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The Lion, Wendlebury
Flood Risk Assessment and Drainage Statement

Site reference

The Lion
Wendlebury
Bicester
Oxon
OX25 2PW

Client

The Lion at Wendlebury

Date

October 2016

Report No.

ICS-2359.07.001 – Rev A

Revision	Compiled by	Checked by	Issue date
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Contents

1.0 Summary

This Flood Risk Assessment (FRA) and drainage statement is to support proposed development at The Lion, Wendlebury and finds the following:

ITEM	RESPONSE
Site Location	The development site is situated the centre of the Oxfordshire Village of Wendlebury, 2.6miles southwest of Bicester. The site is accessed from the Barrets Row/Wendlebury Road. The approximate grid reference of E = 456164, N = 219672.
Size and Current Land Usage	The site area extends to 0.535 hectares and includes the existing pub, and car parking areas.
Flood Zone	The majority of the site falls within Flood Zone 1. The entrance to the site falls within Flood Zone 3.
Fluvial Flood Risk	Low – Refer to Section 5.1.
Overland Flood Risk	Low – Refer to Section 5.2.
Groundwater Flood Risk	Low – Refer to Section 5.3.
Sewerage Flood Risk	Low – Refer to Section 5.4.
Artificial Flood Risk	Low – Refer to Section 5.5.
Proposed Development	The proposed development consists of extensions to provide a new accommodation block within the existing gardens. The car parking area is to be extended.
Proposed Surface Water Drainage	The implementation of suitable SUDS sustainable drainage techniques and mitigation measures, will address any potential risks associated with surface water runoff generated from the development. These will be controlled and managed to a safe and suitable level to ensure downstream areas are not affected by flooding. Roof runoff and private hardstanding will be discharged into tanked cellular storage discharging via the existing site connection. Drainage designed to accommodate the peak storm event for a 1 in 30 year storm. The property owners should be issued with a maintenance manual that details the type and frequency of maintenance required for the sustainable techniques utilised.
Floor Levels	In line with the planning permission 15/00185/F the FFL must be in accordance with the previously approved finished floor levels and 300mm above the estimated EA flood level of 63.000 AOD
Proposed Foul Drainage	Foul drainage from the site will discharge via the existing connection from the public house.
Flood Warning	As a precautionary measure it is recommended that the owner of The Lion signs up to the Environment agencies Flood line service for either telephone, mobile, email SMS text message which gives warning of potential flooding events. Environment Agency operates a flood watch scheme called Floodline 0845 988 1188 (24 hour service) or Type talk 0845 602 6340.

2.0 Introduction

2.1 Commission

The Client, The Lion, has commissioned Infrastruct CS Ltd to prepare a Flood Risk Assessment (FRA) to support a planning application for the development of a new accommodation block with an extension to the car parking area.

2.2 Guidance

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

2.3 Aims and Objectives

The purpose of this flood risk assessment is to demonstrate that the site can be developed safely, without exposing the new development to an unacceptable degree of flood risk or increasing the risk of flooding to third parties.

This report will identify the flood risk zone, potential sources of flood risk, consider the proposed drainage, recommend appropriate flood risk mitigation measures and will be used to support the planning application proposals.

This report is based on information made available at the time of writing. Consequently, there is potential for additional information to be published which may lead to changes to the conclusions drawn in this report. As such Infrastruct CS Ltd cannot be held responsible for such changes.

3.0 Site Details

3.1 Location

The development site is situated on arable land in the centre of the Oxfordshire Village of Wendlebury, 2.6miles southwest of Bicester. The site is accessed from the Barrets Row/Wendlebury Road.

3.2 Grid Reference

The approximate Ordnance Survey national grid reference for the centre of the site;

E = 456164, N = 219672.

3.3 Topography And Description Of The Site

A topographic survey (Appendix A) was undertaken in August 2014. The site is an existing pub and associated car park.

The development site is accessed off the Barrets Row/Wendlebury Road to the east of the development site.

The topography of the site has with an overall fall of 2.83m from the east to the west giving an approximate gradient of 1 in 20. To the west is an un-named watercourse, known locally as Wendlbury Brook. To the east is the farm land and to the north and south are residential properties and associated gardens.

3.4 Geotechnical Conditions

A site investigation has not been undertaken at the time of writing.

Reference to the British Geological Survey Maps indicates mudstone associated with the Peterborough Member.

3.5 Existing Drainage Description

The existing car park structure is conventionally drained via gullies before discharging into the manhole in the north west corner of the site. Roof drainage discharges directly to the road and parking areas.

Foul drainage is connected to the Thames Water foul sewer running within Wendlebury Road.

3.6 Local Rivers And Water Courses

Immediately to the west and at a lower level is an un-named water course, known locally as Wendlbury Brook. The difference in levels between the pub floor level and the river bed is just over 1.0m

3.7 Proposed Development

It is proposed to make extensions to the existing buildings to provide an accommodation block. The car parking hardstanding will be extended.

The site masterplan can be found in Appendix B.

4.0 Flood Risk Policy

4.1 Environment Agency Flood Map

The development site is situated in the Environment Agency Thames Region and their Flood Zone maps for the area indicate fluvial flooding extents.

The flood map for the development site shown below suggests that the majority of the site falls within Flood Zone 1, however the entrance way to the site lies in Flood Zone 3, which is defined as land assessed as having a greater than 1 in 100 annual probability of river flooding in any one year. Wendlebury Road, which the existing building fronts lies in Flood Zone 3.

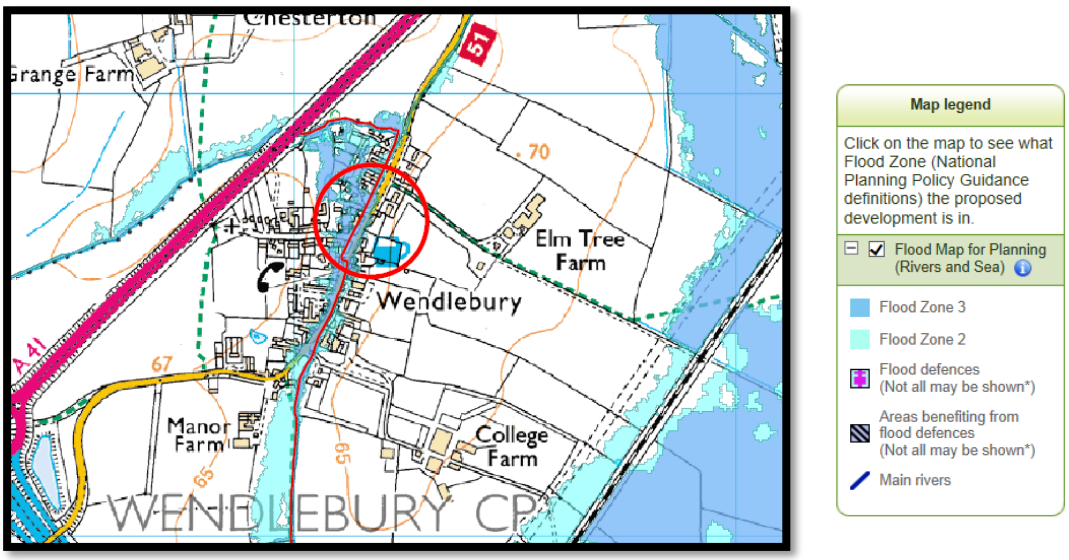

Fig 4.1 – Environment Agency Flood Zone map

4.2 The National Planning Policy Framework

The National Planning Policy Framework and the accompanying Planning Practice Guidance gives direction for development with respect to flooding. These documents promote a sequential approach in order to encourage development away from areas that may or are susceptible to flooding. In doing so it categorises flood zones in the context of their probability of flooding, as shown in the table within Section 4.3 below.

4.3 Flood Zone Definition

The National Planning Policy Framework Definition of Flood Zones

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

4.4 Flood Zones – Table 1 NPPF

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

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

4.5 Flood Risk Vulnerability Classification – Extract from Table 2 NPPF

More Vulnerable

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

Less Vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

With reference to the above, the proposed accommodation and parking is classed as less vulnerable, whilst the proposed accommodation blocks are more vulnerable.

4.6 Flood Risk Vulnerability & Flood Zone Compatibility Table

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

√ Development is appropriate x development is not appropriate

The above table, taken from NPPF (table 3), confirms that the proposed works within Flood Zone 3 and the proposed accommodation blocks within Flood Zone 1 are appropriate for development.

4.7 Local Strategic Flood Risk Assessment SFRA

A strategic flood risk assessment (SFRA) has been undertaken by Cherwell District Council.

The SFRA promotes sustainable development with an integrated approach to water management through a number of guidance notes.

Section 13.9 states that for development in Wendlebury the extents of flood plains need to be established. Product 4 data has been requested from the Environment Agency in order to compare flood levels to existing ground levels.

