



RIDGE

**BLUEGATES FARM
FLOOD ACTION PLAN**

May 2023

BLUEGATES FARM FLOOD ACTION PLAN

May 2023

Prepared for



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1. PROPERTY DETAILS

1.1. Introduction

The proposed dwellings at Bluegates Farm is for a three unit residential building. This document is prepared as a Flood Action plan to review the site and confirm Hazards associated with flooding events specific to the site and actions to take running up to and after a flood event. As it is proposed to be residential dwellings, a proposed maximum number of occupants is suggested to be 24 allowing for visitors with the usual number of people at 8. This does not take in to account the occupancy of the adjacent farm or existing dwelling houses.



Figure 1 - Site Location Plan

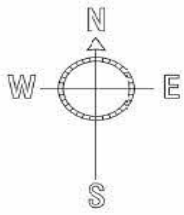


Figure 2 – Proposed Site Layout Plan

1.2. Key locations

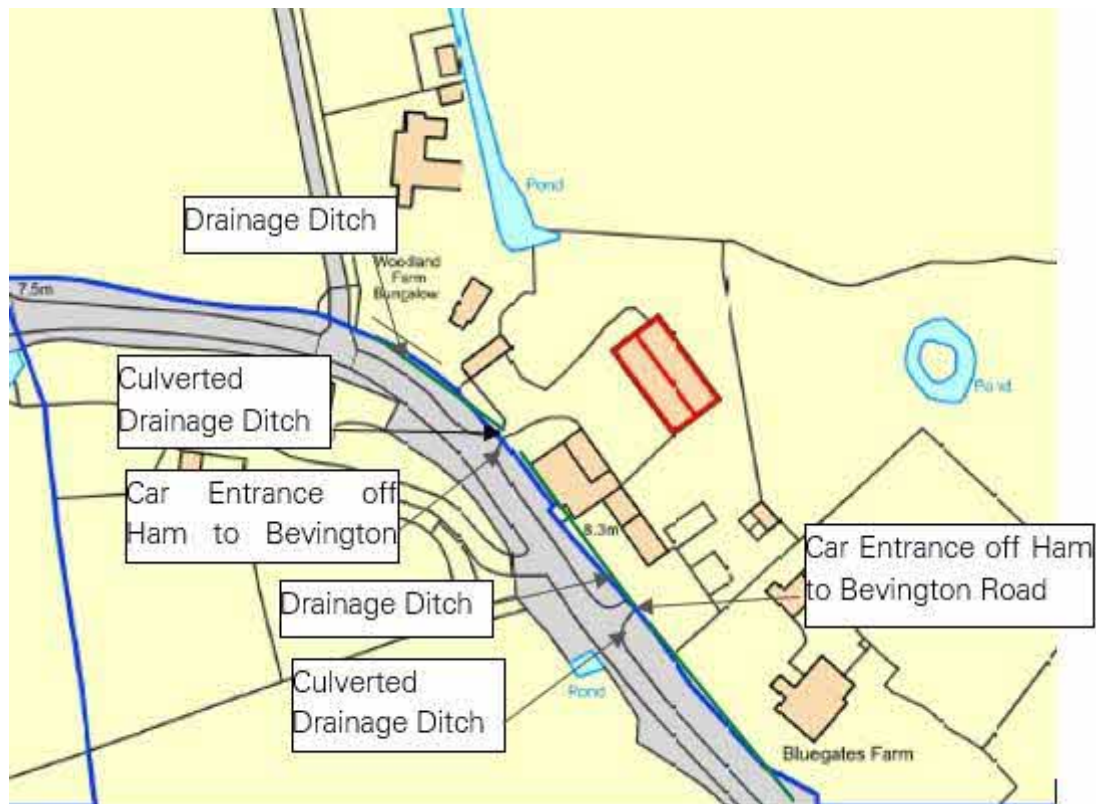


Figure 3 - Key Locations Plan

The key locations around the converted barn are shown in the above figure. Of particular importance is the drainage ditch which is between the road and the site as any flooding of these will rapidly hinder the access to and from the site.

1.3. Infrastructure & utilities

Each property will have electricity & water main supplies, surface water and foul water drainage. The existing electricity supplies will also serve the farm buildings and existing dwellings. The water main for the proposed conversion will be a junction off the existing supply for the Units 1 to 3. No overhead cables are present crossing the dwelling site with the supply coming in from the East via overhead cables. The local water is supplied by Severn Trent Water with Waste Water services provided by Wessex Water. Wessex Water have confirmed that they do not have any assets crossing the site as the site is to be served by a private cess pit.

1.4. Normal access routes

The dwellings will normally be accessed via access on the road between Ham and Bevington. This road access passes over a culverted drainage ditch. The route to Ham takes you from the property at approximately 8mAoD up to approximately 16mAoD. There are a number of low points along the route, but these are not lower than the dwelling.

The dwelling can also be accessed from the road from Bevington. This route is much flatter and does not provide any gain in elevation from the proposed dwelling.

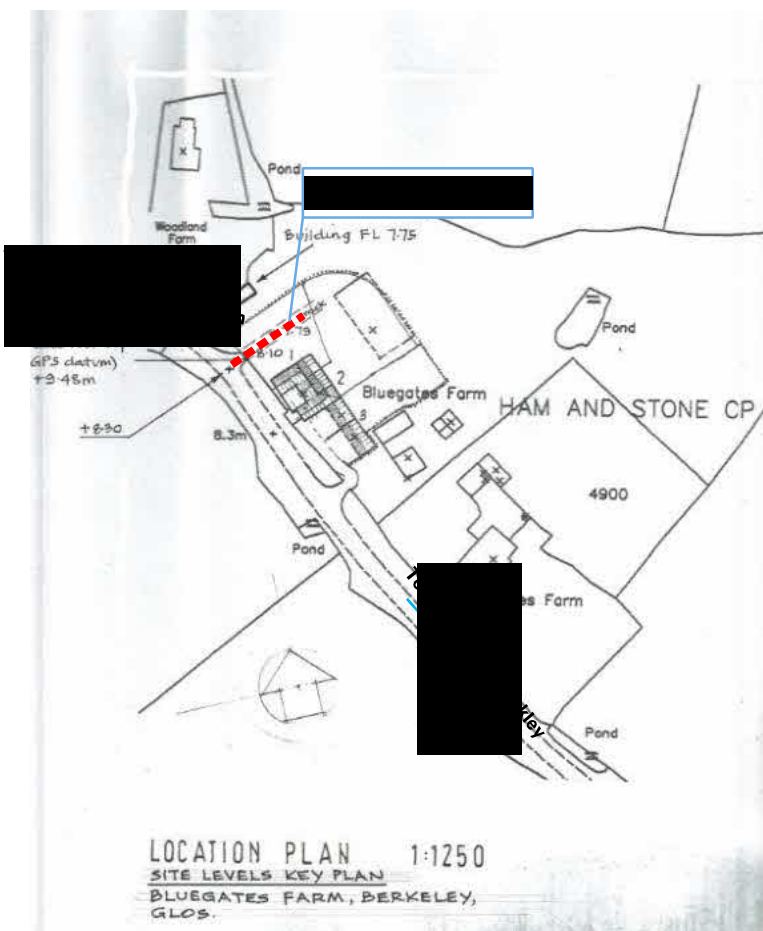


Figure 4 - Existing Access Routes Plan

2. RISK ASSESSMENT

ELEMENT	HAZARD	AT RISK	MITIGATION	RESIDUAL RISK
Groundwater flooding	Water supply contamination	Resident/ Visitors	Contact to be made with Water Authority prior to using tapped water	Local water pipes may become contaminated from ground water which may be unknown to the Water Authority.
Surface Water on access from road	Access route to and from dwelling becoming flooded. Cars becoming stranded.	Resident/ Visitors/ Building	Surface water ditch to be maintained. Headwalls to be checked for blockages before and after storm events. Alternative access route maintained. Grass verge to be maintained to direct flow away from building.	Heavy storm events may still block the access routes.
Surface Water in parking area	Ponding against building	Building	Local external levels to be designed with falls away from the building to minimise ponding, in conjunction with specific building waterproofing details which allow ponding of water against building edge.	Over a very long period of time repeated ponding may still cause issues
Tidal Flooding – 1 in 200 plus climate change level is 10.76mAOD	Access and building including fabric and contents	Building/ Resident/ Visitors	Building to be designed in line with outcomes from Flood Risk Assessment appended to the Flood Action Plan. Sleeping accommodation is to be above the 10.76mAOD level. Residents to evacuate during storms events and refuge sort in the upper floors of the properties as a last resort.	Items & the building fabric on ground floor may become damaged in the tidal flooding event which may need replacement
Sewer flooding	Surrounding site and within property may become flooded with raw sewerage	Resident/ Visitors/ Building	Non return valve to be included on the new run from the dwellings to the Cess Pit. Non return valve to be checked before and after any storm event. Covers to be sealed to prevent flood water ingress.	Failure of NRV during a flood may still occur.

3. PRE-FLOODING ACTIONS

3.1. Flood Alert

The site is to be registered with the Environment Agency to receive Flood Alerts and Warnings. This can be undertaken at <https://www.gov.uk/sign-up-for-flood-warnings>. or phone alerts can be set up by contacting

The site is located within the following flood warning areas:

Flood Alert – Severn Estuary at Oldbury-on Severn.

Flood Warning – Severn Estuary from Sharpness to Oldbury-on-Severn, Clapton, Hill and Nupdown areas.

On receipt of the Flood Alert, the residents are to:

prepare a bag that includes medicines and insurance documents

bring in outdoor possessions where possible

check that the access route is clear and the drainage ditch is free from blockages

check flood warnings

3.2. Flood Warning/Severe Flood Warning

On receipt of a Flood Warning or Severe flood warning, Turn off gas, water and electricity. Move as many items as possible upstairs. It is then recommended that preparations are made to evacuate from the site to higher ground.

4. EVACUATION PROCEDURES

Always follow local advice up to date from the EA and Emergency Services on evacuation procedures for each flooding event. However, should it be deemed that it is safer to evacuate the site than remain, then the following procedure should be followed.

Check with local emergency services if the proposed evacuation route is clear prior to evacuation. Should the site be at risk of being flooded imminently, ensure that the gas, water and electricity supplies have been turned off where possible and safe to do so. If there is time, move electrical items and items which would be damaged by water on to worktops or raised areas.

The dwellings will normally be exited via the access point on the road between Ham and Bevington. This route passes over the drainage ditch, before proceeding check that the route is clear of standing water or the depth has been confirmed as suitable to leave the site by vehicle. Then take the road to Ham which takes you from the property at approximately 8mAoD up to approximately 16mAoD which is above the 1 in 200 yr flood level for the area. Refuse should be sought at the Public House in Ham.

5. POST FLOODING ACTIONS

After flooding has occurred there will be a number of actions the residents will need to take to ensure the properties are safe to return to.

Only return to the property if the local authorities have confirmed the flood risk has passed and that it is safe to return. Attend the dwellings during the daytime so that lights are not required. Use battery-powered Torches, rather than candles or gas lanterns.

Standing water in may be present within the dwellings. The main power should be switched off from a dry location. If you must enter standing water to access the main power switch, then call an electrician to turn it off. Do not attempt to turn power on or off yourself or use an electric tool or appliance while standing in water. Have an electrician check the house's electrical system before turning the power on again.

If you smell gas or suspect a leak, turn off the main gas valve, open all windows, and leave your house immediately. Notify the gas company, and do not turn on the lights or do anything that could cause a spark. Do not return until you are told it is safe to do so.

If the area has been flooded, it also may be contaminated with sewage. A specialist contractor should be contacted to decontaminate the area.

You should confirm with Severn Trent any specific actions that need to be undertaken as the local water supply may have become contaminated during the flood event. If in doubt only use bottled water until confirmation has been received.

If the dwellings have been closed up for several days, enter briefly to open doors and windows to let the house air out for a while (at least 30 minutes) before you stay for any length of time. If your home has been flooded and has been closed up for several days, assume your home has mould.

Contact should be made with your insurers to confirm the assistance they offer. Contact should also be made with the National Flood Forum to assist with recovering after the flood. They can be contacted on 01299 403 055.

6. BRIEFING/TRAINING/UPDATING

All residents should have access to this Flood Action Plan as part of any purchase. The plan should be updated when any access routes or local factors around the site are changed. This plan should be reviewed at least every three years or sooner if required.

APPENDIX 1 – ENVIRONMENT AGENCY WARNING CODES

Flood Warning Codes

What the flood warning codes mean and what action to take.

Four codes are used for flood warnings. They can be issued in any order, usually ending with an 'all clear'.

Flood Alert



What it means

Flooding is possible. Be prepared.

When it's used

Two hours to two days in advance of flooding.

What to do

- Be prepared to act on your flood plan.
- Prepare a flood kit of essential items.
- Monitor local water levels and the flood forecast on our website.

Flood Warning



What it means

Flooding is expected. Immediate action required.

When it's used

Half an hour to one day in advance of flooding.

What to do

- Move family, pets and valuables to a safe place.
- Turn off gas, electricity and water supplies if safe to do so.
- Put flood protection equipment in place.

Severe Flood Warning



What it means

Severe flooding. Danger to life.

When it's used

When flooding poses a significant threat to life.

What to do

- Stay in a safe place with a means of escape.
- Be ready should you need to evacuate from your home.
- Co-operate with the emergency services.
- Call 999 if you are in immediate danger.

Warnings no longer in force

What it means

No further flooding is currently expected in your area.

When it's used

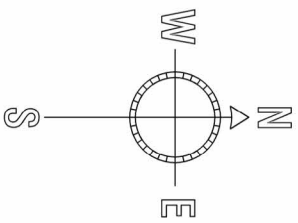
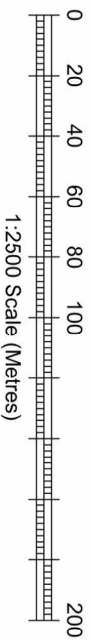
When river or sea conditions begin to return to normal.

What to do

Be careful. Flood water may still be around for several days.

If you've been flooded, ring your insurance company as soon as possible.

