, the development is classed as 'More Vulnerable' development in terms of flood risk vulnerability (Table 3).

4.5 In terms of flood zone compatibility, the construction of 'More Vulnerable' development is considered appropriate in Flood Zone 1 (Table 4).

5.0 DRAINAGE ASSESSMENT

5.1 General

5.1.1 The surface water drainage has been designed in accordance with current CIRIA C753 SuDS Manual guidelines.

5.2 Surface Water Drainage

5.2.1 Existing Site

5.2.1.1 From the aerial photograph included in Figure 3, it can be seen that the development site currently comprises an agricultural field.

Figure 3: Aerial Photograph

5.2.1.2 The overall area of the site has been calculated at approximately 3.15 hectares, which currently drains at the existing greenfield IH124 run-off rate (Q_{BAR}) in this region of 1.3 litres per second. A copy of the IH124 calculations are included in Appendix D.

5.2.2 Run-off Destination

5.2.2.1 Requirement H3 of the Building Regulations establishes a preferred hierarchy for disposal of surface water. Consideration should firstly be given to soakaway, infiltration, watercourse and sewer in that priority order.

5.2.2.2 The use of soakaways as the means for surface water disposal has been ruled out due to the presence of glacial clays, the presence of shallow groundwater and poor soakaway results. Furthermore, the discounting of infiltration was accepted under the extant permission, as covered in the Hamill Davies Limited reports and the WSP submittals.

5.2.2.3 The second preferred option would be to discharge the surface water run-off from the development to a watercourse.

5.2.2.4 Investigations have revealed that there are open drainage ditches present within the area of the development into which surface water run-off could be discharged. This is also in line with the discharge destination as agree in the Hamill Davies Limited reports and the WSP reports that were submitted as part of the extant permission.

5.2.2.5 For the new development, it is proposed that Sustainable Drainage Systems (SuDS) will be constructed to collect the surface water run-off from the site and outfall to the existing open drainage ditch located beyond the western site boundary.

5.2.3 Flood Risk

5.2.3.1 For new developments, the current design criteria required for the surface water drainage will need to be based upon the critical 1 in 100 year storm event, with an additional allowance to account for climate change resulting from global warming.

5.2.3.2 There should be no above ground flooding for the 1 in 30 year return period and no property flooding or off site flooding from the critical 1 in 100 year storm event, with the additional allowance to account for climate change.

5.2.4 Climate Change

5.2.4.1 An additional allowance of 40% has been included in the design to account for climate change resulting from global warming in accordance with Oxfordshire County Council SuDs guidelines.

5.2.5 Urban Creep

5.2.5.1 In accordance with Oxfordshire County Council SuDS guidelines an additional 10% has been added to the calculated impermeable area of the buildings for urban creep.

5.2.6 Archaeological 'No-dig' Area

5.2.6.1 As outlined in Section 2, buried artefacts have been identified under the south-east corner of the site, which have been agreed to be 'preserved in situ'.

5.2.6.2 As no excavation will be permitted within this area, the usual sewers and manholes cannot be used to drain this area, as that would involve excavation.

5.2.6.3 To enable construction of roads, the ground will be built up to enable approx. 0.5m depth of road/car park construction.

5.2.6.4 Shallow drainage methods can be utilized to facilitate drainage of this area, which shall be permeable paving and shallow filter drains. These shall convey storm water at shallow level to outside the no-dig area, whereby these shall outfall into the conventional underground SuDS drainage serving the remainder of the site.

5.2.7 Peak Flow Control

5.2.7.1 The proposed impermeable area for the development has been calculated to be approximately 2 hectares, which would consequently need to be increased to 2.2 hectares for design purposes to allow for urban creep.

5.2.7.2 The uncontrolled surface water run-off from the new development could be approximately 280 litres per second, based on the BSEN752 calculations for a 50mm rainfall event. However, to meet the flood risk planning requirements, it is unacceptable to discharge flows freely from the proposed development site

at an unrestricted rate. Therefore, flows from the proposed development are normally limited to the greenfield runoff rate.

5.2.7.3 For flood risk mitigation and design purposes the flows shall therefore be restricted to an equivalent discharge to the IH124 run-off rate. As in Appendix D, the existing greenfield IH124 runoff rate for the full site is around 1l/s for the 1 in 1-year event, and around 4l/s for the 1 in 100-year event. To restrict flows to the 1 in 1-year rate of 1l/s is too low to reasonably control to, as the flow control would be so small as to be at high risk of blockage, which would likely lead to flooding on the proposed site. Therefore, the design flow will be restricted to the lowest practicable rate of 3.5l/s. At this rate it is less than the 1 in 100-year run-off rate, and the impact on the receiving watercourse is minimised as far as reasonably practicable.

5.2.7.4 In order to ensure the discharge of surface water from the development will not increase the risk of flooding to other properties, it will be necessary to attenuate the drainage by restricting the discharge to the agreed rate and providing storage as required.

5.2.7.5 The drainage ditches that run around the site are all shallow, at less than 1.4m. In accordance with Building Regulations advice the cover to sewers should be 1.2m below trafficked areas, therefore the invert of the smallest pipes (150mm) will be 1.35m deep. The surface water sewers will need to be laid to falls, and these will need to increase in size as the contributing flows increase, therefore the design requirements mean that a discharge via gravity is not possible and a pumping station is unavoidable.

5.2.7.6 The use of shallow SuDS, as set out in later sections, to manage water quality and water quantities, will reduce the depth of the drainage system, giving the best chance of discharging via gravity, but the storage volumes required to balance excess flows and the SUDS chosen and the limited discharge rate meaning that only one outfall is viable, means that at this stage a pumping station needs to be allowed for. If it is not considered, its failure itself could be a flood risk and therefore requires consideration as part of this report

5.2.7.7 The required design criteria will be based on the critical 100-year storm event plus 40% climate change in compliance with Oxfordshire County Council SuDS guidelines.

5.2.7.8 Based upon the above design criteria, a hydraulic model study has been undertaken in order to assess the likely pipe sizes and gradients and the storage volume required.

5.2.7.9 A summary of the storage volumes required is set out in Table 5.

Table 5: Indicative Volume of Surface Water Storage Required

Storm Event	30 Year Storm	100 Year Storm + 40%
Storage Volume Required	750m^3	1410m^3
Additional Storage Volume Required	Nil	660m^3

5.2.7.10 A copy of the hydraulic model study is included in Appendix E.

5.2.7.11 The calculated storage volumes set out above will be subject to detailed design and approval.

5.2.7.12 To comply with current design criteria. The drainage system must contain the storage volume required to accommodate the 30-year storm event below ground within the drainage system.

5.2.7.13 The additional volume over and above the 30-year storm event to accommodate a 100-year storm event plus climate change can be stored above ground provided it remains within the confines of the site without posing a risk to persons or property.

5.2.7.14 Alternatively, this additional volume can be stored below ground in an appropriate storage tank.

5.2.7.15 For this development it is proposed that the storage will be accommodated within the permeable paving construction prior to the outfall to the drainage ditch.

5.2.7.16 Pipe sizes and gradients will be subject to detailed design but are likely to range from 150mm diameter at the upstream drainage pipework up to 600mm diameter at the downstream lower end of the development.

5.2.7.17 A preliminary layout drawing of the proposed drainage network is included in Appendix F.

5.2.8 Volume Control

5.2.8.1 The run-off volume post development will be more than pre-development because of the creation of impermeable areas and the formal drainage systems which must be installed..