4.8 Other Flooding Mechanisms

In addition to the potential for assessing flooding from fluvial and tidal sources, the National Planning Policy Framework also requires that consideration is given to other mechanisms for flooding -

Flooding from land – intense rainfall, often in short duration, that is unable to soak into the ground or enter drainage systems, can run rapidly off land and result in local flooding.

Flooding from groundwater – occurs when water levels in the ground rise above the surface elevations.

Flooding from sewers – in urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water sewers known as combined sewers. Flooding can result causing surcharging when the sewer is overwhelmed by heavy rainfall.

Flooding from reservoirs, canals and other artificial sources – non-natural or artificial sources of flooding can result from sources such as reservoirs, canals lakes etc., where water is held above natural ground levels.

5.0 Flood Risk To The Development Site

5.1 Flooding From Fluvial Sources

The EA flood maps and levels for the development site show the majority of the site (98%+) is Flood Zone 1 which is defined in NPPF as comprising land at low risk of flooding. There is a small area to the entrance which is Flood Zone 3. There is also a small area shown to be below the estimated 1 in 100 year level adjacent to the new kitchens. As this has a gully connection, there is a chance of this area flooding. Levels within the parking area should be reduced to accommodate any loss of flood plain. There have been historic events of flooding from Wendlbury Brook where the channel capacity is exceeded particularly in 2012. However the Environment Agency provide flood warnings for the brook which can help occupants prepare.

It is therefore the consideration of this FRA that the majority of the site has a low risk of flooding from fluvial sources. However the entrance to site is at a lower level and as such is at high risk of flooding from fluvial sources.

5.2 Flooding From Overland Flows To The Site

To the west is the Wendlebury Road and associated Wendlebury Brook, both of which are lower than the site . To the north and south are residential developments which by its nature will not generate 'sheet' overland flows. To the east is are Alchester Stables, whilst these are slightly higher than the site, any flows generated are anticipated to be low.

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

5.3 Flooding From Rising Groundwater

A ground investigation has not been undertaken for this site, however, a bore hole taken locally, at 15 Wendlebury Road, indicated no ground water seepage over a 24 hour test period. (See Appendix C). Other anecdotal evidence indicates a ground water level of approximately 2.5m below ground level.

It is therefore the consideration of this FRA that the site has a low risk of flooding from rising groundwater levels.

5.4 Flooding From The Local Sewerage Network

The sewerage network is owned and maintained by Thames Water. The risk of flooding by surcharging is considered low. The sewerage network runs within Wendlebury Road, which is at a lower level than the development site, and surcharging that may occur will be confined within the highway network.

It is therefore the consideration of this FRA that the site has a low risk of flooding by surcharging of the local sewer network.

5.5 Flooding From Reservoirs, Canals & Other Artificial Sources

Review of location plans for the development site show there to be no signs of large manmade water sources within the local area.

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

5.6 Extents and Depth of Flooding

As the floodplain extends into The Lion site, detailed flood level data from the EA for the River Thames has been interrogated.

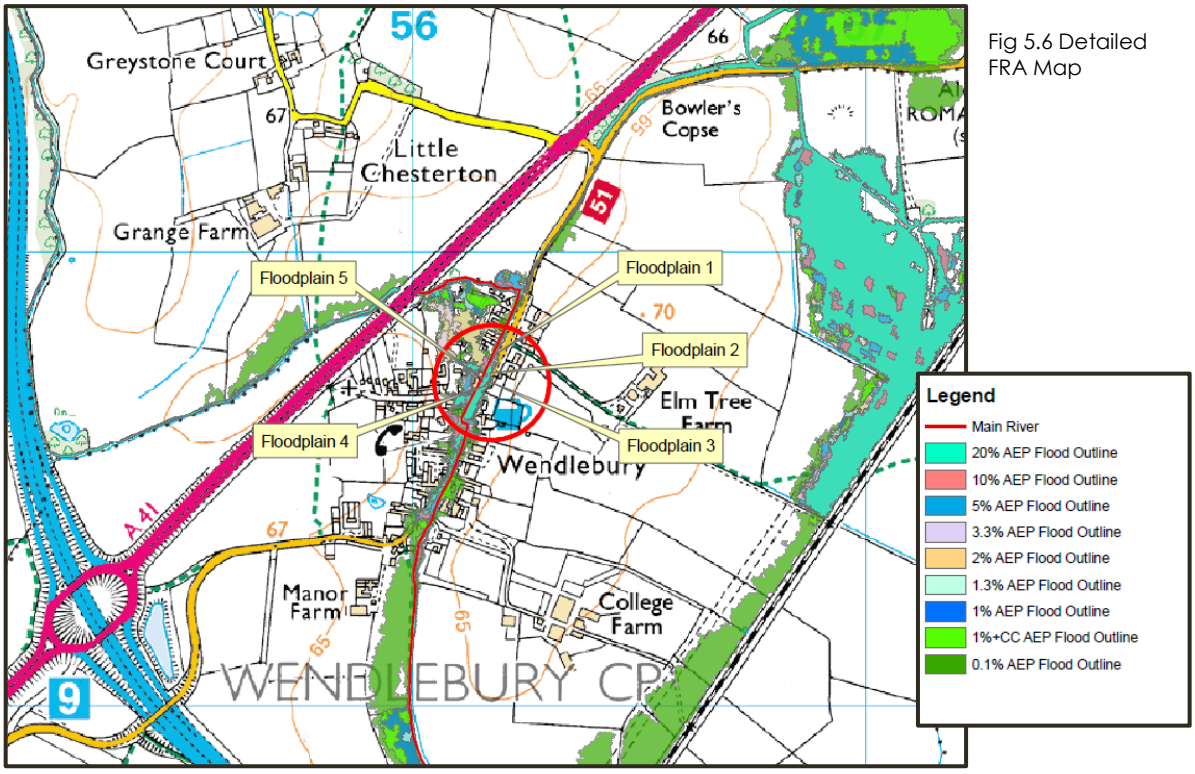

Fig 5.6 Detailed FRA Map

Return Period	Flood Level (m AOD)
1 in 5	62.83
1 in 20	62.91
1 in 100	63.00

Table 5.6.1 Flood data for Floodplain 2

Based on the previously approved levels for the development, the Finished Floor Level for the new accommodation block should be set at 63.300m AOD, 300mm above the 1 in 100 year flood level of 63.000mm.

6.0 Flood Risk As A Result Of The Development

6.1 Effect Of The Development Generally

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

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

6.2 Surface Water Drainage & Sustainable Drainage Systems

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

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

6.3 Sustainable Drainage Hierarchy

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

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

1. store rainwater for later use
2. use infiltration techniques, such as porous surfaces in permeable strata areas
3. Attenuate rainwater in ponds or open water features for gradual release to a watercourse.
4. attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse,
5. discharge rainwater direct to a watercourse
6. discharge rainwater to a surface water drain
7. discharge rainwater to the combined sewer.

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

Sustainable urban drainage systems have been considered for this development unless there are practical reasons for not doing so. Such reasons include the local ground conditions or density of development. The site specific drainage hierarchy check list considered for the drainage design for this development is detailed in the table 6.6 on the next page.

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

Table 6.6 Drainage design hierarchy (SuDS techniques considered for use on this scheme)

It should be noted that where the SuDS techniques are noted as feasible or possible it does not necessarily follow that they will all be used.

6.7 SuDs Techniques Employed

On a local level, the surface water drainage strategy for the development site employs the following SuDS techniques outlined in section 6.8 (below) to address water quality and quantity and to manage surface water runoff where possible at source. The SuDS techniques employed are set out below.

6.8 Surface Water Drainage Strategy & Design

This FRA is not intended to provide a detailed design for the drainage system to serve the proposed development, but to show that a proposed system is feasible in principle given the storage volume required and land availability.

The main contributory factor to surface water runoff is usually from the hard standing associated with driveways and roof areas.

The proposed development increases the existing hardstanding areas from 1237m^2 to 2278m^2, as illustrated in Appendix D.

It is proposed to utilise tanked cellular storage connected to the existing surface water outfall in order to attenuate flows for storm events up to the 1 in 30 year event. The proposed development increases impermeable areas by 1041m^2. It is proposed to keep the current drainage as existing, and provide tanked storage fitted with a hydrobrake to limit flows from the proposed extensions.

The UK Sustainable Drainage Guidance and Tools produced by HR Wallingford recommend that where sites are small and limits of discharge are less than 5l/s there is a risk of throttle blockage. In this situation a minimum of 5l/s or the calculated values of Q1, Q30 or Q100 is allowed, whichever is the greater.

It is therefore proposed to utilise a flow control device such as a HydroBrake or similar, set to 5.0l/s and cellular storage within the development site.

Based on an impermeable site area of 1041m^2 and a permitted discharge rate of 5.0l/s from the development site, the level of storage required to attenuate a 1 in 30yr storm event would be approximately 16m^3. This can be achieved with a cellular storage unit of 20mx2mx0.4m(dp). Microdrainage calculations accompanying the design can be found in Appendix E.