APPENDIX 2 –SITE PLAN



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Site Location Plan

Scale 1:2500 @ A4

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Rev.	Description	By	Date

Client

Project

Bluegates Farm Dutch Barn

Drawing Title

Site Location Plan
Clapton, Berkeley, Gloucestershire.
GL13 9QU

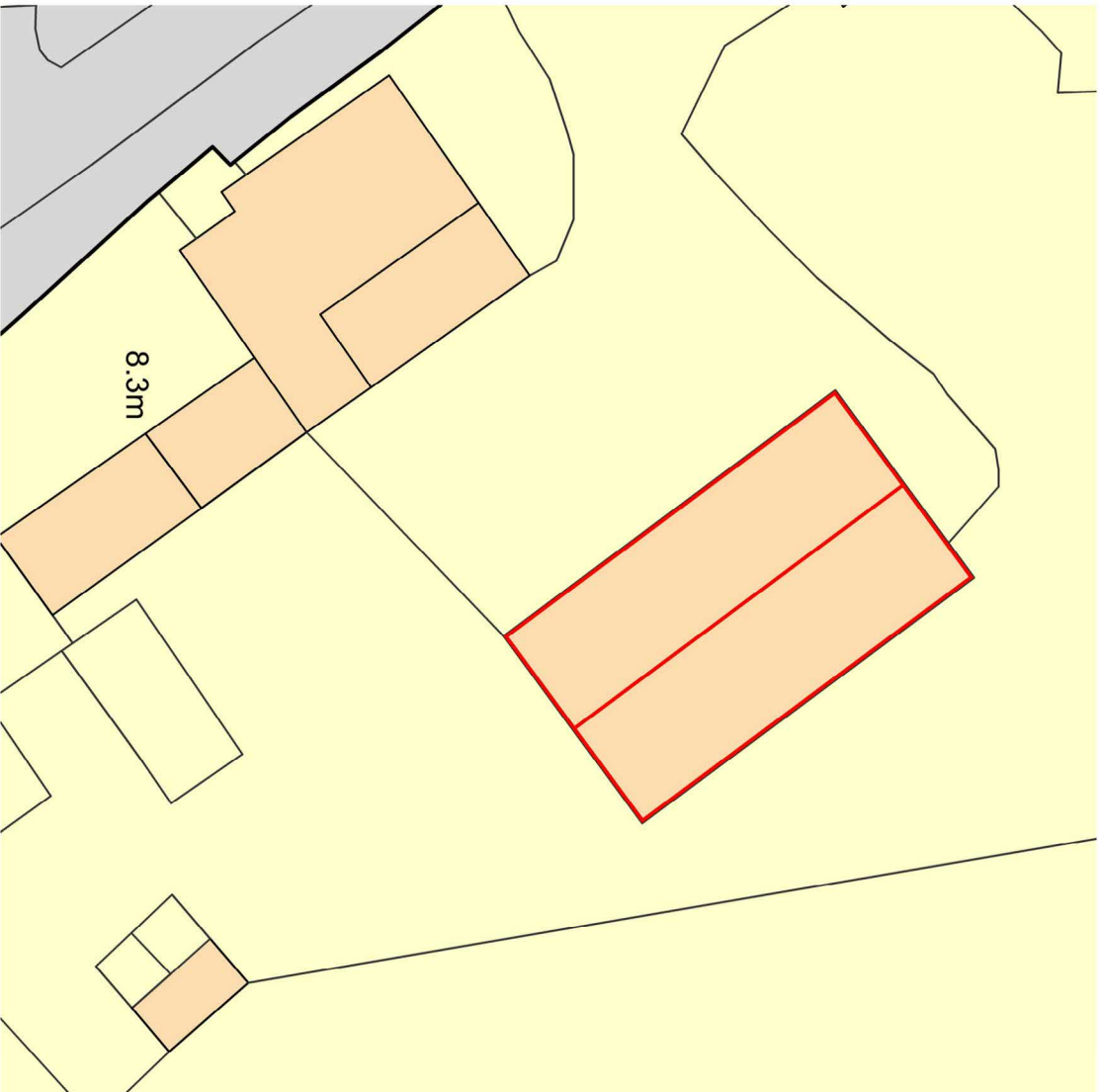
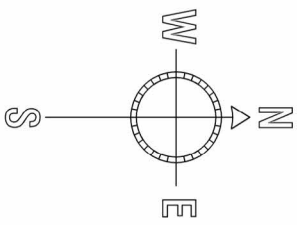
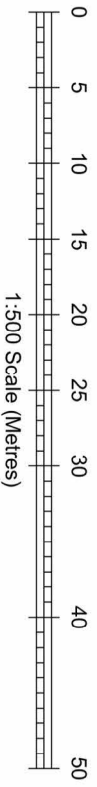
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Drawing Status
Planning

Drawn	Checked
PJP	
Date	Rev.
May'23	



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Block Plan

Scale 1:500 @ A4

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Rev.	Description	By	Date

Client

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Block Plan
Clapton, Berkeley, Gloucestershire.
GL13 9QU

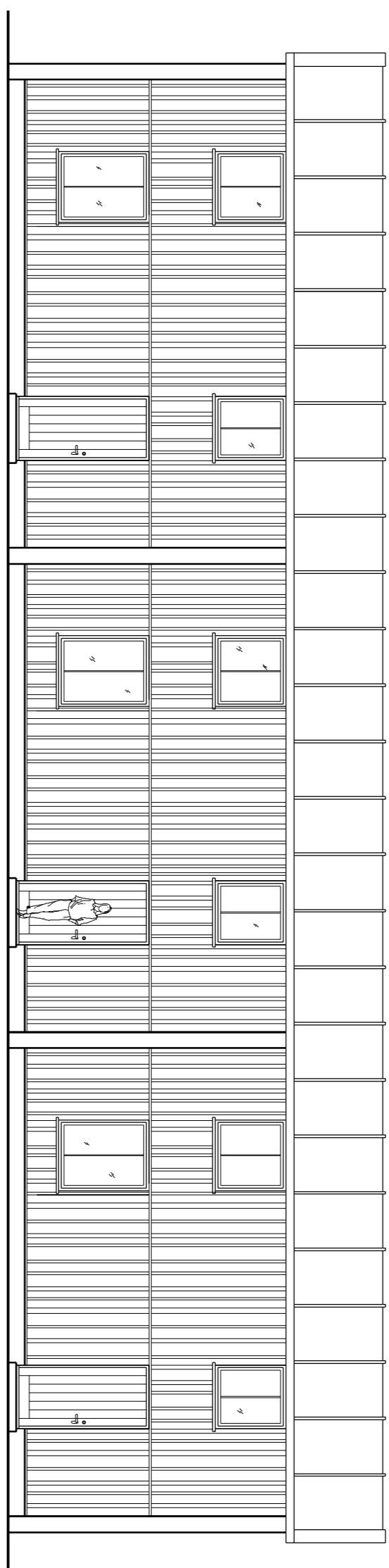
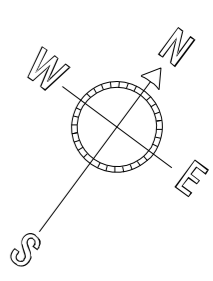
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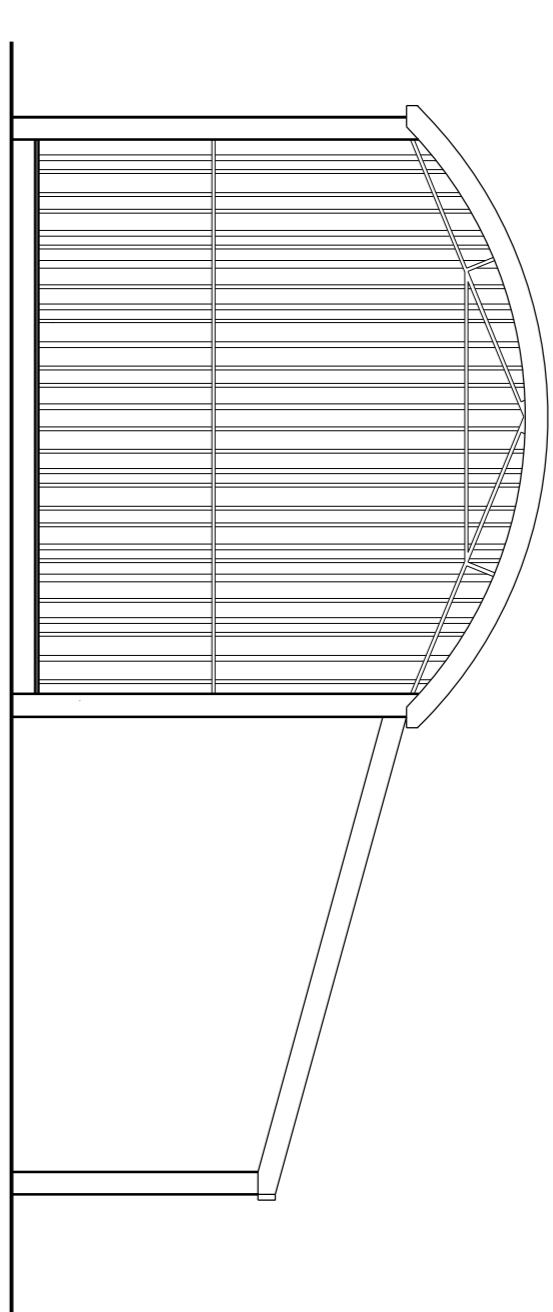
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PJP	.
Date	Rev.
May'23	.