5.2.8.2 To off set the increased runoff volume so as to reduce the impact on the receiving watercourse it is accepted practice to create 'long term' storage on site by reducing flows to less than 2l/s.ha. As demonstrated above however, the peak discharge rate being limited to 3.5l/s, based on a 3.15ha site, equates to a run-of rate of around 1.1l/s.ha, which is lower than the 'long term' storage discharge rate, and therefore no additional storage is required. By reducing the flows to such a small rate the site should protect the downstream ditches from flood risk in the future, compared to the current scenario where flows are not restricted and no storage is present,

5.2.8.3 The impact on the receiving watercourse is minimised as far as reasonably practicable.

5.2.8 Pollution Control

5.2.8.1 The risk of pollution is considered low as the proposed site is to be used for commercial purposes only. Clean roof water drainage will be discharged into the below ground sewers via a closed system. Drainage from the areas of roads and car parks will be collected via trapped gullies and will also be discharged to a sealed below ground surface water sewer system.

5.2.8.2 The storage of surface water within the permeable paving construction will filter out any likely pollutants, eliminating the need for a petrol interceptor for any porous car parking. However, any non-permeable surfaced car parking should discharge via an appropriate interceptor, such as drainage from the proposed multi-storey car park.

5.8.3 The proposed interceptors should be 'Bypass' interceptors due to the source of pollution being 'low risk' car parking, and with 'Class 1' treatment level due to the outfall being into a watercourse.

5.2.9 Designing for Exceedance

5.2.9.1 Overland flood risk from exceedance flows and from off-site sources will be mitigated to a large extent by the creation of the new surface water sewerage system as described above. Where possible road levels and proposed ground levels will be set to channel flows away from the proposed buildings. Furthermore, the ground floor construction level for the buildings should ideally be raised above the finished ground level in order to provide additional clearance above any likely overland flooding.

5.2.9.2 The existing overland flow routes should generally be maintained within the final layout of the development site without increasing the flood risk to off-site parties.

5.2.9.3 Any existing flood risk may reduce by the creation of a formal surface water drainage system but cannot be entirely removed.

5.2.9.4 Indicative drawings showing the existing and post-development overland surface water flood routes are included in Appendix G.

5.2.10 Highways Drainage

5.2.10.1 There is no formal highways drainage involved with the development other than the creation of the site entrance junctions off Wendlebury Road.

5.2.11 Operation and Maintenance

5.2.11.1 The drainage pipework is designed with self-cleansing gradients and consequently the network should require little or no maintenance.

5.2.11.2 All road gullies or drainage channel systems serving areas of hardstanding will need to be regularly inspected to ensure the system remains operable See Table 6.

Table 6: Operation and Maintenance Requirements for Silt Traps/Trapped Gullies (Based on CIRIA C753 Table 14.2)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	6 monthly
	Inspect filter media and establish appropriate replacement frequencies	6 monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months
*During the first year of operation, inspections should 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.		

5.2.11.3 The inspection chambers should be regularly inspected to ensure the system is free-flowing. See Table 6 above.

5.2.11.4 Operation and maintenance requirements for the permeable paving are set out in Table 7.

Table 7: Operation and Maintenance Requirements for pervious pavements (Based on CIRIA C753 Table 20.15)

Maintenance schedule	Required action	Typical frequency*
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually
*During the first year of operation, inspections should 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.		

5.2.11.5 On the basis that a pumped discharge to the sewer will be required then a proprietary package pump station will be required which should be regularly maintained as set out in Table 8.

Table 8: Operation and Maintenance Requirements for Package Pumping Station (based on CIRIA R182, Section 3) – to be used in conjunction with manufacturer's recommendations

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Basic adjustment to equipment	As recommended by manufacturer
	Lubricate systems	As recommended by manufacturer
	Changeover duty pump	As recommended by manufacturer
	Recording systems (where present) – recover data	As recommended by manufacturer/as required by database
	Standby generators (where present) – run off load	Weekly
	Standby generators (where present) – run on load	Monthly
Remedial actions	Clear blockages in pipework	As required
	Clean walls, floor, electrodes and floats	As required
	Replace malfunctioning or worn components	As required
Monitoring	Check operation of non-return valves	Six monthly
	Inspect pump and control equipment for evidence of poor operation or failure	Monthly during the first six months of operation, then every three months
	Inspect the sump for silt/grease accumulation rate and establish appropriate removal frequencies	Monthly during the first six months of operation, then six monthly
	Inspect for structural failure of pump chamber(s) and general condition of any ancillary equipment	Six monthly
	Check the pump and pipework seals for leaks	Monthly during the first six months of operation, then six monthly
Note:- Pump to be isolated from electrical supply prior to maintenance works being undertaken		

5.2.11.6 Operation and maintenance requirements for the filter drains are set out in Table 9.

Table 9: Operation and Maintenance Requirements for Filter Drains (Based on CIRIA C753 Table 16.1)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
Remedial actions	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (e.g. NJUG, 2007 or BS 3998:2010)	As required
	Clear perforated pipework of blockages	As required
Monitoring	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Six monthly*
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate removal frequencies	Six monthly*

*During the first year of operation, inspections should 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.

5.2.11.7 Operation and maintenance requirements for the underground surface water attenuation storage tank are set out in Table 10.

Table 10: Operation and Maintenance Requirements for Attenuation Storage Tanks (Based on CIRIA C753 Table 21.3)

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually*
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required*

*During the first year of operation, inspections should 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.

5.2.11.8 Operation and maintenance requirements for the oil separators/interceptors are set out in Table 11.

Table 11: Operation and Maintenance Requirements for Oil Separators/Interceptors (Based on CIRIA C753 Section 14.12.2 and Environment Agency Document PPG3. To be read in conjunction with BS EN 858-2:2003).

Note: it is also usually required that separators are filled with clean water before being put into operation and each time after emptying for maintenance. Failure to do so will cause the separator to malfunction until surface water builds up the required permanent water level in the facility. It is possible to fit an alarm to separators that will indicate when the collected oil volume is at a maximum, and this may be a regulatory requirement. The alarms should be placed in a location that is clearly visible to those responsible for maintenance of the system.

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Assess the depth of accumulated silt and oil/sludge; empty the separator if required*	Six monthly
	Check thickness of light liquid	Six monthly
	Check function of automatic closure device	Six monthly
	Check the coalescing material, and clean or change if necessary	Six monthly
	Check the function of the warning device (if fitted)	Six monthly
Remedial actions	When major fuel spill occurs, empty the separator*	As required
Monitoring	Check watertightness of system	Monthly during first half year of operation, then five yearly
	Check structural condition	Monthly during first half year of operation, then five yearly
	Check internal coatings	Monthly during first half year of operation, then five yearly
	Check in-built parts	Monthly during first half year of operation, then five yearly
	Check electrical devices and installations	Monthly during first half year of operation, then five yearly
	Check if adjustment of automatic closure devices is required	Monthly during first half year of operation, then five yearly

*If oil or silt levels exceed 90% of the storage volume, the separator should be emptied straight away. If an alarm if fitted, this is usually set to trigger just prior to this level. When the oil or silt reaches this level, or after a spillage, employ a registered waste removal company with experience in emptying separators to empty the separator. Ensure the company does not allow any of the contents to escape from the outlet during emptying.

5.2.11.9 Operation and maintenance requirements of the drainage components, as listed above, should be undertaken in accordance with Chapter 32 of the CIRIA SuDS Manual and any relevant manufacturer's recommendations. See also BS 8582:2013 Code of Practice for Surface Water Management for Development Sites Section 11 and Susdrain Fact Sheet on SuDS Maintenance and Adoption Options (England) dated September 2015.