6.9 SuDs Maintenance

The owners of the properties will be responsible for maintaining the private SuDs features, this may be undertaken by a maintenance contractor. An instruction manual detailing the frequency and type of maintenance required for all the SuDs features employed will be provided to the owners prior to occupancy.

7.0 Flood Warning and Dry Route of Escape

7.1 Flood warning in relation to Wendlebury Road

As a precautionary measure it is recommended that the owner of The Lion signs up to the Environment agencies Flood line service for either telephone, mobile, email SMS text message which gives warning of potential flooding events. Environment Agency operates a flood watch scheme called Floodline **0845 988 1188** (24 hour service) or Type talk 0845 602 6340.

7.2 Dry Access, Egress and Escape

The new accommodation block is situated centrally on the plot. Due to the steeply sloping nature of the site, this will be 1.0m above the road to the front and 700mm above the most extreme flood level.

The only official access to the site is via the road to the front, which lies within flood zone 3. Due to the risk of flooding to the adjacent road and the flood flow, it is not recommended that his route is used for dry access in an extreme flood. However with the Emergency planning noted in section 8.0 of this report and the accommodation block being 700mm higher than the extreme flood it can be shown that the accommodation block would provide a safe haven should such a flood occur.

The flood level given by the EA for the 1%AEP with a 20% allowance for storm events is 63.04 (See Appendix F). At this level, flood floods within the boundary at Wendlebury road will be 390mm deep. The topography of Wendlebury Road is relatively flat and level, therefore flood water velocities can be expected to be low to still. Table 4 'Hazard To People' (Appendix G) classification rates a 390mm depth of flooding with 0.1m/s velocity to have a hazard rating of 1.23. This is classified as having an element of danger for children, the eldest and infirm. It is not considered a danger to general public and emergency services. It is not recommended for residents to enter any flood waters, especially none deeper than 100mm. The emergency services utilising the appropriate vehicles should be able access the site should an emergency occur, prior to the flood subsiding.

8.0 Emergency Planning

8.1 Awareness

Whilst the development is identified by the EA as subject to potential flooding for storms greater than the 1 in 100 plus climate change storm event. There are several sources of information available on flooding events within the area; these being the Environment Agency in conjunction with the Met Office and local radio and television stations. Both will issue and broadcast warnings. The Agency operates a flood watch scheme called Floodline. This service is free and can be accessed by calling Floodline on **0845 988 1188** or Typetalk on 0845 602 6340. Floodline can also be accessed by the internet by logging onto http://www.environment-agency.gov.uk. In many places the Agency can warn interested parties by either telephone, mobile, email, SMS text message or fax of a potential flood up to six hours in advance.

8.2 Equipment

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

- A torch
- Blankets or a sleeping bag, warm clothing and waterproofs
- A first-aid kit, including a supply of any essential medication
- A list of useful telephone numbers
- A supply of bottled water
- A stock of non-perishable food items
- A portable radio and supply of batteries
- Children's essentials (milk, baby food, sterilised bottles and spoons, nappies, wipes, nappy bags, clothing, comforter, teddy)
- Food and accommodation (cages) for pets (If allowed within the hotel)
- Wellington boots or similar waterproof boots
- Check your insurance cover – ensure it covers flood damage
- Know how to turn off the gas, electricity and water mains supplies
- Think about what items you would want to move to safety during a flood

8.3 Flood Watch

On receipt of the Flood Watch warning from the Environment Agency, or from other sources, e.g. TV, Radio, local contacts. Flooding is possible, and the situation could worsen.

Flood watch means – "Flooding of low lying land is expected. Be aware, Be prepared, Watch out."

When a flood watch warning is issued residents should:

- Be aware of water levels and whether the river is rising or falling
- Reconsider travel plans
- Listen and watch for weather and flood warnings on local radio and
- television stations
- Contact Floodline on **0845 988 1188**
- Check that the flood kit has been prepared
- Copy vital hard copy and electronic records and store them in a safe
- place. This includes financial and insurance records
- Keep a store of plastic bags (grocery bags are fine) to place around the
- legs of furniture when you receive a flood warning

At this stage residents should ensure that their neighbours are aware of the Flood Watch alert in case they are not subscribed or did not receive the alert.

8.6 Severe Flood Warning

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

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

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

Residents/hotel staff should monitor the flood progression and evacuate, on foot, as soon as possible. Should the flood levels be higher than 100mm, residents should utilize the safe haven (Hotel block) until such time that he flood waters subside.

8.7All Clear

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

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

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

9.0 Recommendations and Conclusion

In line with the recommendations of the National Planning Policy Framework, the development site lies within land classified as flood zone 1 and 3, which is considered appropriate for the types of development.

The Environment Agency requires that for all sites, the following surface water flood risk principles have been followed. Based on the strategy within this report all of the following have been met.

- That surface water runoff from the development will not increase flood risk to the development or third parties.
- That the residual risk of flooding has been addressed should failure or exceedance of the drainage system occur. This could include measures to manage residual risk such as raising ground or floor levels where appropriate.

As such this report concludes that the site is suitable for development in line with the current architectural proposals.

9.1 Finished Flood Levels

The finished floor levels for the proposed extension must be set to ensure the property is located above the 1 in 100yr flood level to reduce the likelihood of flood water damaging the property. In line with EA guidance LIT9955, **the extension should be set at levels not lower than the original/connecting building**.

The EA have provided some flood levels for the area, giving a flood levels of 63.00m at floodplain 2 and in line with EA recommendations the minimum flood level should be set 300mm above this. **As such a minimum finished floor level for the proposed accommodation block should be 63.30mAOD.**

9.2 Flood Resistant measures

As part of the works associated with the new dwellings it is the recommendation of the report that consideration should be given to flood resistant measures. These are mechanisms which can be implemented by the occupier to provide additional defences against flood water ingress. Systems such as flood barriers to external door openings can prove an effective measure but must be used in conjunction with suitable ground floor construction techniques to prevent water entering the dwelling from the under floor void. As these works are associated with the construction of the residential dwelling and property for business use it would be advisable to site sockets and fuse boxes away from floor level. More information and recommendations can be gained from the CIRIA document 'Improving the flood performance of new buildings'.

References & Bibliography

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- Sewers for adoption 6th Edition and interim guidance prior to the introduction of sewers for adoption 7th edition WRC
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- Flood Estimation Handbook
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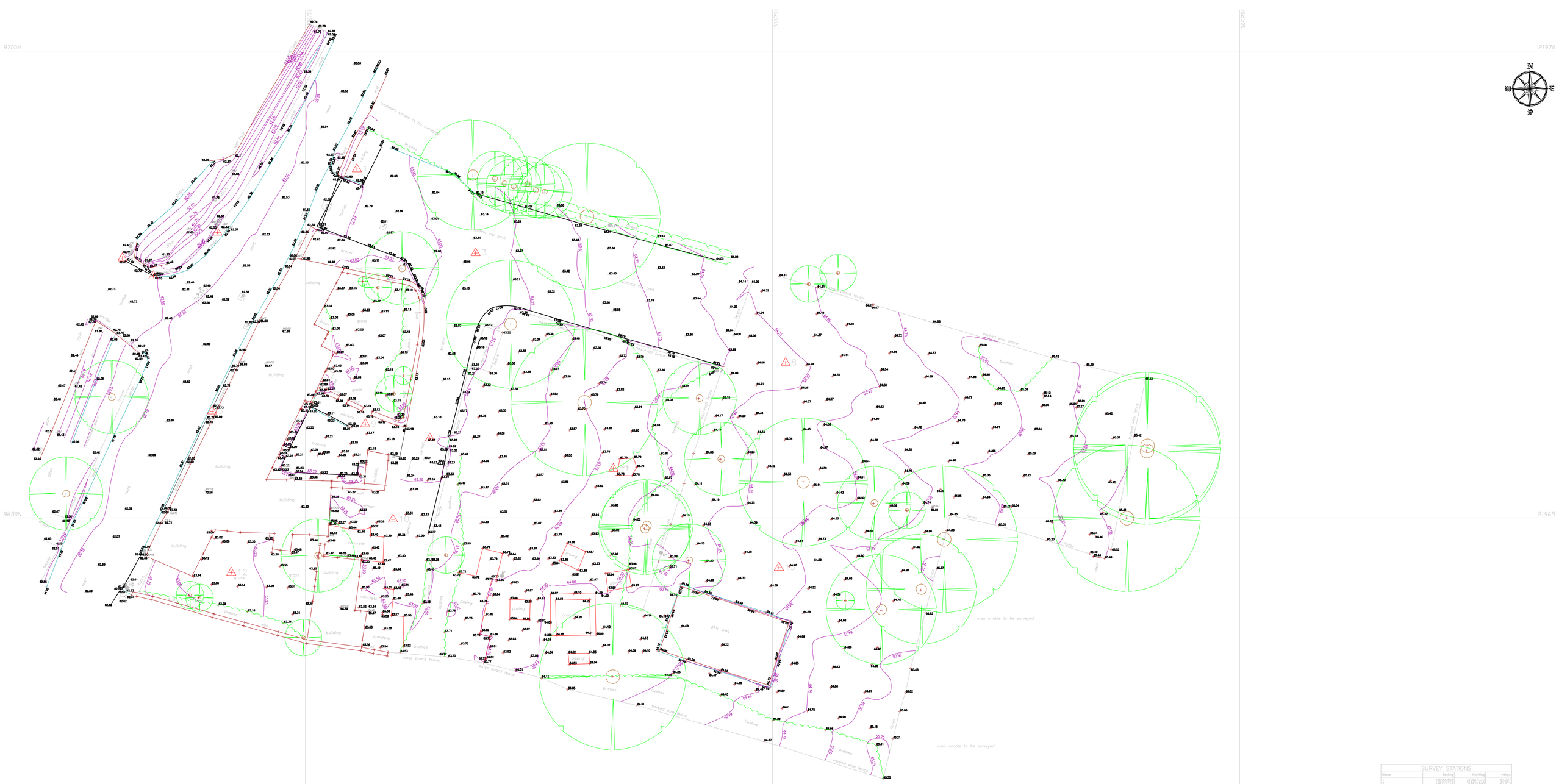
Appendix A – Topographic Survey