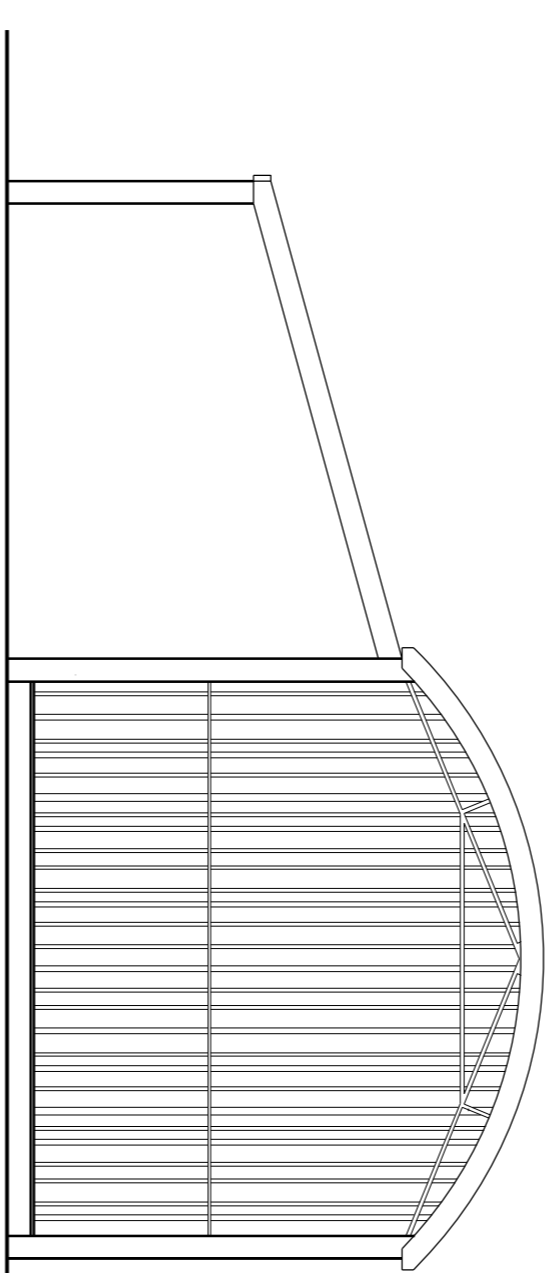
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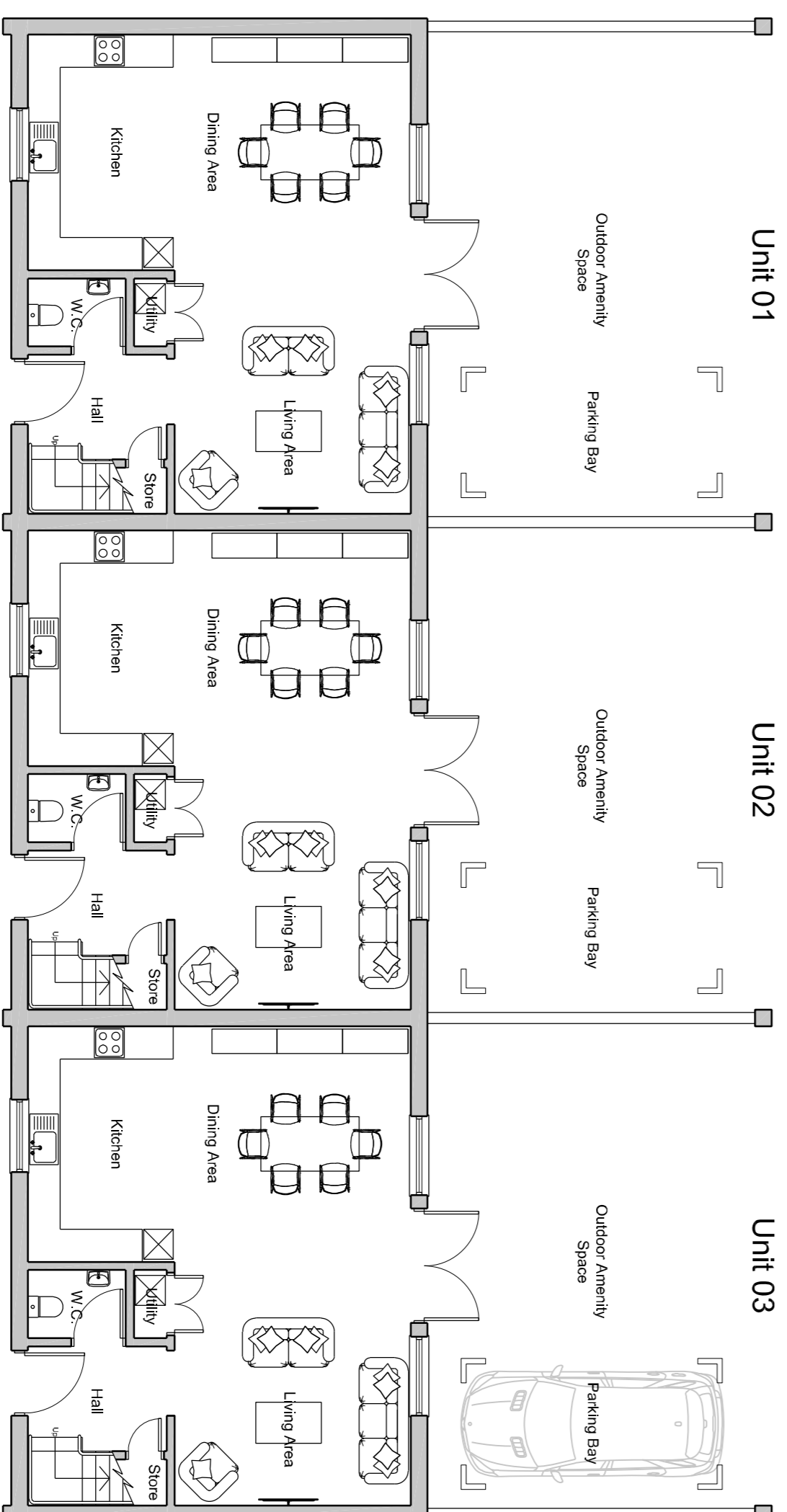
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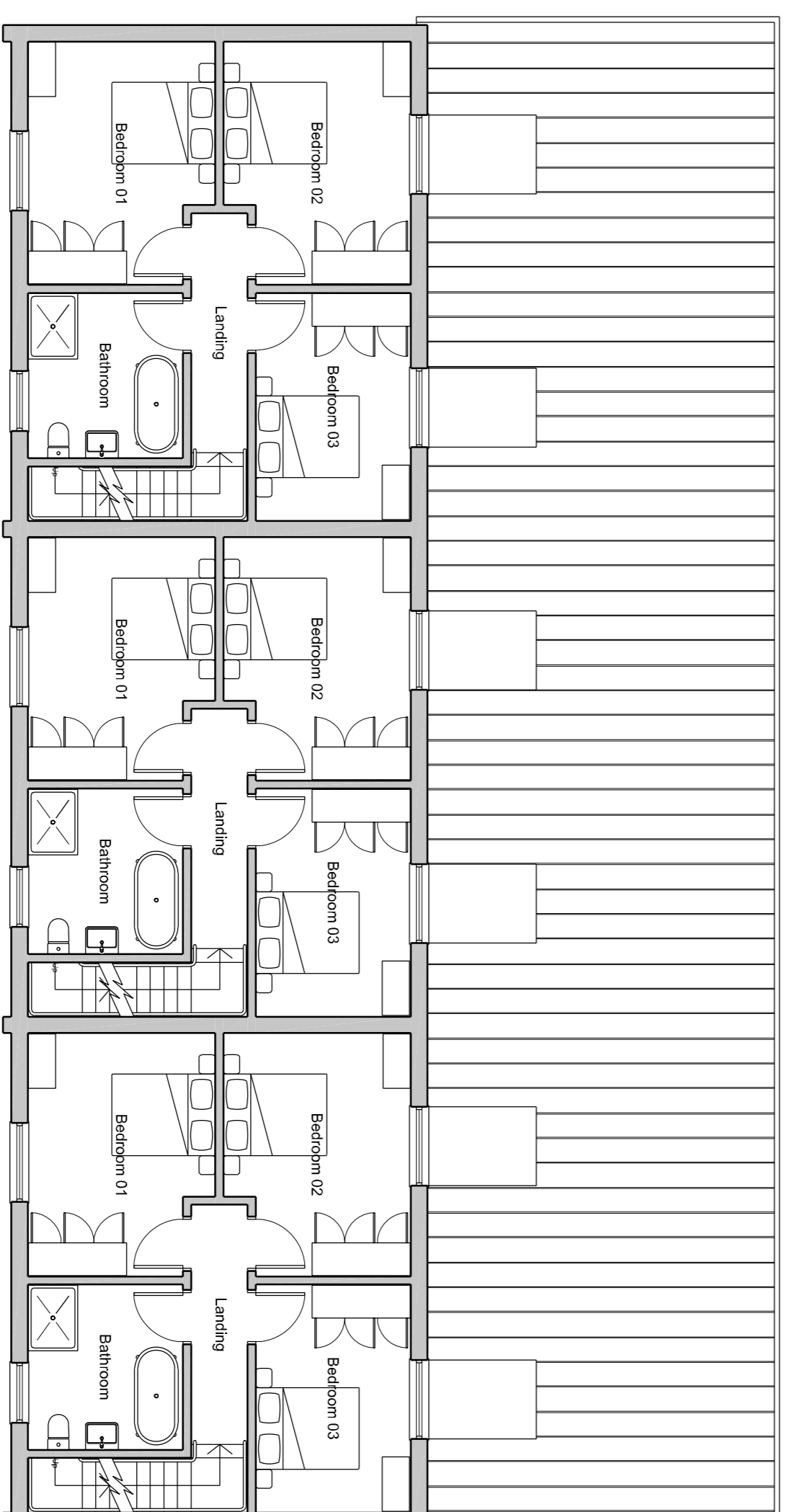
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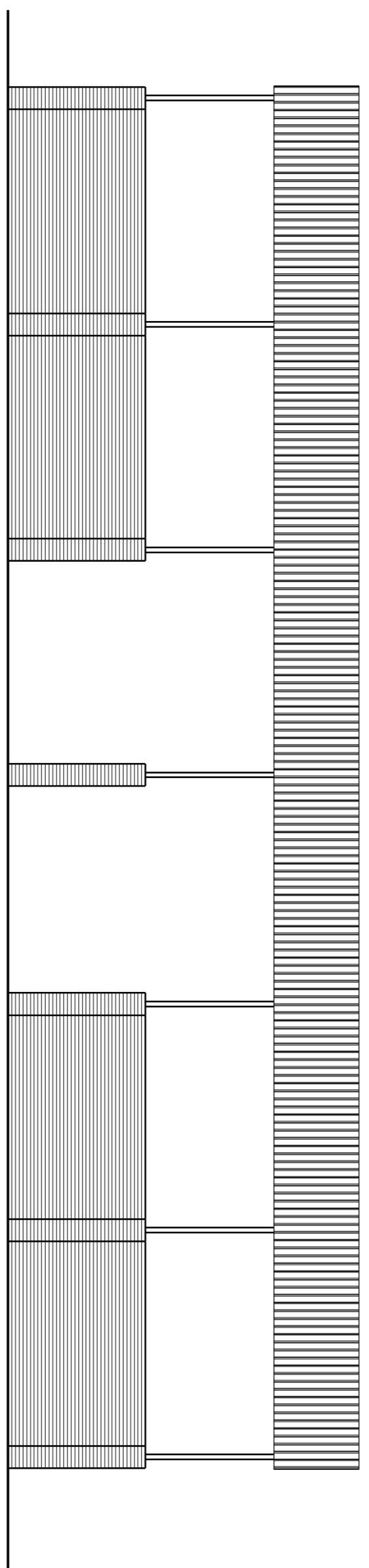
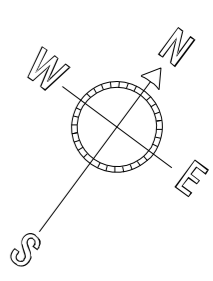
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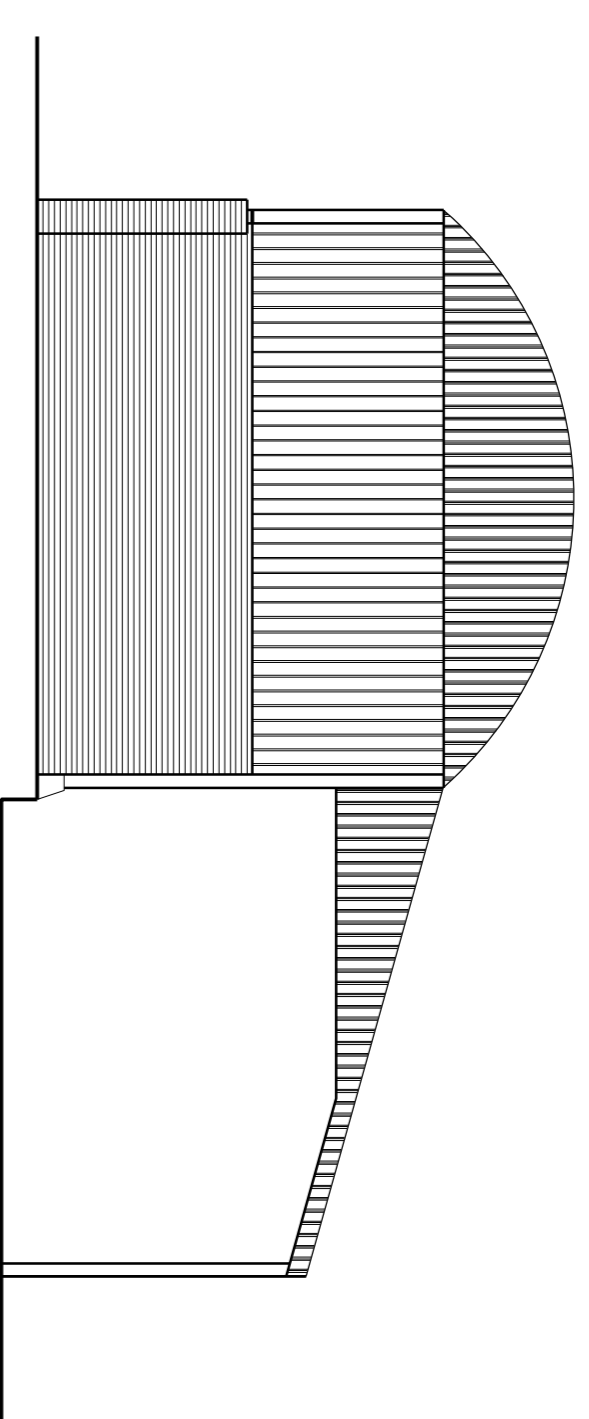
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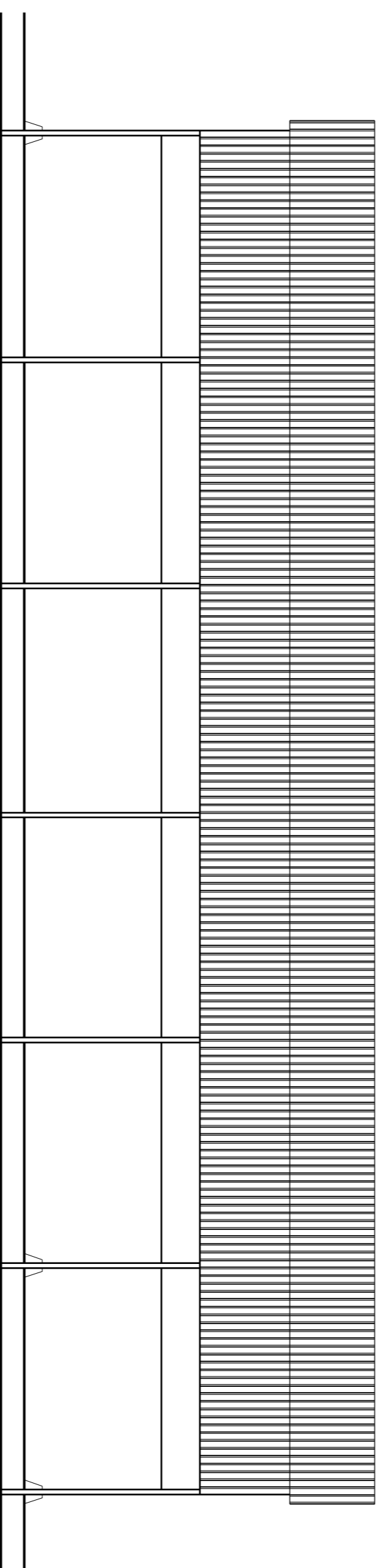
Proposed First Floor Plan
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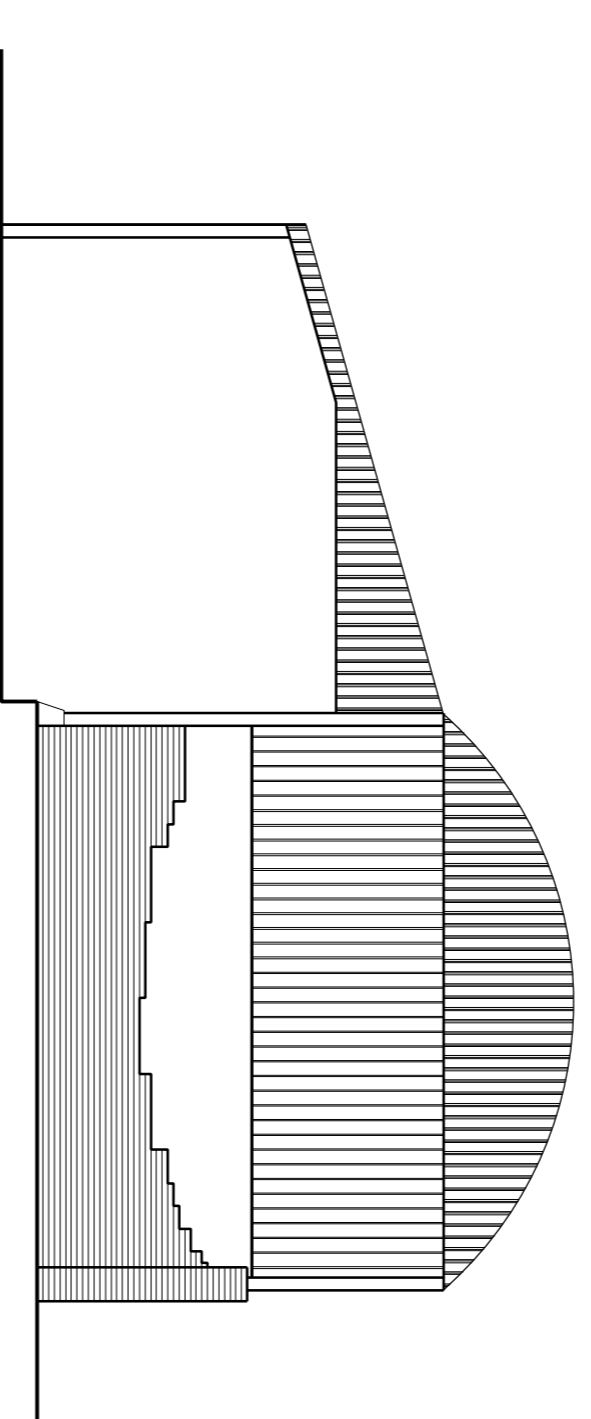
Existing South West Elevation
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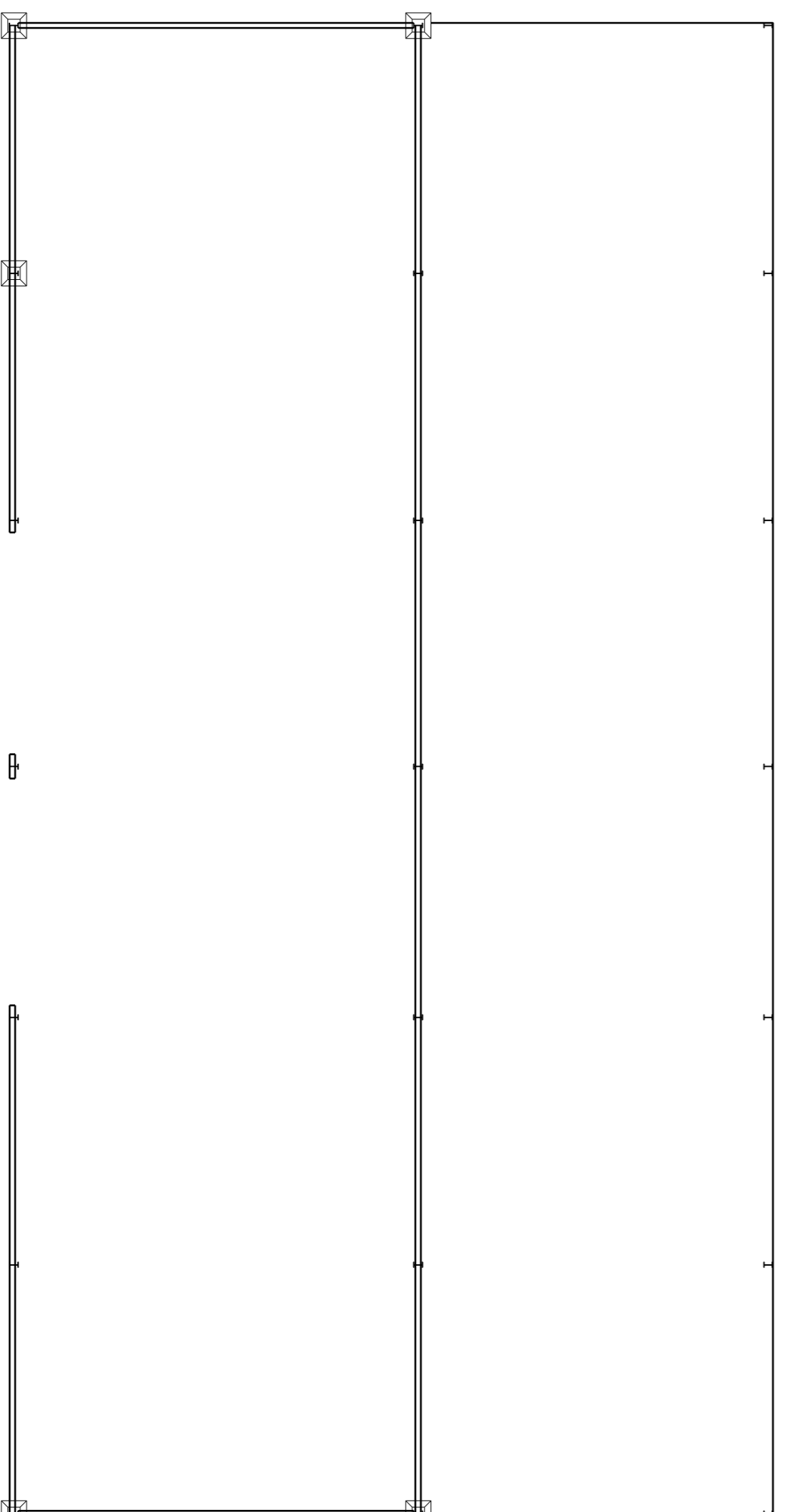
Existing South East Elevation
Scale 1:100 @ A1



Existing North East Elevation
Scale 1:100 @ A1



Existing North West Elevation
Scale 1:100 @ A1



Existing Ground Floor Plan
Scale 1:100 @ A1

No.	Description	By	Scale

Client
Blugates Farm Dutch Barn

Project
Blugates Farm Dutch Barn

Drawing Title
Existing Ground Floor Plan and Elevations

Location
Clapton, Berkeley, Gloucestershire.