5.2.11.10 The personnel undertaking the maintenance should have appropriate experience of SuDS and drainage maintenance and should be capable of keeping sufficiently detailed records of any inspections. An example of a checklist for SuDS maintenance can be found within Appendix B of the CIRIA C753 SuDS Manual v2. If personnel do not have appropriate experience, then specific inspection visits may be necessary. During the first year of operations of SuDS, inspections should usually be carried out at monthly intervals (and after significant storm events).

5.2.11.11 The responsibility for the operation and maintenance of the private drainage and SuDS will lie with Bicester Gateway Ltd or any subsequent owner of the development.

5.2.12 Pumping Station Failure

5.2.12.1 As noted in Section 5.2.7, at this stage the use of a pump is unavoidable, and the risk of its failure should be considered. To mitigate the flood risk due to pump failure, any pumping station could be provided on a duty/standby basis, which will reduce the risk of one pump failure, and the pumping station could be supplied with telemetry and remote alarming. It could also be provided with an emergency power supply or provision for emergency power supply. The pumping station section is provided in Appendix F. The upstream SuDS would also be capable of storing water before flooding occurs, thus affording a degree of protection from pump failure also

5.2.12.2 However, should the pumping station still fail, the residual flood risk would be associated with overland flows, which would tend towards the low parts of the site, and towards the existing drainage ditch. The raised finished floor levels as set out within this report will provide a degree of protection from overland flows, as will shedding of finished ground levels away from the building thresholds. The drawing in Appendix G shows the overland flood routing for the pumping station failure.

5.3 Foul Water Drainage

5.3.1 It is proposed that foul water domestic waste from the development will be discharged to the existing private pumping station on the adjacent development site to the north, which was designed to accommodate waste run-off from the development site.

5.3.2 Based upon the British Water Code of Practice Flows and Loads – 4 and a maximum occupancy of 300 personnel, the average foul water flows from the new development would be less than 1 litre per second. The previous development site to the north allowed for a peak flow of up to 10 l/s from this proposed development.

5.3.5 It is considered that such a small average discharge rate from the site would not have any effect on the public sewer.

5.3.6 A separate foul sewer network will be designed and built to meet the requirements of the Building Regulations.

5.3.7 At this stage of the development it is assumed that a gravity connection to the existing pumping station on the site to the north cannot be achieved.

5.3.8 On this basis an additional foul water pumping package station within the new development would need to be provided to discharge foul wastewater from the pumping station.

5.3.9 It is envisaged that the foul sewer pipe sizes will range from 100mm to 150mm in diameter and the pipe gradients will range from 1/40 to 1/150 to meet the required standards.

5.3.10 A preliminary layout drawing of the foul water drainage serving the development is included in Appendix F.

6.0 FLOOD RISK ASSESSMENT

6.1 Flood Zone

6.1.1 A copy of the Environment Agency Flood Map for Planning is included in Figure 3 which identifies the development site to be located within an area designated as Flood Zone 1, (low probability of flooding), with a less than 1 in 1000 annual probability of flooding in any year.

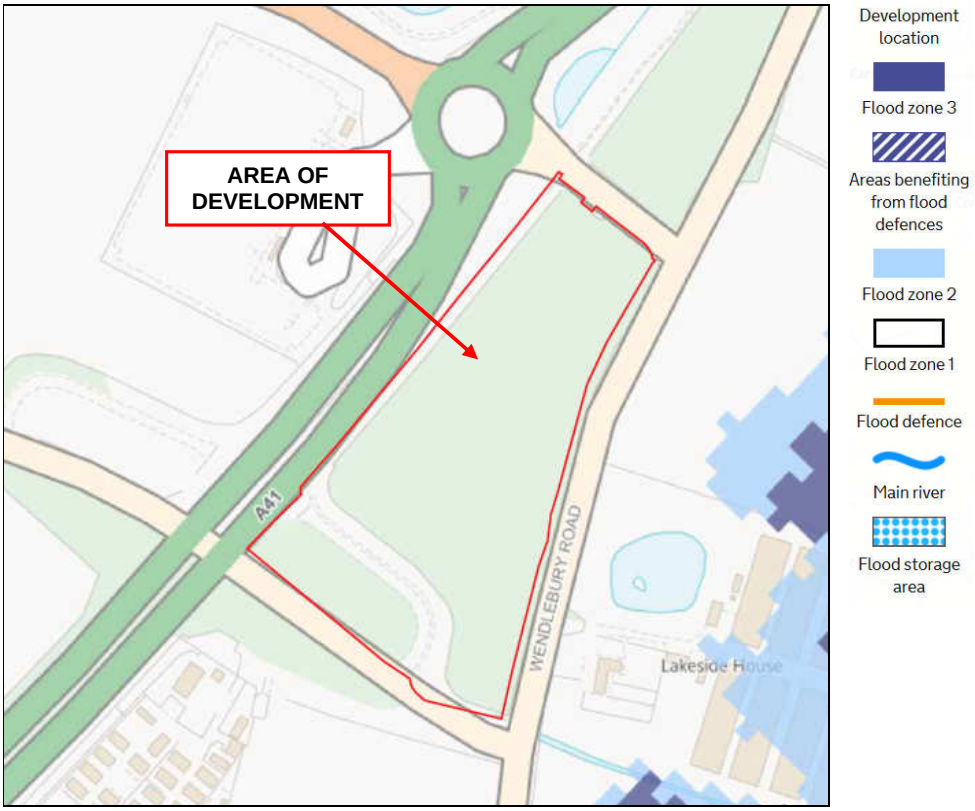


Figure 3: Environment Agency Flood Map for Planning dated December 2019

6.2 Fluvial Flooding

6.2.1 The River Ray is situated to the south east of the site, approximately 4km from the development at its' nearest location.

6.2.2 The River Cherwell is situated approximately 8km to the west of the development.

6.2.3 There is a small open watercourse situated to the east of the development site which drains the adjacent land southwards towards the River Ray.

6.2.4 There is a small open watercourse (Gagle Brook) situated to the west/south west of the development which drains the adjacent land southwards towards the River Ray.

6.2.5 The site is considered to be a sufficient distance from these potential flood sources not to be at risk of flooding should the watercourses overtop during a major flood event.