SURVEY STATIONS			
Name	Easting	Northing	Height
1	456156.563	219687.742	62.907
2	456133.719	219675.890	62.571
3	456168.213	219678.354	63.134
4	456140.570	219680.556	62.485
5	456140.008	219661.416	62.679
6	456130.406	219677.811	62.566
7	456163.317	219658.519	63.220
8	456201.404	219666.591	64.182
9	456156.406	219660.039	63.202
10	456159.375	219649.829	63.341
11	456180.953	219655.252	63.771
12	456200.683	219644.672	64.430
13	456142.058	219644.137	63.125

Shyres Rural Ltd.
RICS
CHARTERED SURVEYORS
MAPPING CONSULTANTS

Shyres Rural Ltd Registered in England and Wales No. 6635142
Foxhaven,14,Grays Grove,Little Staughton,Bedford MK44 2BT
TEL:Office 01234 376959 Mobile 07860540125
e-mail: shyresrural@talktalk.net

JOB TITLE:

RED LION WENDLEBURY

survey to OS grid and datum using gps

CLIENT:

DATA SHOWN ON THIS PLAN PREPARED TO CLIENT SPECIFICATIONS

DATE: 29/08/14	DRAWING NUMBER:	REVISION
SCALE: 1:200	SRL.109.14	
DRAWN BY: taff		

survey data correct at date of survey only.

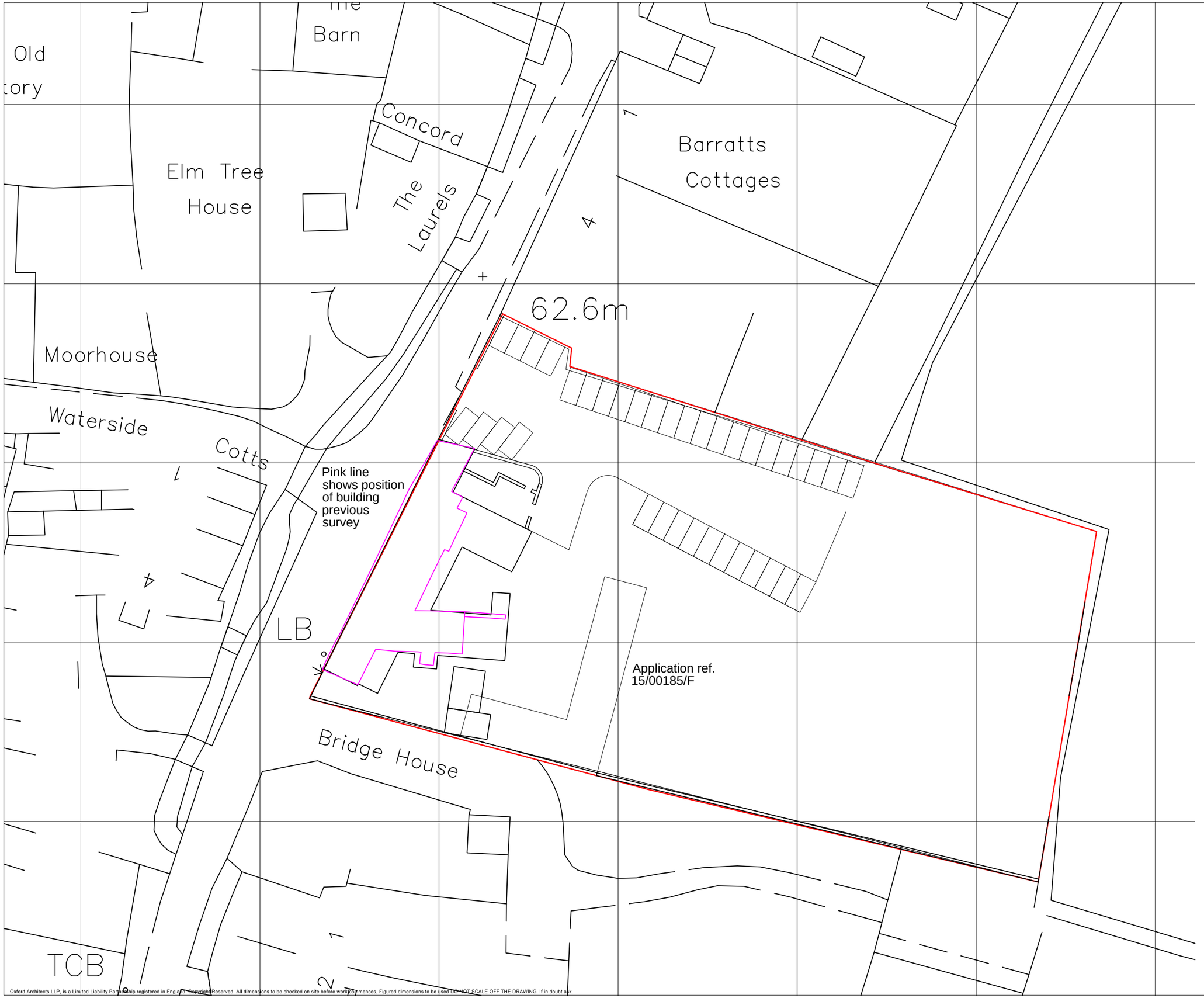
symbols representing tree spread and trunk dimensions are indicative only

all service detail must be considered approximate and its full location must be verified by details obtained from the relevant provider and/or authority

digital copies of this plan can only be considered accurate if supplied directly by Shyres Rural Ltd.

do not scale from plots

Appendix B – Site Masterplan



North

0 15m

1:500 @ A3

Rev	Description	Date

Partner	Drawn	Date
PIC	HA	June 2016

Project

The Lion Pub Wendlebury

Title

Location & Block Plan

Drawing Reference

16124-OA-B1-079-P-00

Drawing No	Revision	Status
079	P1	S0

Scale

1:500 @ A3

OXFORDARCHITECTS
Bagley Croft, Hinksey Hill, Oxford, OX1 5BS
T. 01865 329100 F. 01865 326822 oxford-architects.com
The Workshop, 254 Southmead Road, Bristol, BS10 5EN
T. 0117 9581500 F. 0117 9581501 oxford-architects.com

Appendix C – Local Borehole Logs

TRIAL PIT ONE

Depth -m		Strata Description
		MADE GROUND
Ground level	- 0.34	Soft, brown, occasionally yellow sandy, silty, occasionally gravelly, calcareous CLAY with included clasts of yellow/red chert and sub-angular, creamy oolitic limestone up to 1 cm in diameter. Occasional traces of black carbonaceous material. Traces of red brick and white plastic.
0.34	- 0.61	Soft, brown sandy, rarely gravelly, calcareous CLAY with included fragments of glass and oolitic limestone up to 2 cm in diameter. Occasional traces of black carbonaceous material.
0.61	- 0.78	Soft to firm, yellow/brown, creamy yellow sandy, gravelly, calcareous CLAY with included fragments of creamy white limestone up to 4 cm in diameter and subrounded flints up to 1 cm in diameter. Occasional included bone fragments, red brick and metal nails and hinges.

Date .	TRIAL PIT LOG	Report No.
August, 1986	TYRONE	S.748

TRIAL PIT ONE

0.78	- 0.86	Soft, black/brown, carbonaceous CLAY with included fragments of bituminous coal and creamy/white limestone, occasional inclusions of red brick, nails and broken white tile.
		OXFORD CLAY
0.86	- 1.15	Soft to firm, orange brown yellow, sandy, calcareous CLAY with included fragments of angular creamy brown limestone up to 2 cm in diameter. Occasional traces of black carbonaceous material and flints.