Drawing No.
BLSXXX-EX000

Scale
1:100 @ A1

Drawn
PJP

Date
May 23

Rev.

gleeds

Gleeds Building Surveying Ltd, Unit 17, 2000, Parkway

APPENDIX 3 –FLOOD RISK ASSESSMENT



Flood Risk Assessment

Bluegates and Woodlands Farms, Clapton, Berkeley

Date
Prepared by

23/11/2017



Prepared by ... [REDACTED]
Date 23/11/2017
Version 1.0



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1.0 Introduction

1.1 Introduction

1.1.1 [REDACTED] Hydrologists Limited has been commissioned by T.A. Davis & Son to undertake a Flood Risk Assessment of two barns, one at Woodlands Farm and one at Bluegates Farm, Clapton, Berkeley, GL13 9QU. A Flood Risk Assessment is required for a change of use Planning Application to convert the Barns from agricultural use to domestic dwellings.

1.2 Location

- 1.2.1 The site is located in Berkeley, which is north east of Thornbury, south east of Lydney, west of Dursley and south west of Stroud.
- 1.2.2 Specifically, the barns are located on the neighbouring Farms of Woodlands and Bluegates south west of Berkeley. The farms are north of Bevington, west of Ham and east the River Severn.
- 1.2.3 A National Grid Reference for the Woodlands Farm barn is ST 66166 98279 and for the Bluegates Farm barn is ST 66360 98058. A post code for the area of interest is GL13 9QU.

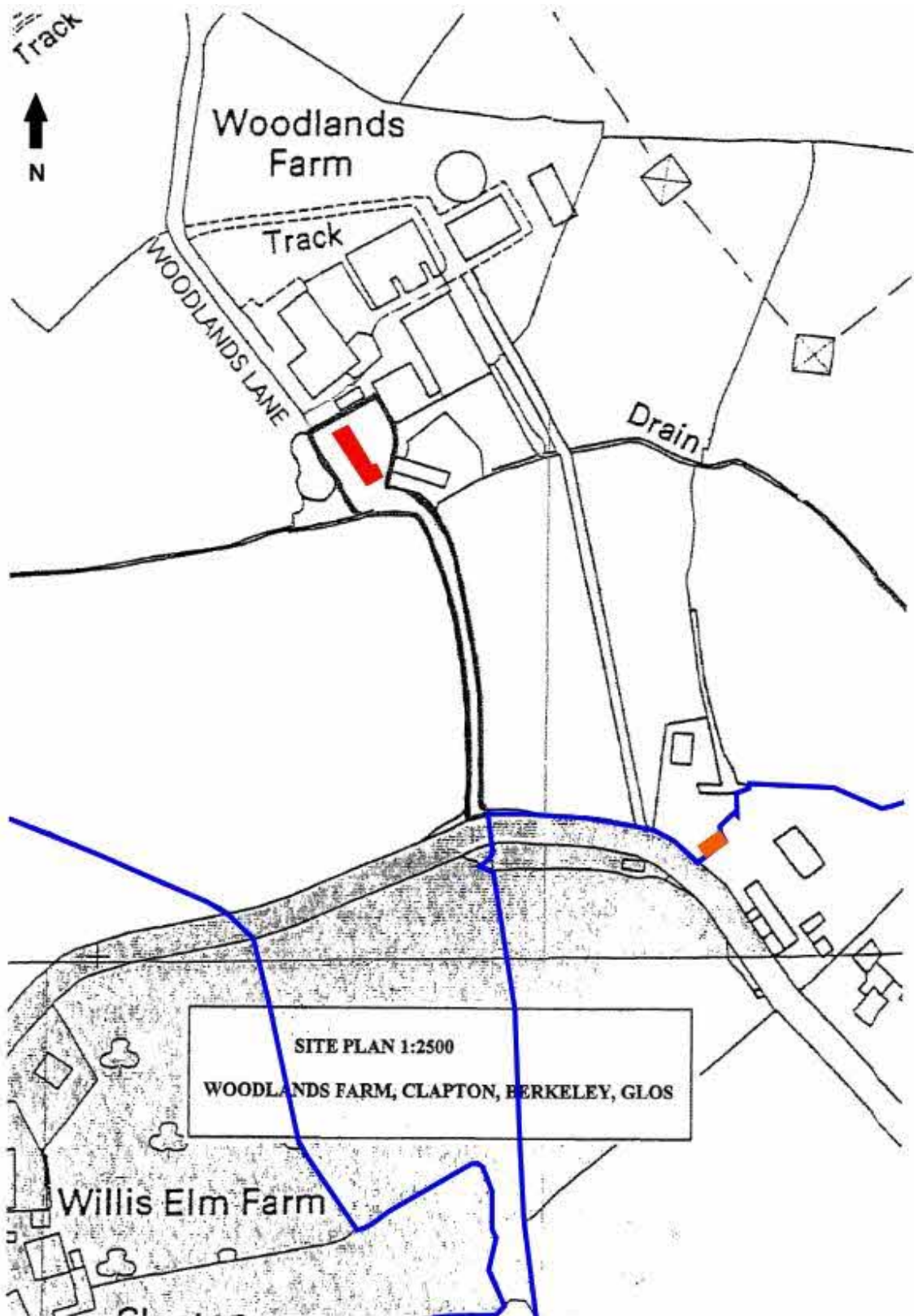


Figure 1: Site Location plan

1.3 Aims and Objectives

- 1.3.1 This report aims to provide an assessment of flood risk in line with National Planning Policy Framework for the purpose of accompanying a Planning Application for a change of use from agricultural to domestic dwelling for the barns.
- 1.3.2 The objectives of this report are to review available information about geology, topography and hydrology local to the site and subsequently assess the risk of flooding from a range of sources based on this information and consultation with relevant authorities. Recommendations will be made, where necessary, to manage and/or mitigate any flood risks identified.

2.0 Development Description and Background

2.0.1 The following section provides a description of the existing and proposed site layout. Background information about topography, geology and hydrology of the site and surrounding area are also detailed to provide a baseline to the Flood Risk Assessment.

2.1 Development Site Description

2.1.1 The barn at Woodlands Farm is located adjacent to the existing farm house and south of the working farm buildings and other buildings at the site used for industrial purposes. The barn at Bluegates Farm is located near to derelict buildings that are undergoing renovation works to fulfill a granted Planning Application for change of use from agricultural to domestic dwellings. The position of the barns at Woodlands Farm and Bluegates Farm are illustrated in Figure 1.

2.1.2 The River Severn Estuary is located approximately 1km to the north west of the site. Here the River Severn channel sands are known as Lydney Sand. Also notable are a number of Drains, which flow into the River Severn Estuary.

2.1.3 It is proposed that the two barns undertake a change of use from agricultural to domestic dwelling, therefore, in line with the National Planning Policy Framework, the buildings post-development would be classified as "*More Vulnerable*", based on the flood risk vulnerability classification outlined in Table 2 of the National Planning Policy Framework (Communities and Local Government, 2014).

2.1.4 The footprint of the barn at Woodlands Farm is approximately 191m² and at Bluegates Farm is approximately 35m². It is noted that post-development it is proposed that the built footprint remain as existing post-development.

2.2 Development Site Background

2.2.1 Topography

2.2.2 A site visit was undertaken to the barns on 22nd May 2017. Whilst on site observations were made regarding relative topography of the sites and surrounds and this is described in the paragraphs below.

2.2.3 Woodlands Farm is located north of the Berkeley Road, along Woodlands Lane. Woodlands Lane runs north from Berkeley Road to Woodlands Farm house then continues on in front of the Farmhouse in a westerly direction and then runs north along the western side of the Barn proposed for conversion. The Barn proposed for change of use is located in the south west corner of the Farm, adjacent and to the west of the Farmhouse.

2.2.4 Woodlands Lane decreases in elevation from the Berkeley Road towards Woodlands Farm. Elevations were observed to be lowest near the eastern end of the Farmhouse. There was a decrease in elevations in an easterly direction along the Woodlands Lane in front of the Farmhouse. The Woodlands Lane, as it passes the Barn proposed for conversion, decreases in elevation in a north westerly direction.

2.2.5 Bluegates Farm is located on the Berkeley Road. The Barn proposed for change of use is located in the north west corner of the Farm, near the entrance to the Farm. The entrance into the Farm slopes down from the Berkeley Road and into the yard in front of the Barn proposed for change of use.

2.2.6 A topographic surveys of Woodlands Farm and Bluegates Farm have been undertaken [REDACTED] (Appendix A; received 09/08/17). The topographic survey of Woodlands Farm indicates a finished floor level of 7.06mAOD at the barn at Woodlands Farm (Appendix A). Levels on Woodlands Lane are illustrated as decreasing from south to north as it passes the barn from 6.92mAOD to 6.80mAOD (Appendix A). The topographic survey of Bluegates Farm indicates a finished floor level of 7.75mAOD at the barn at Bluegates Farm (Appendix A). The topographic survey indicates that the Berkeley Road at the entrance to Bluegates farm is at an elevation of 8.30mAOD (Appendix A). At the entrance into Bluegates Farm the topographic survey indicates an elevation of 8.10mAOD that decreases to 7.79mAOD into the site (Appendix A).

2.2.7 Geology

2.2.8 Available mapping for the area of interest was reviewed, namely the British Geological Survey maps of England and Wales, Solid and Drift Geology Sheets 250 and 251. These maps indicate that the Woodlands Farm is underlain by "*Estuarine Alluvium*" and the Bluegates Farm is located on the boundary of "*Estuarine Alluvium*" with "*Keuper Marl*" (British Geological Survey, 1970).

2.2.9 South of both of the Farms is Deer Park, which is located on a hill comprised of Triassic, Keuper / Rhaetic Marls ("*Tea Green Marl*" and "*Keuper Marl*") and Mainly Clay, as well as Jurassic, Lower Lias Mainly Clay (British Geological Survey, 1970).

2.2.10 North - north west of the site the Environment Agency River Severn defences tie into higher ground, which a review of the British Geological Survey mapping indicates is comprised of an outcrop of "*Keuper Marl*" and "*Head*" (British Geological Survey, 1981)

2.2.11 The Environment Agency was consulted regarding Groundwater Source Protection Zones and Aquifer Designations at the sites; their response indicates that the Farms are not underlain by either (Environment Agency Correspondence, 18/05/17, Appendix B).

2.2.12 **Hydrology**

2.2.13 The River Severn flows in an overall north east to south west direction, north west of the site. The River Severn, near the site, is considered to be Estuary.

2.2.14 There are drains and ditches located along field boundaries and roads in the vicinity of the site. It is understood from the Client that the Internal Drainage Board take care of the main ones and that the rest are left to the Client who maintains them on a regular bi-annual basis and as they require attention. The Bluegates and Woodlands Farms are considered to be located within the catchment of the Conigre Pill.

2.2.15 There was observed to be a pond adjacent and to the west of the Barn at Woodlands Farm. It is understood from the Client that this is groundwater fed and is associated with a historic use by the Farm.

2.2.16 A concrete, water filled, open feature was observed whilst on site. It was located between the west wall of the Barn at Woodlands Farm and the Woodlands Lane. The details of this feature are currently unknown, but are considered likely to be associated with the historic usage as a working farm building.

2.2.17 **History of Flooding**

2.2.18 The Environment Agency was consulted regarding historic flooding; their response directed [redacted] Hydrologists Limited to the online database (Figure 6). A review of the historic flood outlines centered over the two Farms indicates that flooding during **1968** occurred in the vicinity of the Woodlands Farm. This flood did not extend as far as Bluegates Farm. Other events in **April 2012** and **November 2000** affected the Little Avon catchment in and around Berkeley; the Woodlands and Bluegates Farms are not shown to have been affected.

2.2.19 The SFRA highlights that tide-locking combined with high river flows can lead to flooding in the rural areas south west of Berkeley. In addition, risk of flooding due to surface water flooding is also discussed.

2.2.20 The Client has advised that the main ditches are looked after by the Internal Drainage Board and that the rest are left to the Client. It is understood from the Client that there are no known issues associated with the ditches and their operation (pers. comm. whilst on site on 22nd May 2017). A response from the Internal Drainage Board regarding history of flooding associated with the ditches in this location indicates that there are no known issues (Internal Drainage Board correspondence, dated 19/06/17; Appendix B).