6.2.6 The risk to the development from this potential flood source is considered to be low and acceptable.

6.3 Surface Water Flooding

6.3.1 A copy of the Environment Agency map showing the extent of flooding from surface water is included in Figure 4.

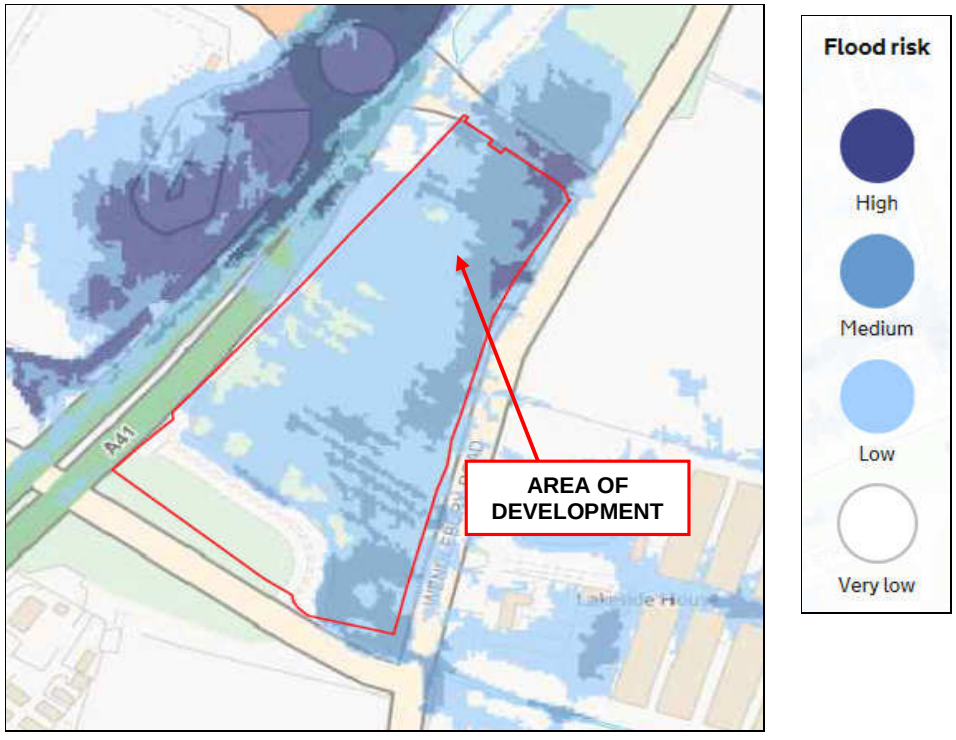


Figure 4: Environment Agency Map dated December 2019 Showing the Extent of Flooding from Surface Water

6.3.2 The map shows that the majority of the site is considered to be at risk from overland surface water flooding.

6.3.3 The maps produced by the Environment Agency showing the likely depth of surface water flooding are included in Figures 5, 6 and 7.

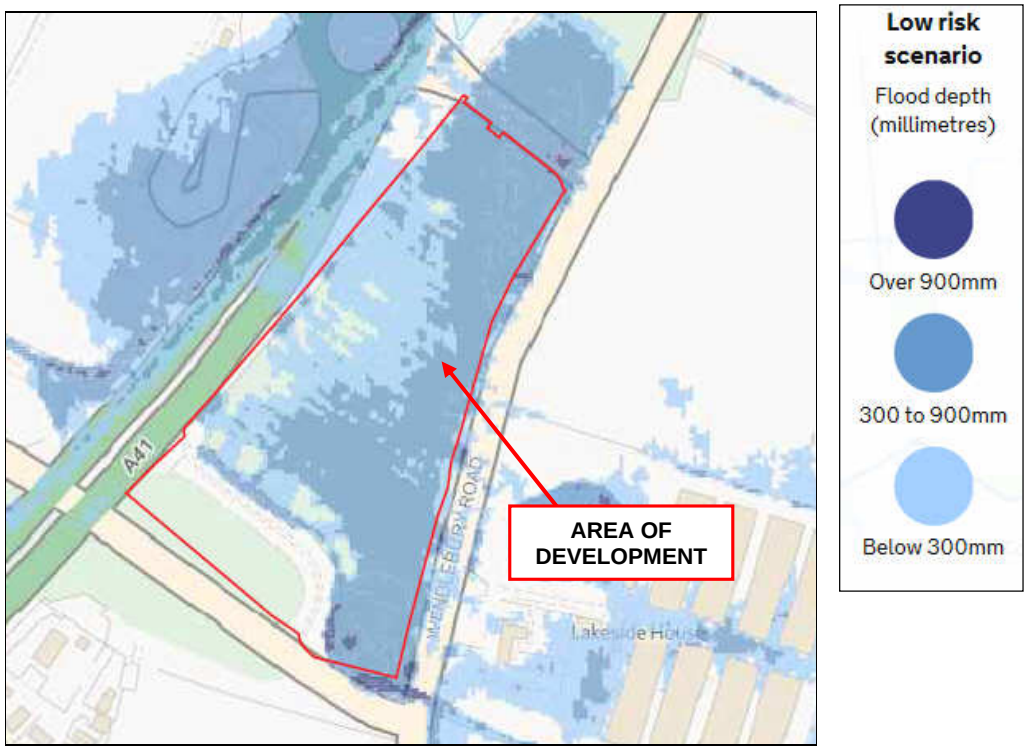


Figure 5: Environment Agency Map dated December 2019 Showing Anticipated Depths – Low Risk

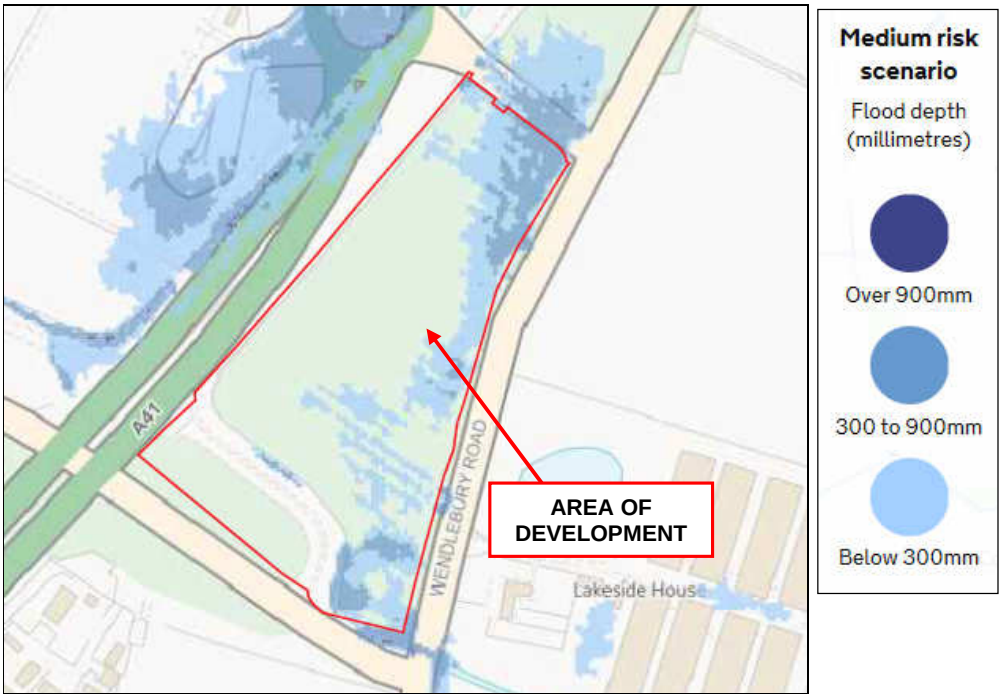


Figure 6: Environment Agency Map dated December 2019 Showing Anticipated Depths – Medium Risk