Remarks.

1. Trial pit excavated by hand on 18.08.1986.

2. Trial pit dimensions 0.60 x 1.35 x 1.15m deep.

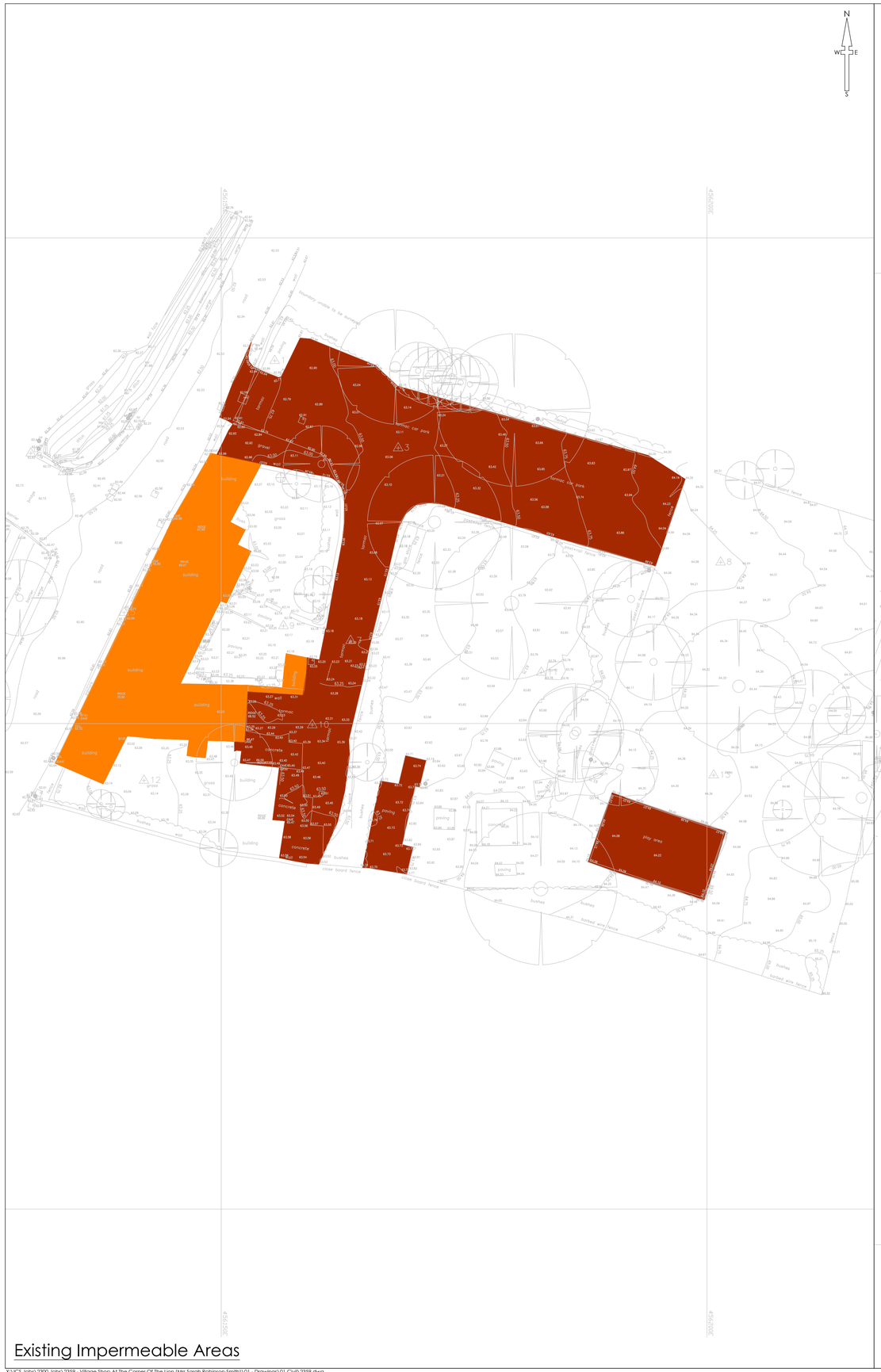
3. No groundwater seepage evident after standing open for twenty four hours.

4. In situ shear strength values - kN/m^2

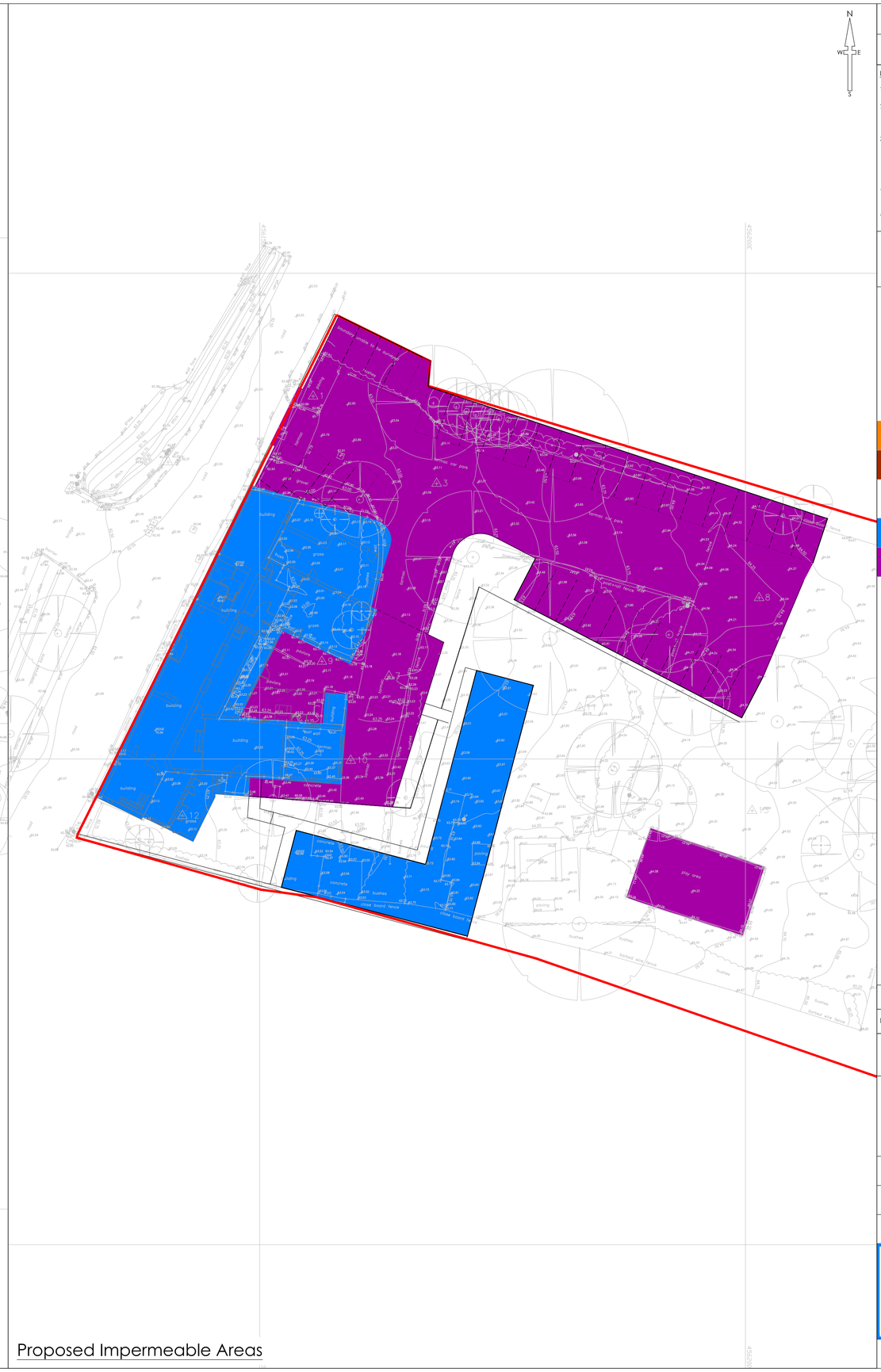
Depth -m	Values			Average
0.86	26	34	36	32
0.97	24	28	30	27
1.15	30	20	26	25

Date.	TRIAL PIT LOG	Report No.
August, 1986	TYRONE	S.748

Appendix D – Impermeable Areas



Existing Impermeable Areas



Proposed Impermeable Areas

SURVEY INFORMATION
Survey Company - ***** ******
DRG NUMBER: DATE RECEIVED:

ARCHITECT SITE PLAN INFORMATION
ARCHITECT PRACTICE - ***** ******
DRG NUMBER: DATE RECEIVED:

NOTES

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

Construction Note
It is essential that new drainage associated with the development is laid from the outfall(s) into the site. This is essential to avoid unforeseen obstructions where encountered (such as services). If the drainage is laid from the site out to the outfall it can result in significant abortive works to relay and overcome such obstructions.