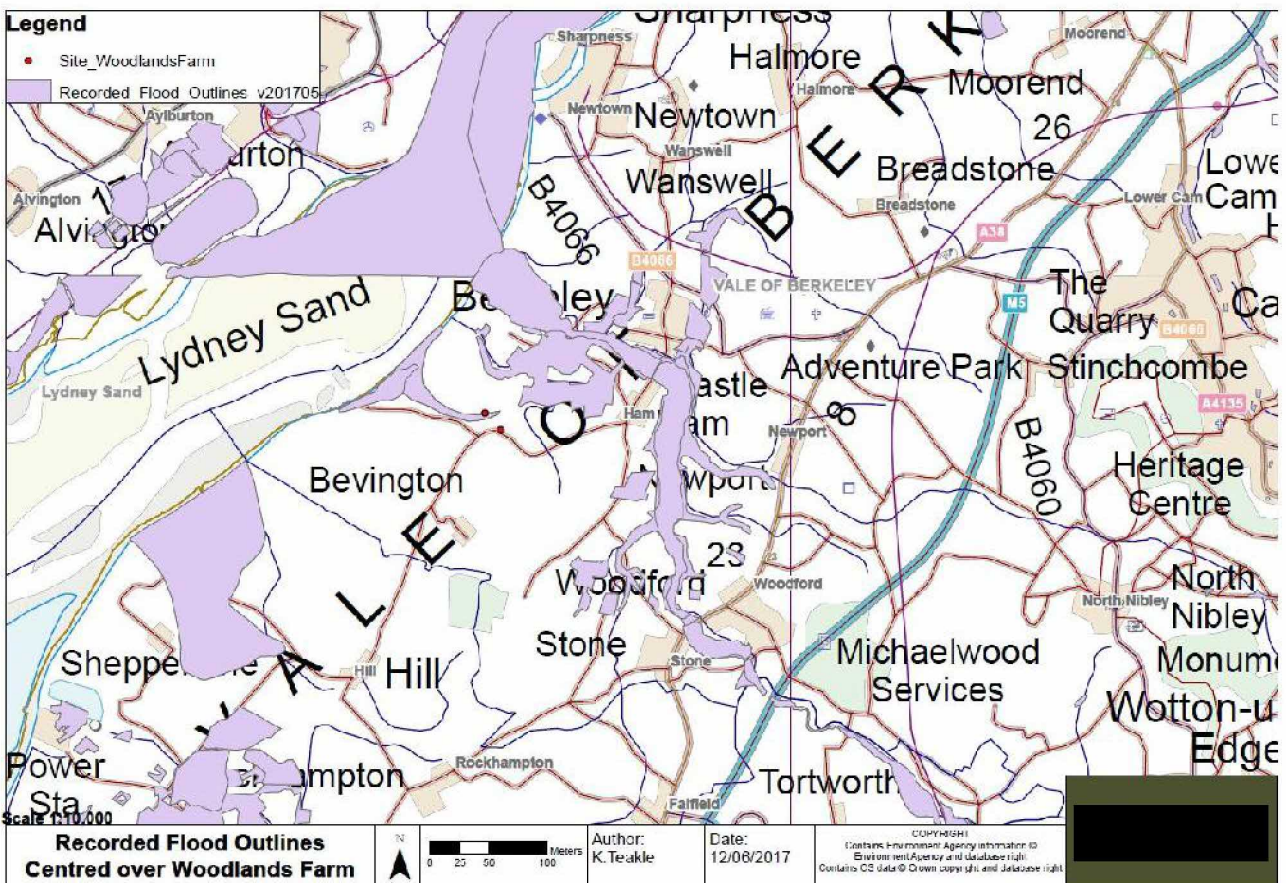


Figure 2: Environment Agency Historic Flood Event Outline. *Contains Environment Agency information © Environment Agency and database right*

2.2.21 **Catchment Flood Management Plan**

The Catchment Flood Management Plan that covers the sites is Severn Tidal Tributaries Catchment Flood Management Plan (Environment Agency, December 2009).

2.2.22 Severn Tidal Tributaries Catchment Flood Management Plan (STTCFMP)

2.2.23 The STTCFMP summary report states that “*The Severn Tidal Tributaries CFMP area has a long history of river, tidal and surface water flooding*” (Environment Agency, December 2009). The report highlights the main sources of flooding in this STTCFMP area are: “...*tide-locking on the tributaries, as a result of tidal flooding from the River Severn. Surface water flooding largely caused by rapid run-off and insufficient local drainage capacity*” (Environment Agency, December 2009).

2.2.24 The STTCFMP summary report outlines the measures currently in place to manage the risk of flooding in the area. The STTCFMP summary report advises that new defences have been constructed and existing ones maintained and improved and that maintenance of sewers, watercourses, road drainage is undertaken (Environment Agency, December 2009).

2.2.25 The proposed development site is considered to be located within Sub Area 2: Severn Vale in the STTCFMP. The issues identified and the approach proposed for this Sub Area is outlined in the following paragraphs.

2.2.26 The STTCFMP summary report identifies the following issues in Sub-Area 2:

2.2.27 It is highlighted in the STTCFMP that this report focuses’ on tide-locking and that the Severn Estuary Shoreline Management Plan covers the Environment Agency’s “...*responsibilities for the Estuary and its coast*” (Environment Agency, December 2009). It is discussed that in this Sub-Area land use is mainly agricultural with several urban settlements. The land is described as floodplain that is flat, mostly below sea level, with “...*frequently saturated*” soils (Environment Agency, December 2009).

2.2.28 The Sub Area is described as having “...*localised surface water flooding*” due to saturated and thus poorly infiltrating soils and “...*a relatively low level of fluvial flood risk, but tide-locking is a significant source of this flooding, for instance around Berkeley*” with the number of properties at risk from a 1% flood event stated as “...*approximately 25*” (Environment Agency, December 2009). It is estimated that this figure will increase to “...*approximately 116*” properties at risk from a 1% flood event in 50-100 years (Environment Agency, December 2009).

2.2.29 The STTCFMP states that “*There is a relatively low level of risk to essential infrastructure, although the area includes a power station*” (Environment Agency, December 2009).

2.2.30 The SCFMP summary report advises that Policy Option 3 is “*the vision and preferred policy*” for this Sub Area (Environment Agency, December 2009). Policy Option 3 is described as “*Areas of low to moderate flood risk where we [the Environment Agency] are generally managing existing flood risk effectively*” (Environment Agency, December 2009).

3.0 Flood Hazard Definition and Probability

3.0.1 In the following section the flood hazard to the proposed development site is defined and the probability of flooding from each potential source is concluded. The potential sources of flooding that may affect the site are considered to be: Fluvial, tidal, surface water, groundwater and sewer sources. The flood hazard from each of these sources is defined and the probability of the site flooding from each source concluded following consultation with the relevant authority and review of available information.

3.1 Fluvial and Tidal Sources

3.1.1 Introduction

3.1.2 The proposed development is located to the East of the tidal River Severn. There is an Ordinary Watercourse in the vicinity of the site: Conigre Pill, which drains east from Woodlands Farm, north of Bluegates Farm. There is also a network of ditches and drains at, and in the vicinity of, the two farms and some groundwater fed ponds.

3.1.3 Environment Agency Data

3.1.4 The Environment Agency Indicative Flood Map locates the proposed development, at Woodlands Farm and Bluegates Farm, Clapton, Berkeley, Gloucester, as within Flood Zone 3 and within an area benefiting from defences (Figure 3).

3.1.5 Environment Agency correspondence dated 18th May 2017 states that “*There is no modelled fluvial data for this area*”. Furthermore, Environment Agency correspondence dated 18th May 2017 states that “*The tables [provided] show the maximum modelled tidal flood levels and depths for defended (actual situation) and undefended (natural floodplain) scenarios taken from [The Environment Agency’s] 2012 Wessex North Coast Model*”.

3.1.6 Environment Agency flood water levels for Tidal River Severn are provided in Table 1 (Appendix B). The Environment Agency advised that these levels are from the 2012 Wessex North Coast Model, from which there are flood water levels available for 0.5% AEP (Annual Exceedance Probability) and 0.1% AEP scenarios. The Environment Agency correspondence dated 18th May 2017 stated that “*Levels and depths have been extracted based upon the site boundary plan provided*”. The site boundary that the Environment Agency refers to is found in Figure 1 of this report.

- 3.1.7 To calculate flood water levels for a 1 in 100 year plus climate change design flood event on the River Severn, a nominal Sea Level Rise Allowance of **1.18m** was added to levels for the 0.5% AEP modelled design event (Climate Change allowances for planning – SHWG area, March 2016).

Defended

AEP	Maximum Depth (m)	Maximum Level (mAOD)
0.5%	0.00	0.00

Undefended

AEP	Maximum Depth (m)	Maximum Level (mAOD)
0.5%	2.86	9.58
0.1%	3.28	10.01
0.5% plus CC	4.04	10.76

Table 1: Environment Agency Coastal / Tidal Flood Water Levels and Depth. Climate Change values in line with SHWG, March 2016 guidance

Contains Environment Agency information © Environment Agency and database right

- 3.1.8 The defended scenario suggests no flooding from this source to either of the Farms.
- 3.1.9 The undefended 0.5% AEP (1 in 200 year) is **9.58mAOD**, 0.5% (1 in 200 year) plus Climate Change Tidal is **10.76mAOD**. The 0.1% (1 in 1000 year) is **10.01mAOD**.
- 3.1.10 As discussed in Section 2.0 of this report, a topographic surveys of Woodlands Farm and Bluegates Farm have been undertaken [REDACTED] (Appendix A; received 09/08/17). The topographic surveys indicate a finished floor level of **7.06mAOD at the barn at Woodlands Farm** and a finished floor level of **7.75mAOD at the barn at Bluegates Farm** (Appendix A).
- 3.1.11 In the **defended scenario**, the Environment Agency data indicates **no flooding**. In the **undefended scenarios** the finished floor levels are at a lower elevation than the flood water levels indicating that there would be **flooding**. At the **Woodlands Farm**, with an existing finished floor level of **7.06mAOD** there would be **2.52m** depth of flooding during a **0.5% AEP** event; **2.95m** depth of flooding during a **0.1% AEP** event; **3.7m** depth of flooding during a **0.5% AEP plus climate change** event. At the **Bluegates Farm**, with an existing finished floor level of **7.75mAOD** there would be **1.83m** depth of flooding during a **0.5% AEP** event; **2.26m** depth of flooding during a **0.1% AEP** event; **3.01m** depth of flooding during a **0.5% AEP plus climate change** event.

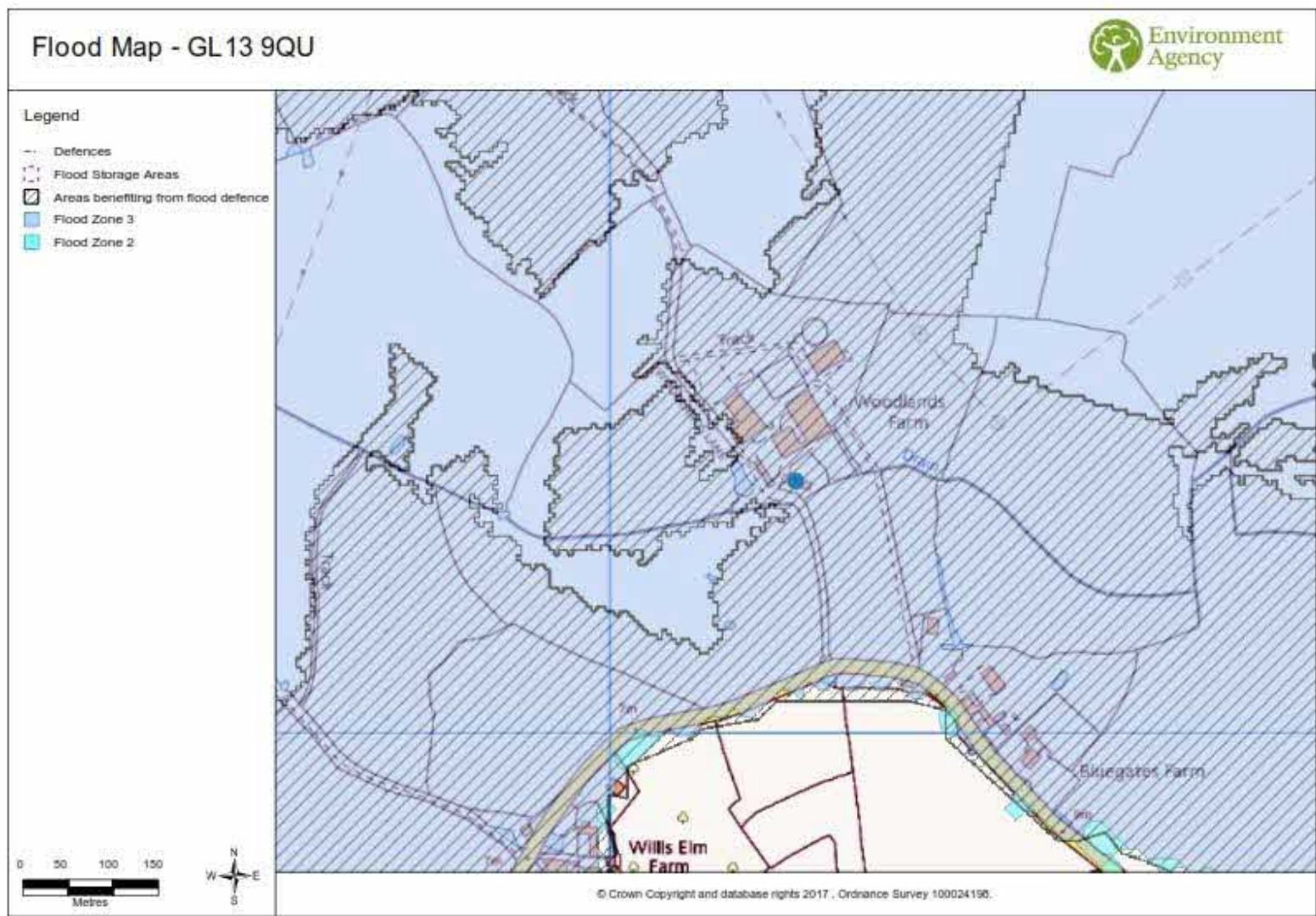


Figure 3: Environment Agency Indicative Flood Zone Map. Contains Environment Agency information © Environment Agency and database right.