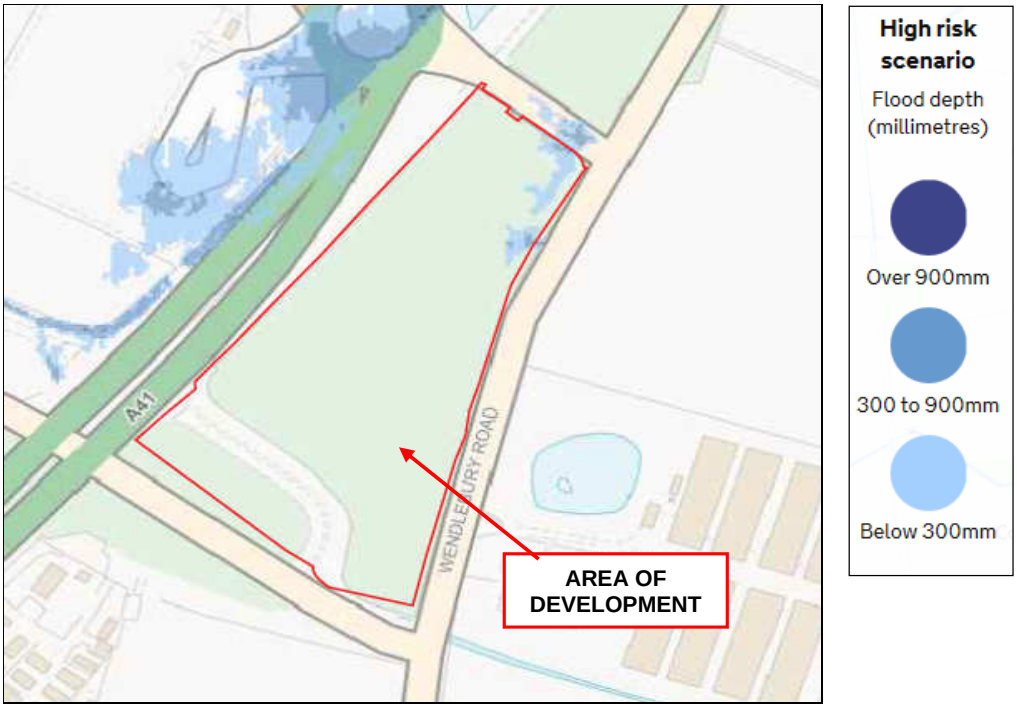


Figure 7: Environment Agency Map dated December 2019 Showing Anticipated Depths – High Risk

6.3.4 The maps show that for a “low risk” scenario the central western area of the site is considered to be at risk of flooding to a depth below 300mm, with the majority of the site shown to be prone to flooding to a depth of 300 to 900mm.

6.3.5 For a “medium risk” scenario the area of the site shown to be prone to surface water flooding is greatly reduced with the eastern site area flooding to a depth of 300 to 900mm.

6.3.6 For a “high risk” scenario there is only one small pocket of land in the north eastern corner of the site which is shown to be prone to flooding to a depth below 300mm.

6.3.7 However, to put the maps into context, these are based on a simplified assessment, using the existing topography and assume no drainage, either formal or informal, nor the collection, conveyance or capacity of any sewerage or ditches or watercourses. The maps are simply there to inform flood risk based on the depth that water could pond to assuming no drainage. Therefore the presence of existing ditches provides a collection and conveyance mechanism, and capacity for some rainfall related drainage which will reduce the risk and depth of flooding to that more likely shown on Figure 7.

6.3.8 Furthermore, the control of surface water flows as set out in Section 5, and the provision of SuDS and attenuation storage sized to accommodate the 1 in 100 year, plus climate change, event, provides a betterment to the current situation, as there is no flow control or storage on site now. The new system is not taken into account in the surface water flood maps.

6.3.9 However, it is still recommended that the surface water flood risk is addressed. It is obvious that the locations of the predicted flooding coincide with the lower parts of the site and in particular, the presence of the shallow drainage ditch on the site boundary, the invert of which is around 64mAOD from the topographic survey.

6.3.10 Taking the flood depth from the mapping at its highest, at 900mm, results in a ‘flood’ level of 64.9mAOD. As noted previously, this level is unlikely to occur, especially when the site is in Flood Zone 1 and it is therefore very much a conservative estimate.

6.3.11 In arriving at a 'flood' level as above, it is un-necessary to require the existing drainage ditches to be modelled and the wider drainage network to be modelled. This would be disproportionate to the scale of the development, the scale of the discharge and the scale of the flood risk.

6.3.12 However, flood mitigation measures should be considered within the design of the development to minimise the potential risk from overland surface water flooding. This is set out in Section 7.

6.3.12 When the mitigation is considered, the risk of flooding from this potential flood source is considered to be low and acceptable.

6.4 Flooding from Open Drainage Ditches

6.4.1 There are a number of open drainage ditches in the vicinity of the development site which drain the adjoining agricultural fields.

6.4.2 Due to the limited capacity of these ditches any localised flooding arising from the ditches overtopping is unlikely to extend to the development site.

6.4.3 However, flood mitigation measures that will be included within the design of the development, as set out in Section 5 and Section 7, will minimise the risk from this source, therefore the risk of flooding from this potential flood source is considered to be low and acceptable.

6.5 Groundwater Flooding

6.5.1 Groundwater flooding can occur when the sub-surface water levels are high and emerges above ground level.

6.5.2 Groundwater is recorded as shallow, but not artesian. It is likely that groundwater makes its way into the surrounding drainage ditches, and therefore whilst groundwater may be shallow, its level is maintained by the drainage ditches.

6.5.3 The scheme involves below ground works that will need to be adequately protected against groundwater ingress.

6.5.4 The management of groundwater is a usual civil engineering risk and groundwater is not expected to rise above the finished ground levels.

Furthermore, the existing drainage ditches around the site will be retained, so these will continue to provide an outlet from groundwater as currently occurs.

6.5.5 Consequently the risk to the development from this potential flood source as is considered to be low and acceptable.

6.6 Flood Risk from Water Mains

6.6.1 There are likely to be existing water mains present in the adjacent highways and serving the nearby developments.

6.6.2 There are no known issues with regard to any such water mains.

6.6.3 The risk to the development from this potential flood source is therefore considered to be low and acceptable.

6.7 Flood Risk from Existing Sewers

6.7.1 There are likely to be existing sewers present in the adjacent highways and serving the nearby developments, of which details are provided in the WSP submittals associated with the extant planning permission and Condition discharge. The drainage of the neighbouring site provides similar SuDS and flood risk mitigation as proposed here, and the allowance for climate change again enhances the drainage provision compared to an un-developed, uncontrolled scenario.

6.7.2 There are no known issues with regard to the condition or capacity of any such sewers. The risk to the development from this potential flood source is therefore considered to be low and acceptable.

6.8 Flooding from Reservoirs, Canals and Other Artificial Sources

6.8.1 A study of the local region reveals that Oxford Canal lies approximately 8km to the west of the development site.

6.8.2 At this distance from the potential flood source it is considered that the site would not be at risk should the canal overtop during an extreme rainfall event.

6.8.3 A copy of the map produced by the Environment Agency showing the likely extent of flooding from reservoirs is included in Figure 8.