Existing Impermeable Areas Key

	Buildings Area = 323.129
	Hard Surface Area = 914.253

Total = 1237.382

Proposed Impermeable Areas Key

	Buildings Area = 914.253
	Hard Surface Area = 1364.074

Total = 2278.327

Rev	Drawn by	Chk'd by	Comments	Date
P01	ATD	RJW	Initial issue	21/10/16

DRAWING TITLE
Impermeable Areas

PROJECT
The Red Lion Public House
Wendlebury
Bicester

DESIGNED BY	DRAFTED BY	APPROVED BY
RJW	NJ	TST

DATE: 21/10/2016
STATUS: **INFORMATION**

SCALE: 1:200 @ A1
0m 5m 10.0m
scale bar @ 1:200

CLIENT
Mrs Sarah Robinson-Smith

Infrastruct CS Ltd

JOB NUMBER: ICS-2359
DRAWING NUMBER: 90
REVISION: P01

Infrastruct CS Ltd, The Stables, High Cogges Farm, High Cogges, Witney, OX29 6UH. Tel: 01993 709709. info@infrastructcs.co.uk. www.infrastructcs.co.uk

Appendix E – MicroDrainage Calculations

Summary of Results for 30 year Return Period

Half Drain Time : 27 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	98.915	0.315	0.0	4.9	4.9	12.0	O K
30 min Summer	98.961	0.361	0.0	4.9	4.9	13.7	O K
60 min Summer	98.970	0.370	0.0	4.9	4.9	14.1	O K
120 min Summer	98.930	0.330	0.0	4.9	4.9	12.6	O K
180 min Summer	98.874	0.274	0.0	4.9	4.9	10.4	O K
240 min Summer	98.823	0.223	0.0	4.9	4.9	8.5	O K
360 min Summer	98.754	0.154	0.0	4.9	4.9	5.8	O K
480 min Summer	98.720	0.120	0.0	4.7	4.7	4.6	O K
600 min Summer	98.705	0.105	0.0	4.2	4.2	4.0	O K
720 min Summer	98.695	0.095	0.0	3.7	3.7	3.6	O K
960 min Summer	98.682	0.082	0.0	3.0	3.0	3.1	O K
1440 min Summer	98.668	0.068	0.0	2.3	2.3	2.6	O K
2160 min Summer	98.657	0.057	0.0	1.7	1.7	2.1	O K
2880 min Summer	98.650	0.050	0.0	1.3	1.3	1.9	O K
4320 min Summer	98.642	0.042	0.0	1.0	1.0	1.6	O K
5760 min Summer	98.637	0.037	0.0	0.8	0.8	1.4	O K
7200 min Summer	98.634	0.034	0.0	0.6	0.6	1.3	O K
8640 min Summer	98.631	0.031	0.0	0.6	0.6	1.2	O K
10080 min Summer	98.629	0.029	0.0	0.5	0.5	1.1	O K
15 min Winter	98.958	0.358	0.0	4.9	4.9	13.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.671	0.0	14.9	20
30 min Summer	49.712	0.0	19.4	31
60 min Summer	30.811	0.0	24.0	48
120 min Summer	18.537	0.0	28.9	82
180 min Summer	13.628	0.0	31.9	114
240 min Summer	10.910	0.0	34.0	144
360 min Summer	7.952	0.0	37.2	200
480 min Summer	6.352	0.0	39.6	256
600 min Summer	5.333	0.0	41.6	314
720 min Summer	4.621	0.0	43.2	374
960 min Summer	3.685	0.0	46.0	496
1440 min Summer	2.675	0.0	50.0	738
2160 min Summer	1.940	0.0	54.4	1104
2880 min Summer	1.543	0.0	57.8	1472
4320 min Summer	1.117	0.0	62.7	2200
5760 min Summer	0.887	0.0	66.4	2936
7200 min Summer	0.742	0.0	69.5	3624
8640 min Summer	0.641	0.0	72.0	4320
10080 min Summer	0.567	0.0	74.2	5072
15 min Winter	76.671	0.0	16.7	20

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	99.012	0.412	0.0	5.0	5.0	15.6	O K
60 min Winter	99.016	0.416	0.0	5.0	5.0	15.7	O K
120 min Winter	98.950	0.350	0.0	4.9	4.9	13.3	O K
180 min Winter	98.861	0.261	0.0	4.9	4.9	9.9	O K
240 min Winter	98.787	0.187	0.0	4.9	4.9	7.1	O K
360 min Winter	98.717	0.117	0.0	4.6	4.6	4.4	O K
480 min Winter	98.697	0.097	0.0	3.8	3.8	3.7	O K
600 min Winter	98.686	0.086	0.0	3.2	3.2	3.3	O K
720 min Winter	98.678	0.078	0.0	2.8	2.8	3.0	O K
960 min Winter	98.668	0.068	0.0	2.3	2.3	2.6	O K
1440 min Winter	98.657	0.057	0.0	1.7	1.7	2.1	O K
2160 min Winter	98.647	0.047	0.0	1.2	1.2	1.8	O K
2880 min Winter	98.642	0.042	0.0	1.0	1.0	1.6	O K
4320 min Winter	98.635	0.035	0.0	0.7	0.7	1.3	O K
5760 min Winter	98.631	0.031	0.0	0.6	0.6	1.2	O K
7200 min Winter	98.628	0.028	0.0	0.5	0.5	1.1	O K
8640 min Winter	98.626	0.026	0.0	0.4	0.4	1.0	O K
10080 min Winter	98.625	0.025	0.0	0.4	0.4	0.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	49.712	0.0	21.7	33
60 min Winter	30.811	0.0	26.9	50
120 min Winter	18.537	0.0	32.4	88
180 min Winter	13.628	0.0	35.7	122
240 min Winter	10.910	0.0	38.1	150
360 min Winter	7.952	0.0	41.7	198
480 min Winter	6.352	0.0	44.4	256
600 min Winter	5.333	0.0	46.6	316
720 min Winter	4.621	0.0	48.4	374
960 min Winter	3.685	0.0	51.5	496
1440 min Winter	2.675	0.0	56.1	738
2160 min Winter	1.940	0.0	61.0	1080
2880 min Winter	1.543	0.0	64.7	1472
4320 min Winter	1.117	0.0	70.2	2152
5760 min Winter	0.887	0.0	74.4	2896
7200 min Winter	0.742	0.0	77.8	3608
8640 min Winter	0.641	0.0	80.7	4328
10080 min Winter	0.567	0.0	83.1	5232

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.410	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.104

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.104

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 98.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	0.500	0.0	57.6
0.400	40.0	57.6			

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0113-5000-0400-5000
Design Head (m)	0.400
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	113
Invert Level (m)	98.600
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	4.9
Flush-Flo™	0.168	4.9
Kick-Flo®	0.310	4.4
Mean Flow over Head Range	-	3.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	8.3	3.000	12.8	7.000	19.3
0.200	4.9	1.400	8.9	3.500	13.7	7.500	20.0
0.300	4.5	1.600	9.5	4.000	14.6	8.000	20.6
0.400	4.9	1.800	10.0	4.500	15.4	8.500	21.3
0.500	5.5	2.000	10.5	5.000	16.3	9.000	21.9
0.600	6.0	2.200	11.0	5.500	17.1	9.500	22.5
0.800	6.8	2.400	11.5	6.000	17.8		
1.000	7.6	2.600	11.9	6.500	18.6		

Appendix F – Environment Agency Flood Data

Product 4 (Detailed Flood Risk) for 4 Barretts Row, Wendlebury OX25 2PH
Our Ref: OX_0896_01

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

i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq metres; and all domestic extensions", and

ii) "all applications with a site area greater than 1 ha" in Flood Zone 2.

Product 4 includes the following information:

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

A table showing:

i) Model node X/Y coordinate locations, unique identifiers, and levels and flows for *defended* scenarios.

ii) Flood defence locations unique identifiers and attributes; (supplied seperately)

iii) Historic flood events outlines unique identifiers and attributes; and

iv) Local flood history data (where available/relevant).