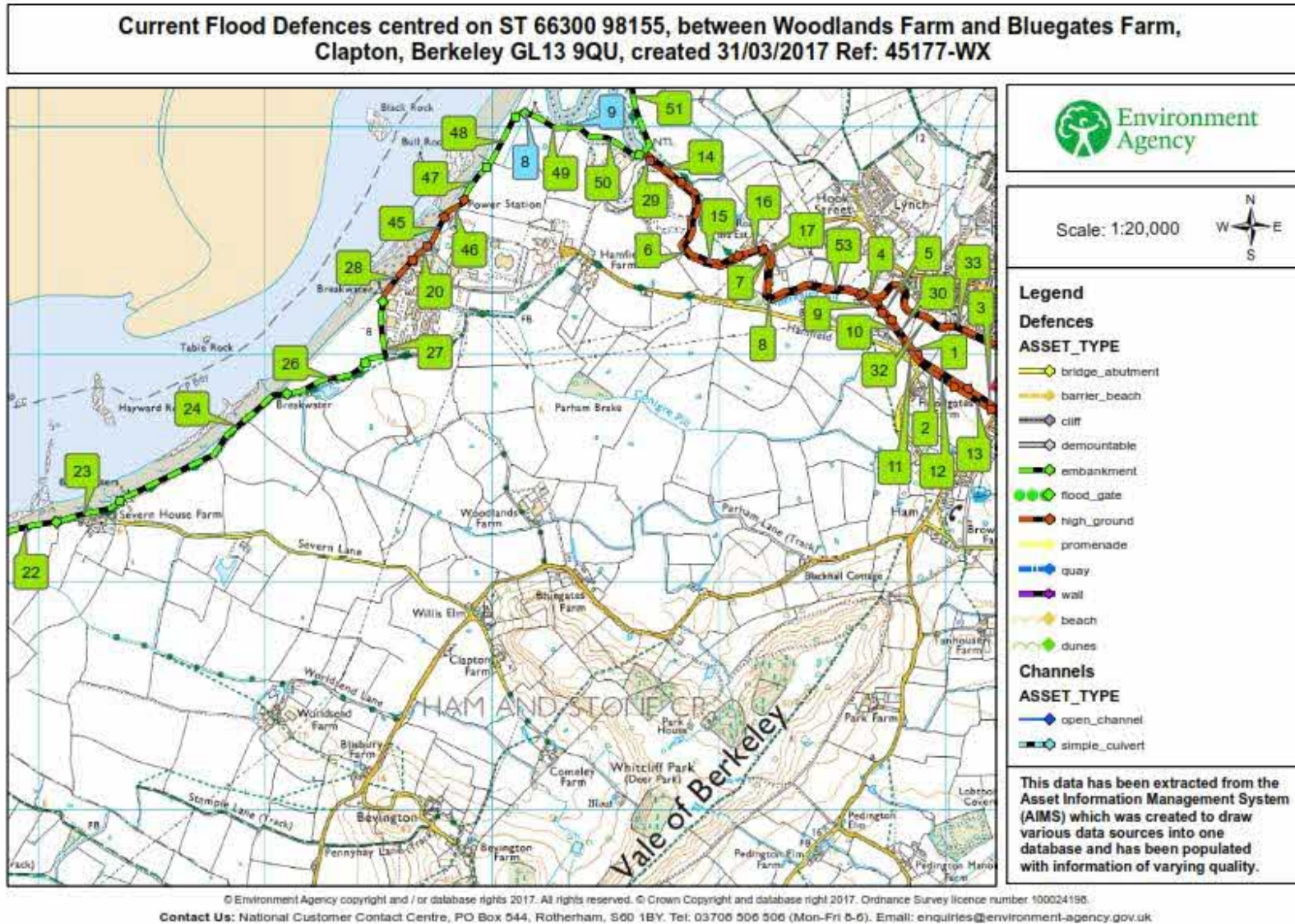


Figure 4: Environment Agency map illustrating position of flood defence locations. Contains Environment Agency information © Environment Agency and database right.

3.1.12 Flood Defences

3.1.13 The Environment Agency was consulted regarding flood defences in the vicinity of the site. The Environment Agency provided a map and detailed list of the flood defences in the vicinity of the site (Figure 4 and Appendix B).

3.1.14 Access and Egress

3.1.15 It is proposed that an access and egress route from the Woodlands Farm site would be to exit the site in a southerly direction along Woodlands Lane and then head east along the Berkeley Road in the direction of Berkeley (Figure 5). It is proposed that an access and egress route from the Bluegates Farm site would be to exit the site onto the Berkeley Road, located adjacent to the site, and head south east in the direction of Berkeley (Figure 5). The Environment Agency's Flood Map indicates that these roads are located in Flood Zone 3, but are areas benefiting from defences (Figure 5). It is recommended to continue along the Road in the direction of Berkeley in an overall north easterly direction to Ham, where there is a Public House called the Salutation Inn (Figure 5).

3.1.16 Flood Management and Mitigation Measures

3.1.17 It is recommended that the finished floor level of both the Woodlands Farm Barn and Bluegates Farm Barn proposed for change of use be elevated a minimum 300mm above surrounding land levels. Sleeping accommodation at the Woodlands Farm Barn and Bluegates Farm Barn proposed for change of use is to be located above 10.76mAOD, which is the 0.5% (1 in 200 year) plus Climate Change Tidal flood water level.

3.1.18 It is recommended that the site be registered with the Environment Agency to receive Flood Warnings. It is understood from correspondence with the Environment Agency (18/05/2017) that:

"Woodlands Farm barn is located within the following:

Flood Alert - Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth

Flood Warning - Severn Estuary from Sharpness to Oldbury-on-Severn, Clapton, Hill and Nupdown areas

Bluegates Farm barn is located within the following:

Flood Alert - Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth

Flood Warning - Severn Estuary from Sharpness to Oldbury-on-Severn"

3.1.19 It is recommended that for each of the Barns a Flood Evacuation and Management Plan be created and followed in the event of receipt of a Flood Warning.

3.1.20 It is recommended that consideration be given to fitting resilience measures to the Barns proposed for change of use. These measures should include raised electrics, wipeable surfaces and sacrificial plasterboard at ground floor level as described in the Communities and Local Government guide to Flood Resilient Construction (May 2007).

3.2 Groundwater Sources

- 3.2.1 Available mapping for the area of interest was reviewed, namely the British Geological Survey maps of England and Wales, Solid and Drift Geology Sheets 250 and 251. These maps indicate that the Woodlands Farm is underlain by “*Estuarine Alluvium*” and the Bluegates Farm is located on the boundary of “*Estuarine Alluvium*” with “*Keuper Marl*” (British Geological Survey, 1970).
- 3.2.2 South of both of the Farms is Deer Park, which is located on a hill comprised of Triassic, Keuper / Rhaetic Marls (“Tea Green Marl” and “Keuper Marl”) and Mainly Clay, as well as Jurassic, Lower Lias Mainly Clay (British Geological Survey, 1970).
- 3.2.3 North - north west of the site the Environment Agency River Severn defences tie into higher ground, which a review of the British Geological Survey mapping indicates is comprised of an outcrop of “*Keuper Marl*” and “*Head*” (British Geological Survey, 1981)
- 3.2.4 The Environment Agency was consulted regarding Groundwater Source Protection Zones and Aquifer Designations at the sites; their response indicates that the Farms are not underlain by either (Environment Agency Correspondence, 18/05/17, Appendix B).
- 3.2.5 The Level 1 SFRA states that groundwater flooding can be an issue “*in low-lying areas*” because the water table is nearer to the surface than in other areas. Therefore, when a rainfall event occurs, subsequent groundwater tends to drain towards these lower-lying areas and flooding can occur (Halcrow Group Limited, September 2008).
- 3.2.6 The SFRA Level 1 highlights that records of groundwater level monitoring are scarce in geological settings similar to those found at the site “*...lower lying valley areas, which can be susceptible to groundwater flooding such as mudstones, clays and superficial alluvial deposits*” (Halcrow Group Limited, September 2008).
- 3.2.7 Whilst on site on 22nd May 2017 an existing below ground concrete holding tank was observed directly adjacent to the Barn proposed for change of use at Woodlands Farm. During this site visit the pond adjacent to the proposed Barn at Woodlands Farm was observed and the Client clarified that the pond is considered to be groundwater fed.
- 3.2.8 There is therefore considered to be a potential for groundwater issues at the site.
- 3.2.9 **Flood Management and Mitigation Measures**
- 3.2.10 The finished floor level of the proposed building is to be elevated above surrounding ground levels. In addition, it is recommended that construction processes and practices reflect working in groundwater prone locations. Furthermore, it is recommended that the below ground holding tank be properly investigated, emptied-sealed-filled or entirely removed, to manage the risk of this potential source of groundwater adjacent to the Barn proposed for change of use at Woodlands Farm. It is also recommended that that the outflow arrangement from the groundwater fed pond be reviewed, any works identified for its effective operation for the lifetime of the development are to be undertaken and a maintenance scheme put in place.

3.3 Sewer Sources

3.3.1 The sites are currently serviced by private treatment works, which would continue post-development.

3.3.2 Flood Management and Mitigation Measures

3.3.3 It is recommended that measures such as non-return valves on foul water sewers servicing the development should be considered to manage the risk of flooding from sewer sources.

3.3.4 The finished floor level of the property is to be elevated above surrounding ground levels.

3.4 Surface Water Sources

3.4.1 Whilst on site on 22nd May 2017 observations were made regarding relative topography of the sites and surrounds.

3.4.2 With regards to the Barn at Woodlands Farm, Woodlands Lane decreases in elevation from the Berkeley Road towards Woodlands Farm. Elevations were observed to be lowest near the eastern end of the Farmhouse. There was a decrease in elevation in an easterly direction along the Woodlands Lane in front of the Farmhouse. The Woodlands Lane, as it passes the Barn proposed for conversion, decreases in elevation in a north westerly direction. It is considered that surface water would follow topographic elevations and so a surface water flow path in a northerly direction along Woodlands Lane from the Berkeley Road to the eastern corner of the Farmhouse is considered possible. Elevations were observed to decrease along Woodlands Lane from near the Barn proposed for development in a south easterly direction towards the eastern corner of the Farmhouse. An area of gravel is present between Woodlands Lane and the south eastern corner of the Farm house. In addition, it is considered that there is the potential for a surface water flow route along Woodlands Lane in a northerly direction as it passes the Barn proposed for conversion.

3.4.3 Bluegates Farm is located on the Berkeley Road. The Barn proposed for change of use is located in the north west corner of the Farm, near the entrance to the Farm. The entrance into the Farm slopes down from the Berkeley Road and into the yard in front of the Barn proposed for change of use. It is considered that there is a potential surface water flow route from the Berkeley Road into the yard.

3.4.4 The Environment Agency's map of Surface Water flood risk (Figure 5 and Appendix B) indicates that at Woodlands Farm the Barn proposed for conversion is located outside of the mapped flood extent. At Bluegates Farm the Barn proposed for conversion is located within the 1 in 1000 year flood extent. The 1 in 100 year flood extent is shown as extending to the south western end of the Barn (Figure 5 and Appendix B).

3.4.5 Flood Management and Mitigation Measures

3.4.6 At the Woodlands Farm site it is considered that there is the potential for surface water runoff along the Lane adjacent to the Barn proposed for conversion. It is also considered that there is the potential for surface water in the farm yard due to the presence of hard surfaces here. At the Bluegates Farm it is considered that there is the potential for surface water runoff on Berkeley Road entering into the farm yard. The Barn proposed for change of use at Bluegates Farm could be at risk of flooding from this source.

3.4.7 To manage the risk of flooding at Woodlands Farm due to surface water runoff from Woodlands Lane it is recommended that the grassed verge be maintained post-development. In addition, it is recommended that the finished floor level of the Barn be raised above the adjacent land levels of the Woodlands Lane and the aforementioned grassed verge, as well as the Farm yard land levels. It is recommended that appropriate damp proofing and tanking of the floors and lower parts of the walls be undertaken.

3.4.8 It is recommended that land levels are adjusted, where possible, to ensure that surface water runoff drains away from the Barn building and towards permeable areas. The existing roof down pipes discharge freely into the adjacent grass verge and above ground rill. It is recommended that post-development that roof runoff and runoff from hard surface areas

adjacent to the Barn be directed to a nearby ditch via an area of gravel with a gravel sub base.

- 3.4.9 To manage the risk of flooding at Bluegates Farm due to surface water runoff from Berkeley Road it is recommended that land levels at and around the entrance way are altered to direct surface water runoff on along Berkeley Road and into roadside ditches. It is understood that the Internal Drainage Board are largely responsible for ditches in this locality; however it is recommended that a maintenance regime of clearing the roadside ditches be put in place to manage the risk of surface water runoff flowing from the road into the site.
- 3.4.10 It is recommended that finished floor levels are raised above surrounding land levels. In addition it is recommended that land levels are adjusted, where possible, to direct surface water runoff away from the Barn building and towards permeable areas. Where levels adjacent to the Barn are lower than surrounding land levels it is recommended that cut off drains and gullies be appropriately positioned. It is recommended that a formal surface water drainage arrangement be put in place to accommodate roof runoff and runoff from hard surface areas adjacent to the Barn. It is recommended that the runoff be directed to a nearby ditch via an area of gravel with a gravel sub base.



Figure 5: Environment Agency Risk of Flooding from Surface Water map. *Contains Environment Agency information © Environment Agency and database right.*

3.4.11 Existing Surface Water Drainage Arrangements

3.4.12 The arrangement for surface water drainage from the Barn at Woodlands Farm is currently free drainage to open channels and permeable areas of grass. The arrangement for surface water drainage from the Barn at Bluegates is currently free drainage.

3.4.13 Existing rates and volumes of runoff generated by the site

3.4.14 Calculations have been undertaken using Modified Rational Method (HR Wallingford) for hard surface runoff. Climate change has been allowed for in the Modified Rational Method by addition of 40% to the 1 in 100 year rainfall depth.

3.4.15 The calculated peak runoff and runoff volume from the hard surface areas for a 6 hour storm are provided in the table below (Table 2 and Appendix C).

Woodlands Farm

Return Period Event (Years)	Hard Surface Runoff Qp (l/s)	Runoff Volume from Hard Surface Area (m ³)
2	1.563	3.798
50	4.549	8.825
100	5.319	10.373
100+Climate Change	7.447	14.523

Table 2: Peak runoff and runoff volume from the previous site layout

Bluegates Farm

Return Period Event (Years)	Hard Surface Runoff Qp (l/s)	Runoff Volume from Hard Surface Area (m ³)
2	0.286	0.696
50	0.834	1.617
100	0.975	1.901
100+Climate Change	1.365	2.661

Table 3: Peak runoff and runoff volume from the previous site layout

3.4.16 The following describes the surface water runoff generated by Woodlands Farm. The peak runoff from a 1 in 100 year storm with allowance for climate change that would be generated by the site is calculated as 7.447 l/s. The volume of runoff generated during this 6 hour storm with the existing layout has been calculated as 14.523 m³ (Table 2).

3.4.17 The following describes the surface water runoff generated by Bluegates Farm. The peak runoff from a 1 in 100 year storm with allowance for climate change that would be generated by the site is calculated as 1.365 l/s. The volume of runoff generated during this 6 hour storm with the existing layout has been calculated as 2.661 m³ (Table 3).

3.4.18 SuDS Scheme

3.4.19 It is recommended that a SuDS scheme is developed for each of the sites with the aim of achieving betterment in terms of the quantity and quality of water discharged from the site.

3.4.20 It is recommended that an area of deep based gravel be included in the developments to provide a storage and attenuation area for surface water. It has been calculated that an area of 107.6m² of deep based porous gravel would have be capable of attenuating the total volume of runoff generated by hard surfaces at the Woodlands Farm Barn and 19.71m² at the Bluegates Farm Barn during a 6 hour, 1 in 100 year storm with allowance for climate change

(14.523m³ – Woodlands Farm and 2.661m³ – Bluegates Farm). Furthermore, this storage would achieve betterment when compared to existing runoff volumes generated by sites. Calculations are based on 0.45m depth with 30% permeability.

3.4.21 Proposed Mitigation Measures

3.4.22 There are no proposals for an increase in hard surface area at either of the sites. It is proposed to provide betterment by, in the first instance, infiltration to ground being investigated as an option for management of surface water runoff generated by the development. Where infiltration to ground is not feasible then it is recommended that surface water runoff be attenuated on site prior to discharge to the adjacent ditch courses.