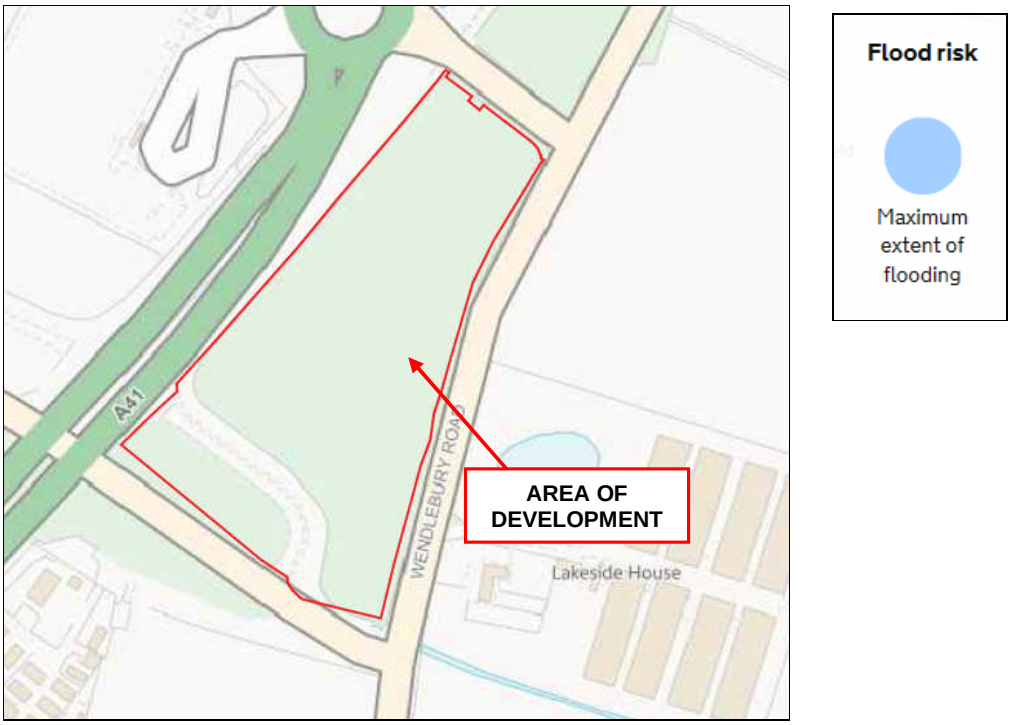


Figure 8: Environment Agency Map dated December 2019 Showing the Extent of Flooding from Reservoirs

6.8.4 The map shows that the development site would not be affected by reservoir flooding. The risk to the development from any such potential flood source is considered to be low and acceptable.

6.9 Flooding from Culverting of the Existing Ditch

6.9.1 The entrance into the site needs to cross an existing ditch. The ditch is shallow and narrow and has limited capacity and in the main, takes agricultural greenfield run-off. It is already culverted, as shown on the topographic survey.

6.9.2 The ditch will therefore need to be culverted to provide suitable access and if possible, the existing culvert will be re-used. However, if a new culvert is required, because the new entrance must tie into the existing highway, the opportunity to use large diameter culverts is limited, because sufficient cover is required to the culvert to allow for the construction of the entrance above it, and so as not to unduly overload the culvert structurally.

6.9.3 The existing culvert and the surrounding culverts will dictate the new culvert size, and the cross-sectional area of the new culvert will be no smaller than the existing culverts and will be as short as required to form the entrance and to suit the earthworks.

6.9.4 Furthermore, the culvert could be installed with a protective grille to reduce the risk of blockage and its inspection, operation and maintenance requirements will be added to the site wide management regime. The risk to the development from culverting of the ditch is considered to be low and acceptable.

6.10 Flooding from the Proposed Sewers

6.10.1 Free discharge of surface water run-off from the new development would result in an unacceptable risk of flooding.

6.10.2 However, the measures as recommend in Section 5 will reduce the risk to a low and acceptable level. These include discharging at the lowest practicable rate of 3.5l/s, or around 1.1l/s.ha and balancing excess flows on site in SuDS up to an including the 1 in 100 year, plus 40% increase to rainfall intensity to the impact of climate change.

6.10.3 As noted in Section 5.2.7, at this stage the use of a pump is unavoidable, and the risk of its failure should be considered. Mitigation is set out in Section 5 and repeated in Section 7.

6.10.4 Should the pumping station still fail, the residual flood risk would be associated with overland flows, which would tend towards the low parts of the site, and towards the existing drainage ditch. The raised finished floor levels as set out within this report will provide a degree of protection from overland flows, as will shedding of finished ground levels away from the building thresholds. The drawing in Appendix G shows the overland flood routing for the pumping station failure.

6.11 Flood Risk to Existing Ditches

6.11.1 The discharge of surface water will be to the local drainage ditch as infiltration is not viable, as set out on Section 5. The ditches already take ‘greenfield’ run-off from the site, at a unrestricted rate, in that the 1in 100 year rainfall event

will run-off the field into the ditches at the 1in 100 year rate. For this site the 1 in 100year greenfield runoff rate from the 3.3ha site is calculated at 4.1l/s.

6.11.2 In discharging surface water to existing ditches at the lowest practicable rate of 3.5l/s, this is less than the existing 1 in 100 year rate, and therefore, in theory the flood risk from the development is reduced.

6.11.3 In achieving the above it would be un-necessary to require the existing drainage ditches to be modelled and the wider drainage network to be modelled. It would also be disproportionate to the scale of the development, the scale of the discharge and the scale of the flood risk.

7.0 FLOOD MITIGATION MEASURES

7.1 The area of the proposed development is shown to lie within Flood Zone 1 (low probability of flooding) and would normally permit traditional levels of construction.

7.2 However, as the site is shown to be at risk of flooding to a variable depth from overland surface water flooding it is considered that the ground floor construction level should be elevated to reduce the likelihood of flood waters entering the buildings.

7.3 The buildings are shown to be located in the part of the site which is generally shown to be prone to a shallower depth of flooding. The greatest potential flood depth is shown to be in the eastern area of the site which has generally been allocated for car parking serving the development.

7.4 As the proposed buildings are intentionally located outside of the main 'zone' of flooding and based on the development being located within Flood Zone 1, it would be usual for the building finished floor levels to be set a minimum of 150mm above existing surrounding ground levels.

7.5 The Drainage drawing in Appendix F shows finished floor levels above 65.30mAOD. The 'flood' level, as defined in Section 6.3, of 64.90mAOD means that the FFLs are 400mm above this, and as set out in Section 6.3, this 'flood' level is very much a conservative estimate, so setting FFLs significantly above this level at this stage results in the flood risk being low and acceptable, as concluded in Section 6.3.

7.6 External levels around the buildings should also be designed to ensure any overland flows, exceedance flows or flows from pumping station failure are diverted away from the buildings.

7.7 The surface water drainage should be designed in accordance with Section 5 of this report in order to ensure the development does not pose a risk of flooding to the new development or to other parties. In theory, reducing the flows to the lowest practicable rate of 3.5l/s is less than 1 in 100 year the greenfield equivalent runoff rate, therefore flood risk is reduced.

7.8 To mitigate the flood risk due to pump failure, any pumping station could be provided on a duty/standby basis, which will reduce the risk of one pump failure, and the pumping station could be supplied with telemetry and remote alarming. It could also be provided with an emergency power supply or provision for emergency power supply. The upstream SuDS would also be capable of storing water before flooding occurs, thus affording a degree of protection from pump failure also

7.9 All approach roads to the development are shown to lie within Flood Zone 1 (low probability of flooding) and consequently safe access to and egress from the development should still be achievable should a flood situation arise.

7.10 There should therefore be no requirements for evacuation of building occupants resulting from the development during an extreme flood event.

7.11 It is not considered that any other specific mitigation works will be required in respect of flood risk to the development.

8.0 SUMMARY

8.1 This report has been prepared to assess the flood risk and drainage implications for a proposed commercial development which is located on land to the west of Wendlebury Road, Bicester, Oxfordshire.

8.2 This report forms part of the overall submission in relation to planning application to Cherwell District Council, reference 20/00293. However, the site's development is also covered under an extant planning application, reference 16/02586, which had a supporting Flood Risk Assessment report and a Services, Foul and Surface Water Drainage Strategy report. Subsequent submittals have been made to discharge planning Conditions relevant to the extant permission, reference 18/00389/DISC, which had a WSP Drainage Technical Note and supporting drainage drawings and calculations.

8.3 Throughout the extant permitted development, which covered this site, and the Condition discharge application, no adverse comments were provided by the Consultees and the flood risk and drainage principles as set out int his report follow the previously agreed principles.