Please note:

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

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

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

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

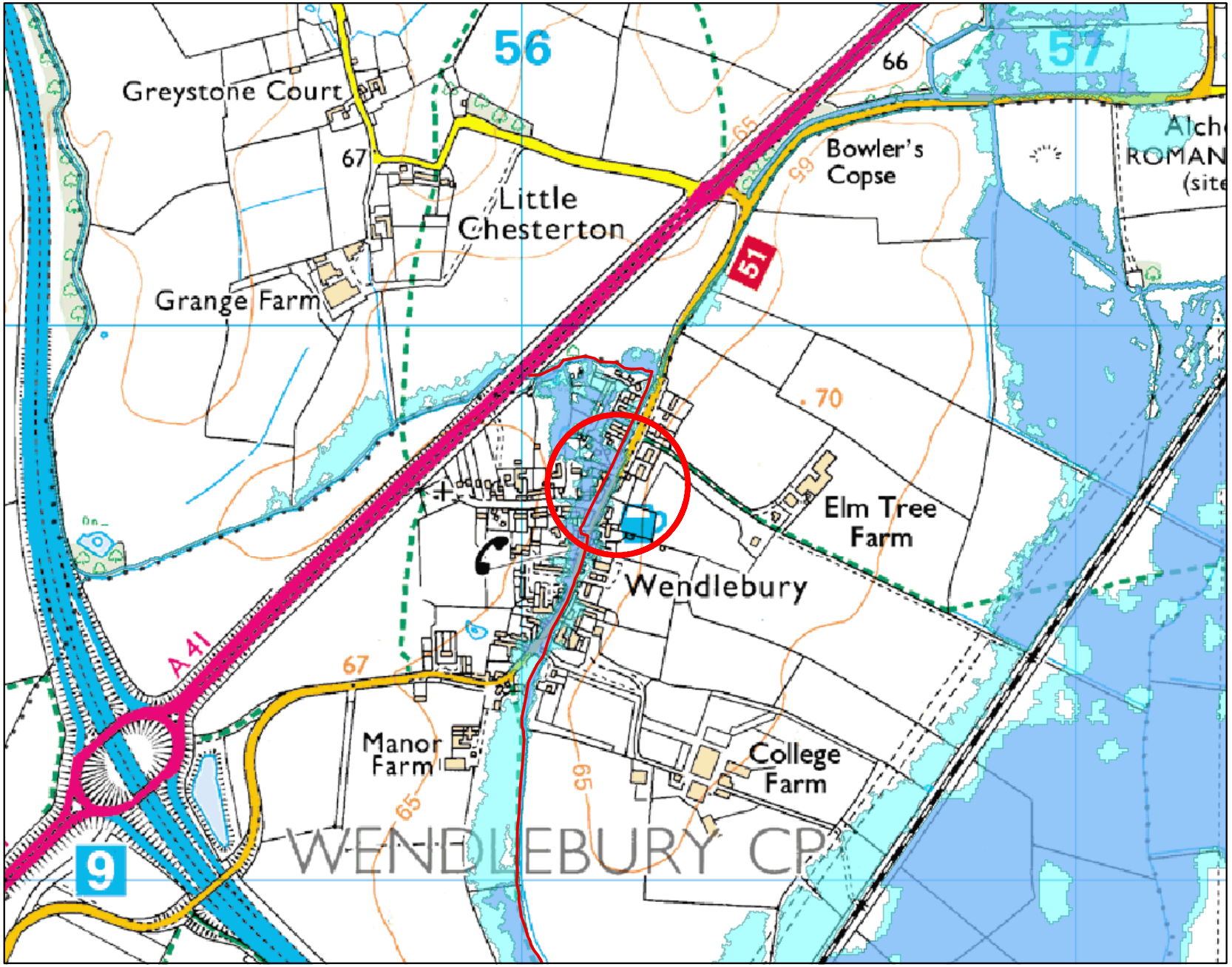
http://www.environment-agency.gov.uk/research/planning/82584.aspx

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

http://www.environment-agency.gov.uk/research/planning/33580.aspx

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

Flood Map centred on 4 Barretts Row, Wendlebury OX25 2PH
Created on 04/09/2014 REF: OX_0896_01



Environment Agency

Kilometres

0 0.125 0.25

Legend

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

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

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

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Defence information

OX_0896_01

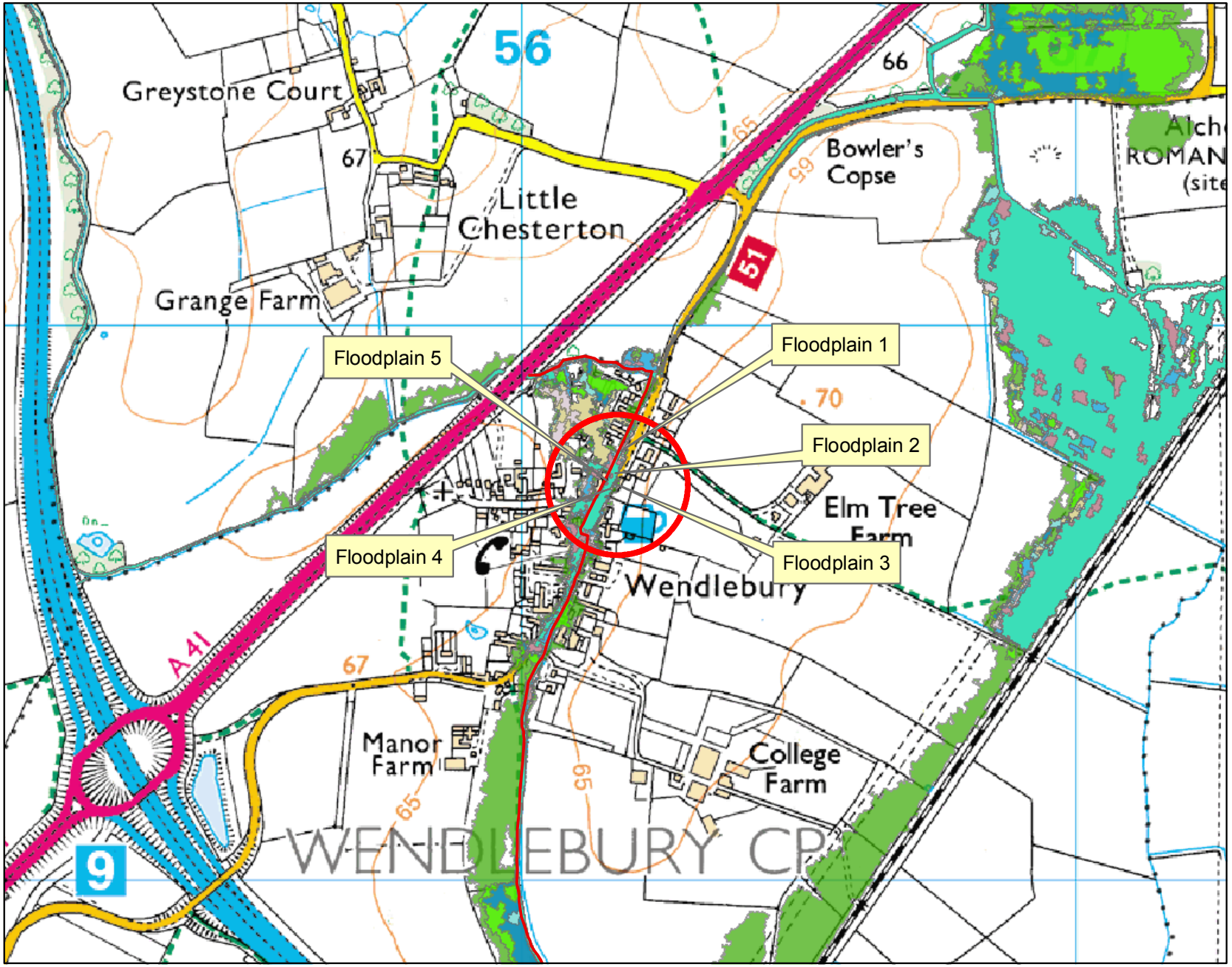
Defence Location:	No defences on Main River
Description:	This location is not currently protected by any formal defences and we do not currently have any flood alleviation works planned for the area. However we continue to maintain certain watercourses and the schedule of these can be found on our internet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

Model information

OX_0896_01

Model:	Wendlebury Brook 2014
Description:	The information provided is from the Wendlebury Brook Flood Mapping Study completed in April 2014. The study was carried out using 2D modelling software (ISIS-Tuflow). Model design runs: 1 in 5 / 20% AEP; 1 in 10 / 10% AEP; 1 in 20 / 5% AEP; 1 in 30 / 3.3% AEP; 1 in 50 / 2% AEP; 1 in 75 / 1.33% AEP; 1 in 100 / 1% AEP, 1 in 100+20% / 1% AEP with climate change and 1 in 1000 / 0.1% AEP. Mapped outputs: 1 in 5 / 20% AEP; 1 in 10 / 10% AEP; 1 in 20 / 5% AEP; 1 in 30 / 3.3% AEP; 1 in 50 / 2% AEP; 1 in 75 / 1.33% AEP; 1 in 100 / 1% AEP, 1 in 100+20% / 1% AEP with climate change and 1 in 1000 / 0.1% AEP. Model accuracy: Levels ± 250mm

Model Map centred on 4 Barretts Row, Wendlebury OX25 2PH
Created on 04/09/2014 REF: OX_0896_01



Environment Agency

Kilometres

0 0.125 0.25

Legend

- Main River
- 20% AEP Flood Outline
- 10% AEP Flood Outline
- 5% AEP Flood Outline
- 3.3% AEP Flood Outline
- 2% AEP Flood Outline
- 1.3% AEP Flood Outline
- 1% AEP Flood Outline
- 1%+CC AEP Flood Outline
- 0.1% AEP Flood Outline