4.0 Flood Risk Management Measures

- 4.0.1 It is recommended that the finished floor level of both the Woodlands Farm Barn and Bluegates Farm Barn proposed for change of use be elevated a minimum 300mm above surrounding land levels. Sleeping accommodation at the Woodlands Farm Barn and Bluegates Farm Barn proposed for change of use is to be located above 10.76mAOD, which is the 0.5% (1 in 200 year) plus Climate Change Tidal flood water level.
- 4.0.2 It is recommended that the site be registered with the Environment Agency to receive Flood Warnings. It is understood from correspondence with the Environment Agency (18/05/2017) that:
- 4.0.3 *“Woodlands Farm barn is located within the following:
Flood Alert - Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth
Flood Warning - Severn Estuary from Sharpness to Oldbury-on-Severn, Clapton, Hill and Nupdown areas*
- 4.0.4 *Bluegates Farm barn is located within the following:
Flood Alert - Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth
Flood Warning - Severn Estuary from Sharpness to Oldbury-on-Severn”*
- 4.0.5 It is recommended that for each of the Barns a Flood Evacuation and Management Plan be created and followed in the event of receipt of a Flood Warning.
- 4.0.6 It is recommended that consideration be given to fitting resilience measures to the Barns proposed for change of use. These measures should include raised electrics, wipeable surfaces and sacrificial plasterboard at ground floor level as described in the Communities and Local Government guide to Flood Resilient Construction (May 2007).
- 4.0.7 The finished floor level of the proposed building is to be elevated above surrounding ground levels. In addition, it is recommended that construction processes and practices reflect working in groundwater prone locations. Furthermore, it is recommended that the below ground holding tank be properly investigated, emptied-sealed-filled or entirely removed, to manage the risk of this potential source of groundwater adjacent to the Barn proposed for change of use at Woodlands Farm. It is also recommended that that the outflow arrangement from the groundwater fed pond be reviewed, any works identified for its effective operation for the lifetime of the development are to be undertaken and a maintenance scheme put in place.
- 4.0.8 It is recommended that measures such as non-return valves on foul water sewers servicing the development should be considered to manage the risk of flooding from sewer sources.
- 4.0.9 At the Woodlands Farm site it is considered that there is the potential for surface water runoff along the Lane adjacent to the Barn proposed for conversion. It is also considered that there is the potential for surface water in the farm yard due to the presence of hard surfaces here. At the Bluegates Farm it is considered that there is the potential for surface water runoff on Berkeley Road entering into the farm yard. The Barn proposed for change of use at Bluegates Farm could be at risk of flooding from this source.

- 4.0.10 To manage the risk of flooding at Woodlands Farm due to surface water runoff from Woodlands Lane it is recommended that the grassed verge be maintained post-development. In addition, it is recommended that the finished floor level of the Barn be raised above the adjacent land levels of the Woodlands Lane and the aforementioned grassed verge, as well as the Farm yard land levels. It is recommended that appropriate damp proofing and tanking of the floors and lower parts of the walls be undertaken.
- 4.0.11 It is recommended that land levels are adjusted, where possible, to ensure that surface water runoff drains away from the Barn building and towards permeable areas. The existing roof down pipes discharge freely into the adjacent grass verge and above ground rill. It is recommended that post-development that roof runoff and runoff from hard surface areas adjacent to the Barn be directed to a nearby ditch via an area of gravel with a gravel sub base.
- 4.0.12 To manage the risk of flooding at Bluegates Farm due to surface water runoff from Berkeley Road it is recommended that land levels at and around the entrance way are altered to direct surface water runoff on along Berkeley Road and into roadside ditches. It is understood that the Internal Drainage Board are largely responsible for ditches in this locality; however it is recommended that a maintenance regime of clearing the roadside ditches be put in place to manage the risk of surface water runoff flowing from the road into the site.
- 4.0.13 It is recommended that finished floor levels are raised above surrounding land levels. In addition it is recommended that land levels are adjusted, where possible, to direct surface water runoff away from the Barn building and towards permeable areas. Where levels adjacent to the Barn are lower than surrounding land levels it is recommended that cut off drains and gullies be appropriately positioned. It is recommended that a formal surface water drainage arrangement be put in place to accommodate roof runoff and runoff from hard surface areas adjacent to the Barn. It is recommended that the runoff be directed to a nearby ditch via an area of gravel with a gravel sub base.
- 4.0.14 There are no proposals for an increase in hard surface area at either of the sites. It is proposed to provide betterment by, in the first instance, infiltration to ground being investigated as an option for management of surface water runoff generated by the development. Where infiltration to ground is not feasible then it is recommended that surface water runoff be attenuated on site prior to discharge to the adjacent ditch courses.

5.0 Offsite Impacts

5.1 Surface Water Runoff

5.1.1 Proposed rates and volumes of runoff generated by the site

5.1.2 Calculations have been undertaken and are presented in Section 3.4 above. There are no proposed increases in hard surface area post-development. Surface water at Woodlands Farm Barn currently discharges to an open rill and permeable areas of grass. At Bluegates Farm surface water runoff from the Barn is currently free drainage. It is recommended that surface water from each barn be attenuated within an area of gravel with a deep sub-base to provide attenuation and water quality improvements prior to discharge to the nearby ditch courses.

5.2 Compensatory Storage

5.2.1 There are no proposed increases in built footprint post-development.

6.0 Conclusion

- 6.0.1 A Flood Risk Assessment has been undertaken of two barns, one at Woodlands Farm and one at Bluegates Farm, Clapton, Berkeley, GL13 9QU. The proposal is to change the current use of the agricultural barns to domestic dwellings.
- 6.0.2 The Barns are located on the neighbouring farms of Woodlands and Bluegates south west of Berkeley. The farms are north of Bevington, west of Ham and east the River Severn.
- 6.0.3 The Environment Agency was contacted regarding flood water levels for the River Severn in the vicinity of the proposed development sites. Environment Agency correspondence dated 18th May 2017 states that *“There is no modelled fluvial data for this area”*. Furthermore, Environment Agency correspondence dated 18th May 2017 states that *“The tables [provided] show the maximum modelled tidal flood levels and depths for defended (actual situation) and undefended (natural floodplain) scenarios taken from [The Environment Agency’s] 2012 Wessex North Coast Model”*.
- 6.0.4 The Environment Agency provided flood water levels from the 2012 Wessex North Coast Model, for 0.5% AEP (Annual Exceedance Probability) and 0.1% AEP scenarios. The Environment Agency correspondence dated 18th May 2017 stated that *“Levels and depths have been extracted based upon the site boundary plan provided”*.
- 6.0.5 In the defended scenario, the Environment Agency data indicates no flooding. The undefended 0.5% AEP (1 in 200 year) flood water level is 9.58mAOD, 0.5% AEP (1 in 200 year) plus Climate Change Tidal flood water level is 10.76mAOD. The 0.1% AEP (1 in 1000 year) flood water level is 10.01mAOD.
- 6.0.6 At the Woodlands Farm, with an existing finished floor level of 7.06mAOD there would be 2.52m depth of flooding during a 0.5% AEP event; 2.95m depth of flooding during a 0.1% AEP event; 3.7m depth of flooding during a 0.5% AEP plus climate change event. At the Bluegates Farm, with an existing finished floor level of 7.75mAOD there would be 1.83m depth of flooding during a 0.5% AEP event; 2.26m depth of flooding during a 0.1% AEP event; 3.01m depth of flooding during a 0.5% AEP plus climate change event.
- 6.0.7 It is recommended that the finished floor level of both the Woodlands Farm Barn and Bluegates Farm Barn proposed for change of use be elevated a minimum 300mm above surrounding land levels. Sleeping accommodation at the Woodlands Farm Barn and Bluegates Farm Barn proposed for change of use is to be located above 10.76mAOD, which is the 0.5% (1 in 200 year) plus Climate Change Tidal flood water level.
- 6.0.8 It is recommended that the site be registered with the Environment Agency to receive Flood Warnings. It is understood from correspondence with the Environment Agency (18/05/2017) that:
- 6.0.9 *“Woodlands Farm barn is located within the following:
Flood Alert - Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth
Flood Warning - Severn Estuary from Sharpness to Oldbury-on-Severn, Clapton, Hill and Nupdown areas*

6.0.10 *Bluegates Farm barn is located within the following:*

Flood Alert - Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth

Flood Warning - Severn Estuary from Sharpness to Oldbury-on-Severn"

- 6.0.11 It is recommended that for each of the Barns a Flood Evacuation and Management Plan be created and followed in the event of receipt of a Flood Warning.
- 6.0.12 It is recommended that consideration be given to fitting resilience measures to the Barns proposed for change of use. These measures should include raised electrics, wipeable surfaces and sacrificial plasterboard at ground floor level as described in the Communities and Local Government guide to Flood Resilient Construction (May 2007).
- 6.0.13 The finished floor level of the proposed building is to be elevated above surrounding ground levels. In addition, it is recommended that construction processes and practices reflect working in groundwater prone locations. Furthermore, it is recommended that the below ground holding tank be properly investigated, emptied-sealed-filled or removed entirely, to manage the risk of this potential source of groundwater adjacent to the Barn proposed for change of use at Woodlands Farm. It is also recommended that the outflow arrangement from the groundwater fed pond be reviewed, any works identified for its effective operation for the lifetime of the development are to be undertaken and a maintenance scheme put in place.
- 6.0.14 It is recommended that measures such as non-return valves on foul water sewers servicing the development should be considered to manage the risk of flooding from sewer sources.
- 6.0.15 At the Woodlands Farm site it is considered that there is the potential for surface water runoff along the Lane adjacent to the Barn proposed for conversion. It is also considered that there is the potential for surface water in the farm yard due to the presence of hard surfaces here. At the Bluegates Farm it is considered that there is the potential for surface water runoff on Berkeley Road entering into the farm yard. The Barn proposed for change of use at Bluegates Farm could be at risk of flooding from this source.
- 6.0.16 To manage the risk of flooding at Woodlands Farm due to surface water runoff from Woodlands Lane it is recommended that the grassed verge be maintained post-development. In addition, it is recommended that the finished floor level of the Barn be raised above the adjacent land levels of the Woodlands Lane and the aforementioned grassed verge, as well as the Farm yard land levels. It is recommended that appropriate damp proofing and tanking of the floors and lower parts of the walls be undertaken.
- 6.0.17 It is recommended that land levels are adjusted, where possible, to ensure that surface water runoff drains away from the Barn building and towards permeable areas. The existing roof down pipes discharge freely into the adjacent grass verge and above ground rill. It is recommended that post-development that roof runoff and runoff from hard surface areas adjacent to the Barn be directed to a nearby ditch via an area of gravel with a gravel sub base.
- 6.0.18 To manage the risk of flooding at Bluegates Farm due to surface water runoff from Berkeley Road it is recommended that land levels at and around the entrance way are altered to direct surface water runoff on along Berkeley Road and into roadside ditches. It is understood that the Internal Drainage Board are largely responsible for ditches in this locality; however it is recommended that a maintenance regime of clearing the roadside ditches be put in place to manage the risk of surface water runoff flowing from the road into the site.

- 6.0.19 It is recommended that finished floor levels are raised above surrounding land levels. In addition it is recommended that land levels are adjusted, where possible, to direct surface water runoff away from the Barn building and towards permeable areas. Where levels adjacent to the Barn are lower than surrounding land levels it is recommended that cut off drains and gullies be appropriately positioned. It is recommended that a formal surface water drainage arrangement be put in place to accommodate roof runoff and runoff from hard surface areas adjacent to the Barn. It is recommended that the runoff be directed to a nearby ditch via an area of gravel with a gravel sub base.
- 6.0.20 There are no proposals for an increase in hard surface area at either of the sites. It is proposed to provide betterment by, in the first instance, infiltration to ground being investigated as an option for management of surface water runoff generated by the development. Where infiltration to ground is not feasible then it is recommended that surface water runoff be attenuated on site prior to discharge to the adjacent ditch courses.
- 6.0.21 It is recommended that an area of deep based gravel be included in the developments to provide a storage and attenuation area for surface water. It is recommended that an area of deep based gravel be included in the developments to provide a storage and attenuation area for surface water. It has been calculated that an area of 107.6m² of deep based porous gravel would have be capable of attenuating the total volume of runoff generated by hard surfaces at the Woodlands Farm Barn and 19.71m² at the Bluegates Farm Barn during a 6 hour, 1 in 100 year storm with allowance for climate change (14.523m³ – Woodlands Farm and 2.661m³ – Bluegates Farm). Furthermore, this storage would achieve betterment when compared to existing runoff volumes generated by sites.

7.0 References

British Geological Survey, 1970. Malmesbury. England and Wales Sheet 251. Solid and Drift Geology. 1:63,360 (Keyworth, Nottingham, British Geological Survey).

British Geological Survey, 1981. Chepstow. England and Wales Sheet 250. Solid and Drift Geology. 1:50,000 (Keyworth, Nottingham, British Geological Survey).

Communities and Local Government, March 2014, Planning Practice Guidance to the National Planning Policy Framework

Communities and Local Government, May 2007, Improving the flood performance of new buildings: flood resilient construction

CEH, 2015, The Flood Estimation Handbook (FEH) Online Service, Centre for Ecology and Hydrology, Wallingford, Oxon, UK

Environment Agency, March 2016, Climate Change allowances for planning (SHWG area)