8.4 The site falls in Flood Zone 1 (low probability of flooding) on the Environment Agency Planning map and the proposals are considered to be 'More Vulnerable' in terms of flood risk vulnerability which is considered to be appropriate in Flood Zone 1.

8.5 This report has considered other potential sources of flooding to the site, including fluvial, groundwater, surface water, existing sewers, water mains and other artificial sources.

8.6 The majority of the site is shown to be risk from surface water flooding with the locations of the new buildings shown to be prone to lower depths of flooding. Nevertheless, the finished floor levels of the proposed buildings will be set above the highest predicted surface water 'flood' level in order to protect the buildings and their inhabitants.

8.7 Surface water discharge will be limited to the lowest practicable rate and excess flows will be stored in sustainable drainage systems up to the 1 in 100 year, plus climate change, event.

8.8 In discharging surface water at a rate that is less than the current 1 in 100 year rate, in theory the flood risk will be reduced.

8.9 Overall this report demonstrates that the flood risk to the site is reasonable and acceptable.

8.10 Overall, this report also demonstrates that the site can be suitably, safely and sustainably drained, with the development being designed and constructed to meet the required standards.

8.11 In summary, therefore, ssuitably worded conditions can be applied to the grant of planning permission to control the delivery of the development in the usual manner.

9.0 RESPONSE TO LLFA QUERIES

9.1 Whilst the report has been enhanced and provides more detail on flood risk and drainage matters, the salient points of the LLFA queries are summarised below.

9.2 Flood Risk and Drainage Context

9.2.1 The planning application to Cherwell District Council is covered under application reference 20/00293. However, the site is also covered under an extant planning application, reference 16/02586, and Hamill Davies Limited provided a supporting 'Flood Risk Assessment' report and a 'Services, Foul and Surface Water Drainage Strategy' report. No adverse comments were provided by the Consultees and planning was granted, amongst other things, on the basis of the reports' findings.

9.2.2 In addition to the extant planning permission reference 16/02586, subsequent submittals have been made to discharge planning Conditions relevant to Phase 1A (the hotel). Pertinent to this report is application reference 18/00389/DISC, which included the WSP Drainage Technical Note and supporting drainage drawings and calculations. Again, no adverse comments were provided by the Consultees and Condition was discharged.

9.2.3 Therefore, the flood risk and drainage principles of this application have been set by the extant permission and its supporting reports.

9.3 Pumping Risk

9.3.1 In relation to the need to pump, the use of shallow SuDS is recommended, however, pumping can not be avoided because the existing ditches are shallow (at less than 1.4m deep) and the upstream sewers that will supplement the shallow SuDS will need to comply with the Building Regulations and be set at 1.2m cover under roads, and need to be laid to falls and be sized to suit the peak 1 in 100 year, plus climate change, flows.

9.3.2 The risk of pump failure is included in this updated report.

9.4 Soakage Tests

9.4.1 The soakaway tests were taken from the extant planning permission and seek to demonstrate that the underlying strata and its groundwater levels preclude the use of infiltration.

9.4.2 The details submitted as part of the extant permission and the discharge of planning Conditions both rule out infiltration, as does this report.

9.5 Climate Change

9.5.1 The calculations and drainage drawing in this report to allow for 40% climate change.

9.6 Land Drainage Consent

9.6.1 We note reference to requiring land drainage consent, which will be formally applied for at the right time.

9.6.2 The drainage ditches are riparian owned, and site already discharges rainfall run-off to the surrounding ditches, so we are maintaining the status quo.

9.6.3 With the surface water discharge rate limited to the lowest practicable rate, and in theory this being less than the greenfield equivalent rate for the 1 in 100 year return period, and with us allowing for climate change within the assessment, the flood risk to the existing ditches will be reduced.

9.7 Cross Section Drawings

9.7.1 The drainage drawing in Appendix F has been supplemented and these show the cross-sections of the SuDS and the pumping station.

9.8 Drainage Drawings

9.8.1 The drainage drawing in Appendix F has been supplemented and these show the SuDS referenced in the report.

9.9 Culverting

9.9.1 The report has been updated to include reference to the ditch and noting that the ditch is already culverted on site and in the surrounding area.

9.10 Watercourse Modelling

9.10.1 As noted in Section 5 of the report, surface water from the proposed development will be controlled to the lowest practicable rate, of 3.5l/s, which is less than the existing greenfield equivalent, and less than the 'long term storage' requirement run-off rate of 2l/s.ha.

9.10.2 It is reasonable to state therefore that the impact of surface water discharge on the downstream drainage ditch network is minimised, and flood risk, in theory, is reduced.

9.10.3 With the flood risk to the drainage ditches being reduced, it is un-necessary to model the watercourses and ditches in the surrounding area. Furthermore, modelling would also be disproportionate to the scale of the development and flood risk.

9.11 Surface Water Flood Risk and Mitigation

9.11.1 In relation to surface water flood risk the site is shown to be theoretically at risk from flooding up to 900mm, even though it is in Flood Zone 1 (less than 1 in 1000 annual probability of flooding in any year).

9.11.2 The flood depths on the surface water mapping are based on a simple assessment, using the site's topography and assumes no drainage is in place. In reality the drainage ditches provide a mechanism for collection, conveyance and capacity, and these currently manage the surface water on site, and there have been no known instances of the site flooding.

9.11.3 Furthermore, the site will have a SuDS system which controls flows to an agreed rate, and excess flows will be balanced up to the 1 in 100 year, plus climate change, allowance, which is an improvement to the current situation, therefore the overall risk from surface water flooding is considered to be low.

9.11.4 However, taking the theoretical flood depth at its highest, the flood level could be 64.90mAOD, based on the ditch invert level of 64mAOD.

9.11.5 The finished floor levels of the proposed buildings will be set at 65.30mAOD, which is above the theoretical flood depth, with 400mm freeboard.

9.12 Summary

9.12.1 The flood risks and mitigation that were recommended in the original eport that accompanied the original planning application have not materially changed, and neither have the drainage principles, which were previously established and accepted for the extant permission and Condition discharge submittals.

9.12.2 However, this updated report clarifies the principles and provided further details in the updated report based on the LLFA feedback. This should provide the LLFA with sufficient confidence that Outline permission can be granted with suitably worded planning Conditions to control the proposed scheme as it is brought forward to the Reserved Matters stage.

APPENDIX A

Topographic Survey Drawings

NOTES

ALL LEVELS ARE IN METRES RELATED TO ORDNANCE SURVEY DERIVED FROM GPS TRANSFORMATION OSTN02.

THE COORDINATE GRID IS BASED ON ASSUMED VALUES.