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

1%CC = 1% Climate Change extent
This is the 1% AEP event with an allowance for climate change (+20% on river flows)

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Modelled floodplain flood levels

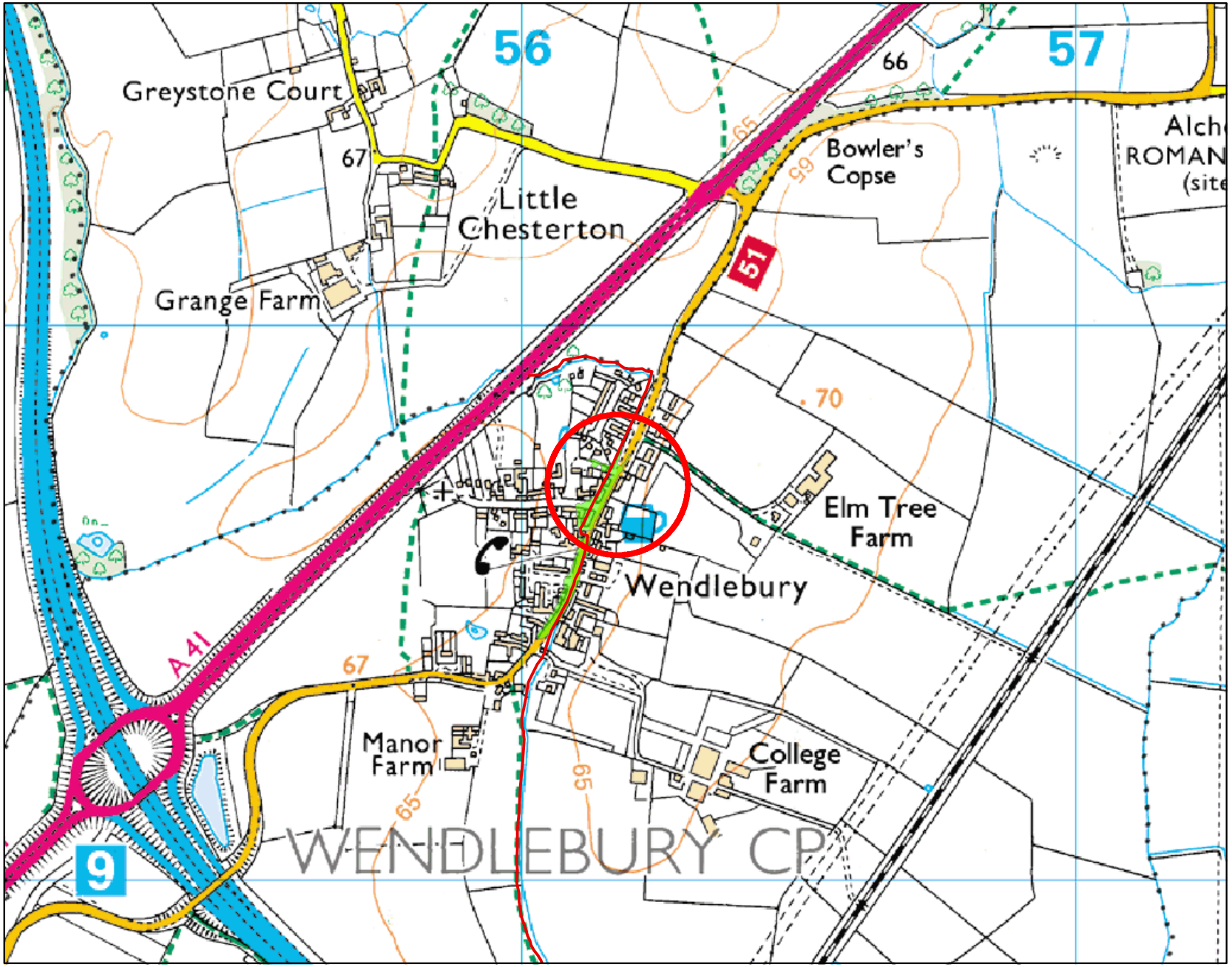
OX_0896_01

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

				flood levels (mAOD)				
2D grid cell reference	Model	Easting	Northing	20% AEP	5% AEP	1% AEP	1% AEP with climate change allowance (+20% on river flows)	0.1% AEP
Floodplain 1	Wendlebury Brook 2014	456,181	219,771	62.91	62.97	63.03	63.07	63.14
Floodplain 2	Wendlebury Brook 2014	456,173	219,730	62.83	62.91	63.00	63.04	63.11
Floodplain 3	Wendlebury Brook 2014	456,167	219,712	0.00	62.89	62.97	63.01	63.08
Floodplain 4	Wendlebury Brook 2014	456,160	219,702	62.78	62.87	62.95	62.99	63.07
Floodplain 5	Wendlebury Brook 2014	456,156	219,718	0.00	62.89	62.98	63.02	63.08

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

Historic Map centred on 4 Barretts Row, Wendlebury OX25 2PH
Created on 04/09/2014 REF: OX_0896_01



Environment Agency

Kilometres

0 0.125 0.25

Legend

Main River

year

2008

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

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

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Historic flood data

OX_0896_01

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

Flood Event Code	Flood Event Name	Start Date	End Date	Source of Flooding	Cause of Flooding
EA061140001	Wendlebury_Fluvial	03/06/2008	10/06/2014	main river	channel capacity exceeded (no raised defences)

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

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

Appendix E – Extract from FD2320/TR2 (FRA guidance for new development)

This table is recommended for development planning and control use.

Table 4 - Hazard to People Classification using Hazard Rating *(HR= d x (v + 0.5) + DF)* for (Source Table 13.1 of FD2320/TR2 - Extended version)

HR	Depth of flooding - d (m)												
	DF = 0.5				DF = 1								
Velocity - v (m/s)	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.0	0.03 + 0.5 = 0.53	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.13 + 0.5 = 0.63	0.15 + 1.0 = 1.15	0.20 + 1.0 = 1.20	0.25 + 1.0 = 1.25	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25
0.1	0.03 + 0.5 = 0.53	0.06 + 0.5 = 0.56	0.12 + 0.5 = 0.62	0.15 + 0.5 = 0.65	0.18 + 1.0 = 1.18	0.24 + 1.0 = 1.24	0.30 + 1.0 = 1.30	0.36 + 1.0 = 1.36	0.48 + 1.0 = 1.48	0.60 + 1.0 = 1.60	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.55
0.3	0.04 + 0.5 = 0.54	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.19 + 0.5 = 0.69	0.23 + 1.0 = 1.23	0.30 + 1.0 = 1.30	0.38 + 1.0 = 1.38	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	1.13 + 1.0 = 2.13	1.50 + 1.0 = 2.50	1.88 + 1.0 = 2.88
0.5	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.25 + 0.5 = 0.75	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	2.50 + 1.0 = 3.50
1.0	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.38 + 0.5 = 0.88	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	2.25 + 1.0 = 3.25	3.00 + 1.0 = 4.00	3.75 + 1.0 = 4.75
1.5	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.50 + 0.5 = 1.00	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	2.00 + 1.0 = 3.00	3.00 + 1.0 = 4.00	4.00 + 1.0 = 5.00	5.00 + 1.0 = 6.00
2.0	0.13 + 0.5 = 0.63	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	0.63 + 0.5 = 1.13	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.75	6.00	7.25
2.5	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.60 + 0.5 = 1.10	0.75 + 0.5 = 1.25	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	1.80 + 1.0 = 2.80	3.40	4.00	5.50	7.00	8.50
3.0	0.18 + 0.5 = 0.68	0.35 + 0.5 = 0.85	0.70 + 0.5 = 1.20	0.88 + 0.5 = 1.38	1.05 + 1.0 = 2.05	1.40 + 1.0 = 2.40	1.75 + 1.0 = 2.75	3.10	3.80	4.50	6.25	8.00	9.75
3.5	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.80 + 0.5 = 1.30	1.00 + 0.5 = 1.50	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	3.00	3.40	4.20	5.00	7.00	9.00	11.00
4.0	0.23 + 0.5 = 0.73	0.45 + 0.5 = 0.95	0.90 + 0.5 = 1.40	1.13 + 0.5 = 1.63	1.35 + 1.0 = 2.35	1.80 + 1.0 = 2.80	3.25	3.70	4.60	5.50	7.75	10.00	12.25
4.5	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	1.00 + 0.5 = 1.50	1.25 + 0.5 = 1.75	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.00	5.00	6.00	8.50	11.00	13.50
5.0	0.28 + 0.5 = 0.78	0.60 + 0.5 = 1.10	1.10 + 0.5 = 1.60	1.38 + 0.5 = 1.88	1.65 + 1.0 = 2.65	3.20	3.75	4.30	5.40	6.50	9.25	12.00	14.75

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