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LEGEND

TOPOGRAPHICAL SURVEY KEY:–

osbm	ORDANANCE SURVEY BENCH MARK	fh	FIRE HYDRANT
tbm	TEMPORARY BENCH MARK	g	GULLY
ffl	FINISHED FLOOR LEVEL	re	RODDING EYE
tl	THRESHOLD LEVEL	bt	BRITISH TELECOM
mh	MANHOLE COVER	catv	CABLE TELEVISION
ic	INSPECTION COVER	conc	CONCRETE
cl	COVER LEVEL	bk	BRICK
il	INVERT LEVEL	f/b	FLOWER BED
wl	WATER LEVEL	ht	HEIGHT
bl	BED LEVEL	tow	TOP OF WALL
ø	PIPE DIAMETER	tof	TOP OF FENCE
wfc	WATER FILLED CHAMBER	toh	TOP OF HEDGE
utl	UNABLE TO LIFT	ep	ELECTRICITY POLE
d–chan	DRAINAGE CHANNEL	tp	TELEGRAPH POLE
g–run	GULLY RUN	lp	LAMP POST
rwp	RAIN WATER PIPE	ts	TRAFFIC SIGNAL
svp	SOIL VENT PIPE	rs	ROAD SIGN
vp	VENT PIPE	sp	SIGN POST
wp	WASTE PIPE	nb	NOTICE BOARD
sp	SOIL PIPE	bol	BOLLARD
cr	CABLE RISER	c/b	CLOSEBOARD
er	EARTH ROD	c/l	CHAINLINK
sv	STOP VALVE	p/r	POST & RAIL
gv	GAS VALVE	p/w	POST & WIRE
wm	WATER METER	i/r	IRON RAILING

MEASURED BUILDING SURVEY KEY:–

(0.00)	ROOM HEIGHT
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sh	SILL TO HEAD
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dh	DOOR HEIGHT
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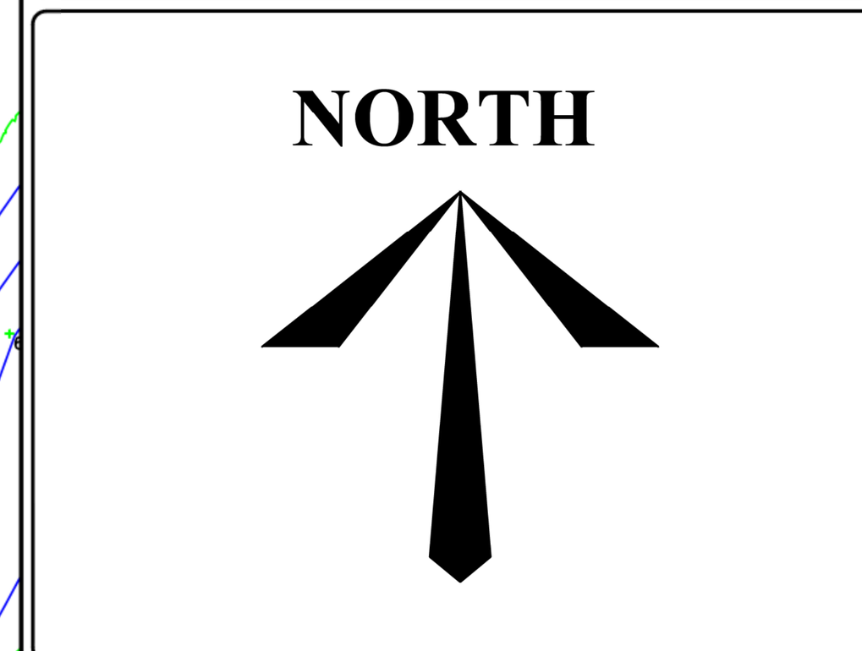
t/s	TOPSIDE
s/c	SUSPENDED CEILING
rl	ROOFLIGHT
fp	FIREPLACE
sd	SLIDING DOOR
fb	FLOORBOARDS
cup'd	CUPBOARD
elec	ELECTRICS
▬	RADIATOR
htr	HEATER
hwt	HOT WATER TANK



STATION COORDINATES

STATION	EASTINGS	NORTHINGS	LEVEL	REMARKS

REVISIONS

Revision	Date	Remarks
A	27/10/2016	Survey related to O.S.

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CLIENT:	HILL STREET HOLDINGS LTD		
REF:	1367/4	DATE:	OCTOBER 2016
SCALE:	1:200@A0	SURVEYOR:	JS/RG

COMPANY NUMBER: 7846319
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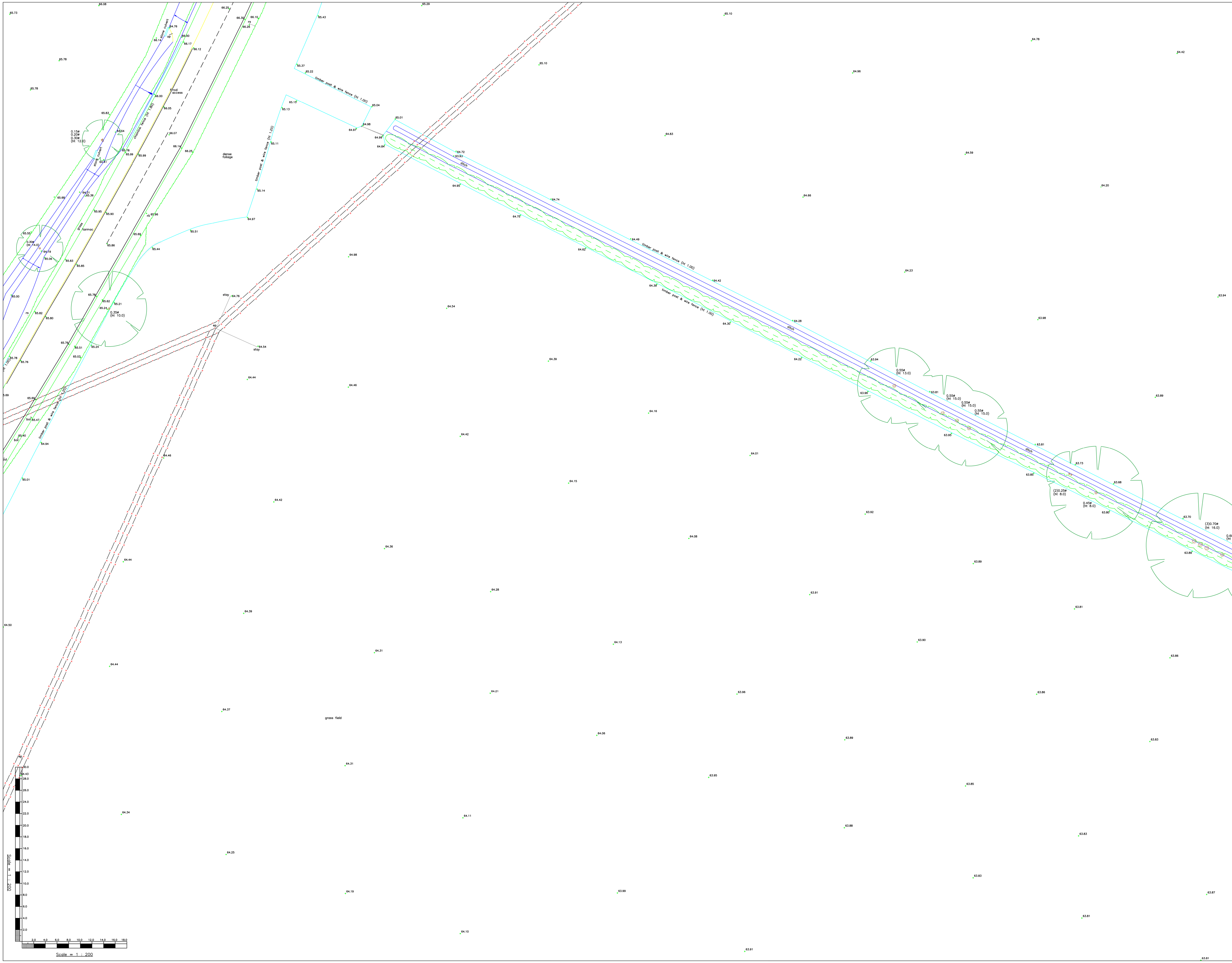

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fb	FLOORBOARDS
cup'd	CUPBOARD
elec	ELECTRICS
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