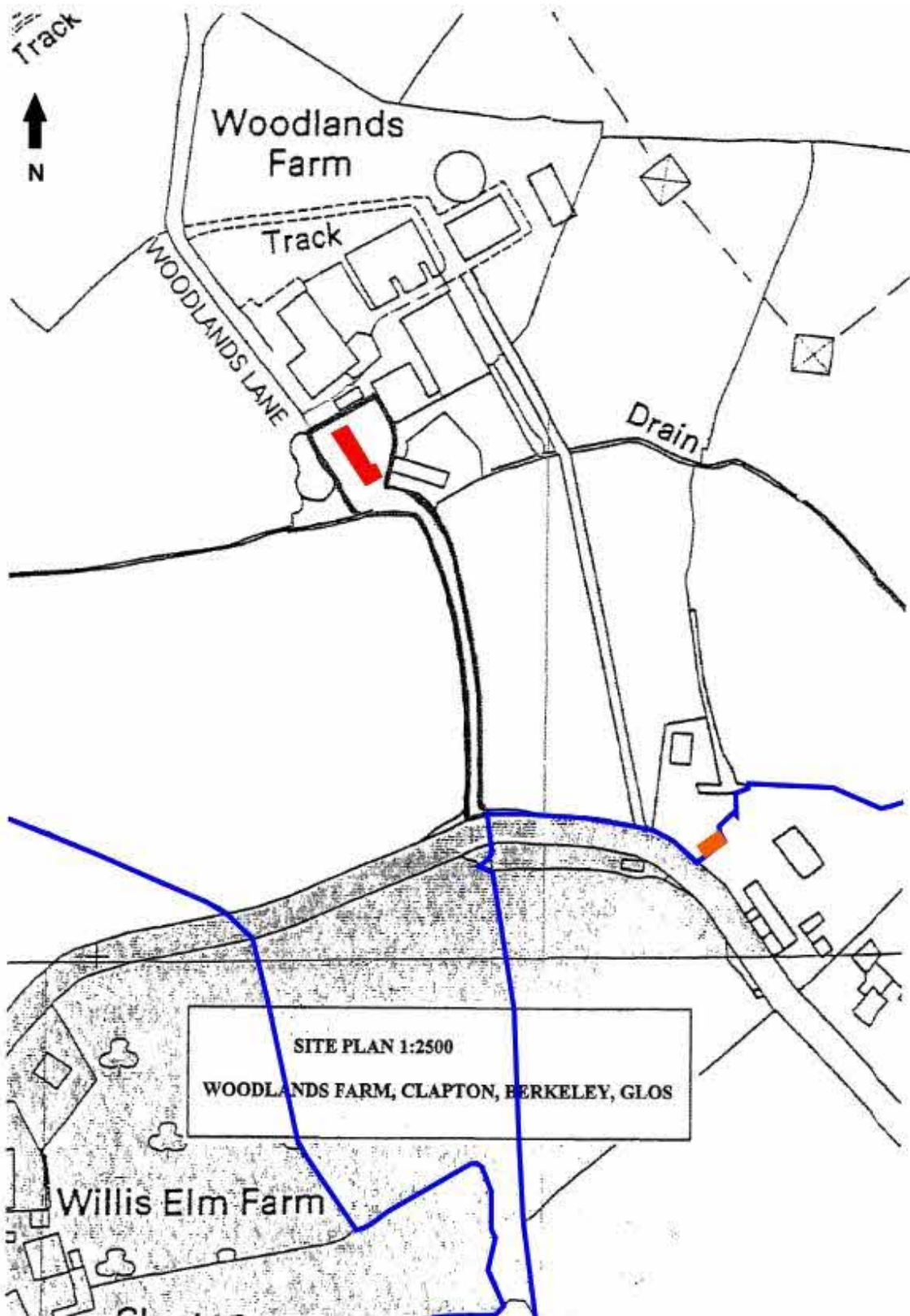
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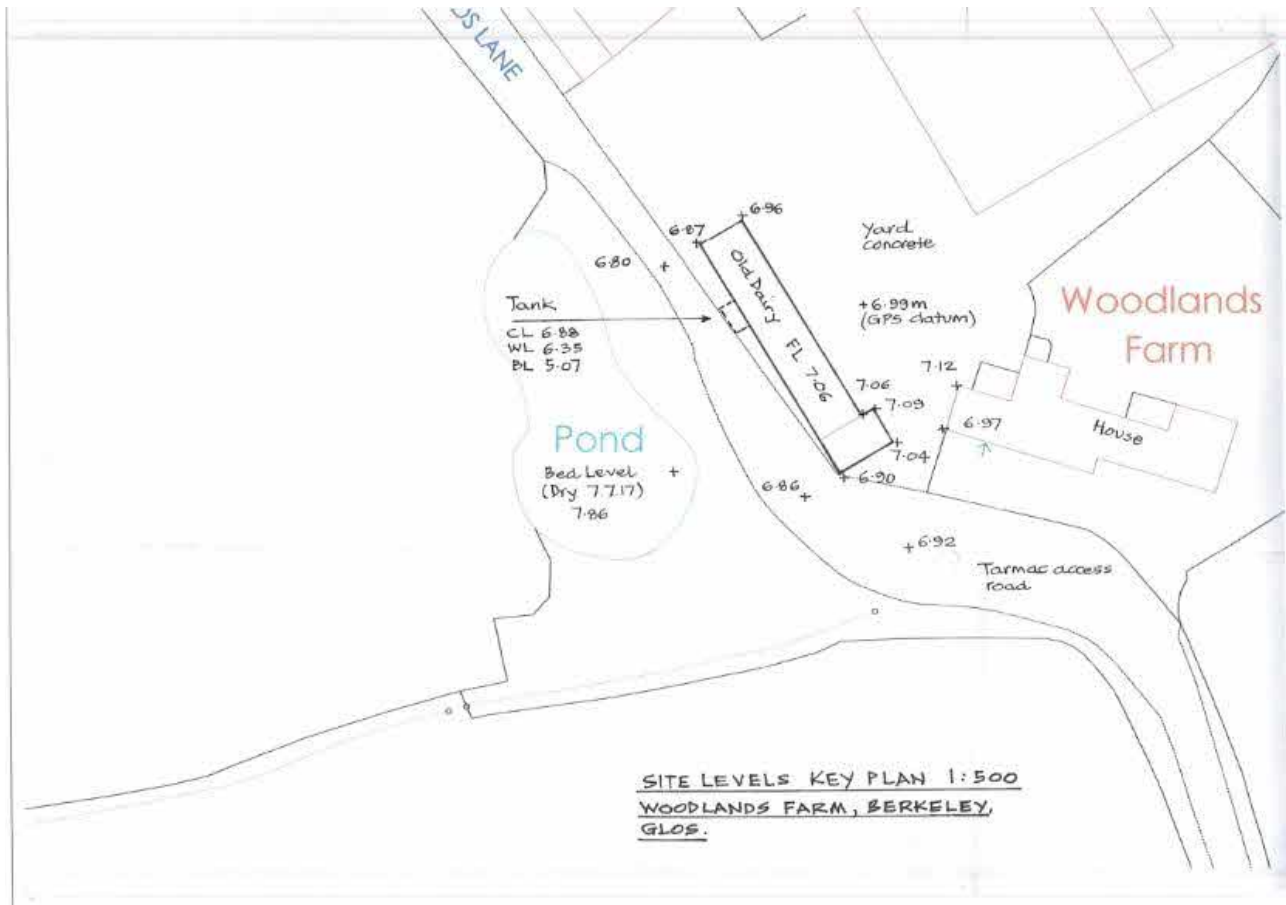
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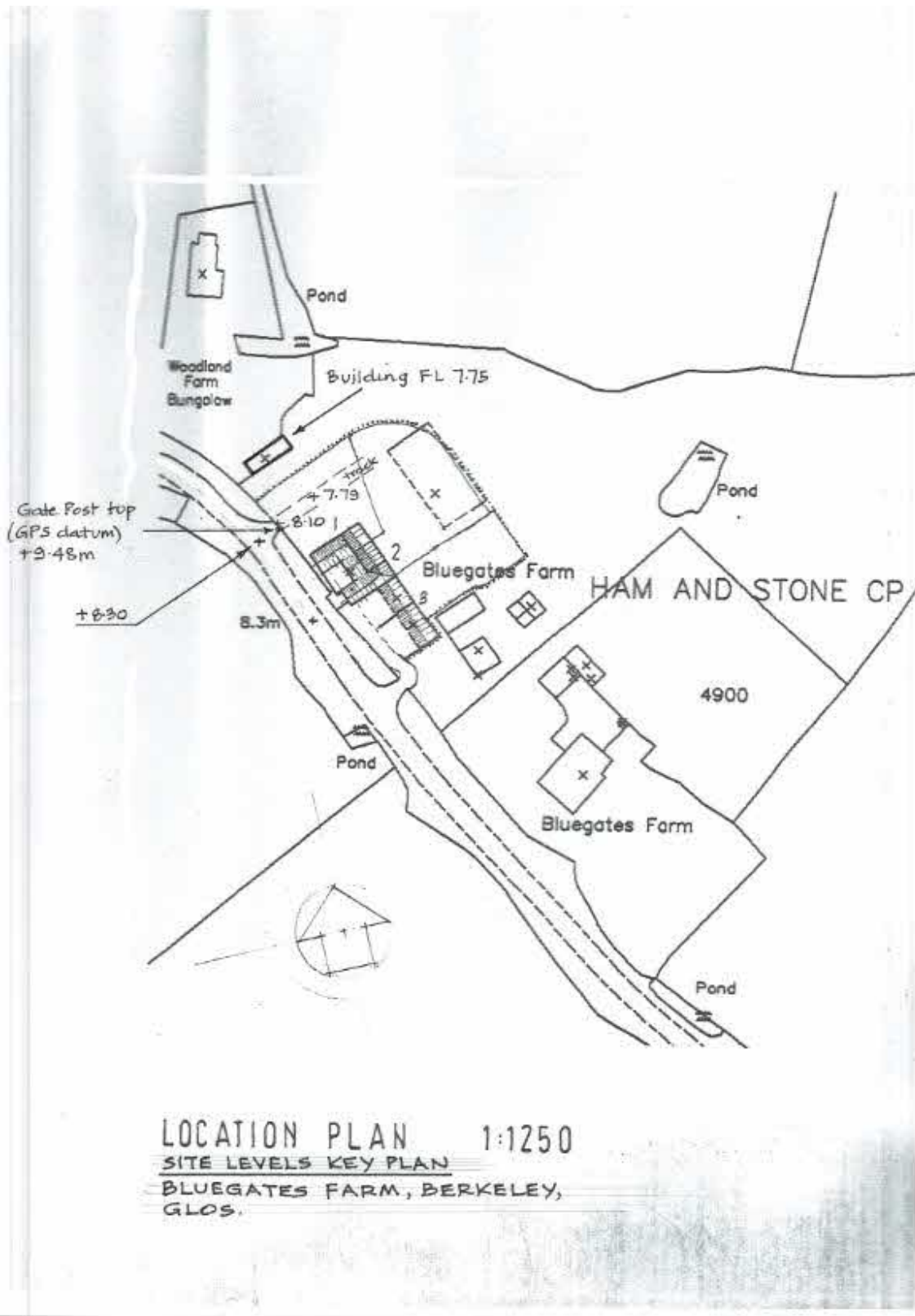
Appendices

Appendix A

Existing Site Layout







Appendix B

Consultation Responses



Our ref: 45177-WX
Your ref:
Date: 18 May 2017

Dear 

Thank you for your enquiry which was received on 24 April 2017. We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Please refer to [Open Government Licence](#) which explains the permitted use of this information.

Abstract

Name	Product 4
Description	Detailed Flood Risk Assessment Map for Woodlands Farm and Bluecoates Farm, Clapton, Berkeley, GL13 9QU
Licence	Open Government Licence
Information Warnings	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198.

The following Environment Agency published datasets are now available on the weblink below as part of the Government's 'Open Data' project and are available for you to download free of charge. Environment Agency published datasets; <https://data.gov.uk/data/search?publisher=environment-agency&unpublished=false>

You will need to search and select the name of the following datasets to take you directly to the weblink to enable you to download the data:

- Flood Map for Planning (Rivers and the Sea) – Flood Zones 2 and 3
- Flood Map for Planning (Rives and Sea) – Areas Benefiting from Defences
- Flood Map for Planning (Rivers and Sea) Spatial Flood Defences
- Flood Map for Planning (Rivers and Sea) Flood Storage Areas
- Risk of Flooding (Rivers and Sea)
- Recorded Flood Outlines
- Historic Flood Map

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 Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
 Phone: 03708 506 506
 Email: wessexenquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

VAT No: 662 4901 34

- Risk of Flooding from Surface Water Extent for:
 - 3 percent annual chance
 - 1 percent annual chance
 - 0.1 percent annual chance

If you have requested this information to help inform a development proposal, then you should also note the detail in the attached advisory text on the use of Environment Agency Information and Further Guidance for FRAs.

Strategic Flood Risk Assessment (SFRA)

When preparing your FRA to support the planning application, you should also refer to South Gloucestershire Council’s Level 1 SFRA available to download via the following link: <http://www.southglos.gov.uk/environment-and-planning/planning/local-development-framework/flood-risk/>

Planning

If you have questions regarding the planning nature of your enquiry, or require advice on floor levels, please contact our Sustainable Places team on [NW X.SP@environment-agency.gov.uk](mailto:NWX.SP@environment-agency.gov.uk). Please be aware that we now charge for planning advice when consulted on pre-application enquiries. This new approach provides advice to developers in two ways. Firstly there is the provision of ‘free’ advice available to everyone where we give a preliminary opinion on a proposed development. This sets out the environmental constraints together with any issues this raises for us. Should you wish us to review in detail any of these issues then we can do this through a chargeable scheme aimed at recovering our costs.

Flood Levels

Fluvial flood levels and depths

There is no modelled fluvial data for this area.

Coastal/tidal flood levels and depths

The tables below show the maximum modelled tidal flood levels and depths for defended (actual situation) and undefended (natural floodplain) scenarios taken from our 2012 Wessex North Coast Model. For the undefended scenarios the 0.5% (1 in 200 year return period) and 0.1% (1 in 1000 year return period) annual exceedance probability (AEP) is given. Only the 0.5% (1 in 200 year) AEP is available for the defended scenario.

Defended

AEP	Maximum depth (in metres)	Maximum level (mAOD)
0.5%	0.00	0.00

No model data reaches the site as this is within an area benefitting from defences.

Undefended

AEP	Maximum depth (in metres)	Maximum level (mAoD)
0.5%	2.86	9.58
0.1%	3.28	10.01

Levels and depths have been extracted based upon the site boundary plan provided.

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VAT No: 662 4901 34

Land Drainage Consent

The watercourse adjoining this site is classed as an 'Ordinary Watercourse' not a 'Main River' under our control. Works to ordinary watercourses may require consent from either the relevant Lead Local Flood Authority or Local Internal Drainage Board. Please contact the Lower Severn Internal Drainage Board, [REDACTED] and Drainage Engineer at [REDACTED] telephone number [REDACTED]

Responsibility for general maintenance of the watercourses and their banks, rest with riparian owners (i.e. the owner of the bed and / or bank of river).

The publication that explains the rights and responsibilities of riverside ownership is now available on the .GOV.uk weblink; <https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities>

Further Information

We advise that you also contact the Flood Risk Management Team, by email LeadLocalFloodAuthority@southglos.gov.uk, or by telephone, [REDACTED] at South Gloucestershire Council, Council Offices, Badminton Road, Yate, Bristol, BS37 5AF as they may be able to provide further advice with respect to localised flooding and drainage issues.

Further details about the Environment Agency information supplied can be found on our website: <https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for FRAs:

<https://www.gov.uk/planning-applications-assessing-flood-risk>
<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

We hope you find this information helpful.

Yours sincerely,

Customer & Engagement, Wessex

Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
Email: wessexenquiries@environment-agency.gov.uk
Telephone number [REDACTED]

Enc:

Use of Environment Agency Information for Flood Risk Assessments (below)
45177-WX Node Location Map
45177-WX Node Data
45177-WX Defence Map
45177-WX Defence Data

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VAT No: 662 4901 34

Use of Environment Agency Information for Flood Risk Assessments (FRAs)**Important**

Use of Environment Agency data: you should note that

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but the use of Environment Agency information does not constitute such an assessment on its own.
2. As part of your data request, we have provided all of the modelled data we hold for your location. Please note that some of our modelled information may have been produced for purposes other than for flood zone generation. This may mean that some of the modelled data you have been provided with has a lower confidence level, and has not been used in producing our flood map, nor definitively reflects the predicted flood water level at the property/development site scale. To check the suitability of the use of this information in your FRA please contact your local Partnership & Strategic Overview (PSO) team.
3. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or surface water runoff. The information produced by the Local Planning Authority and the Lead Local Flood Authority (LLFA) may assist in assessing other sources of flood risk.
4. Where a planning application requires a FRA and this is not submitted or deficient, the Environment Agency may well raise an objection.
5. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your Local Planning Authority.

Pre-Planning Advice from the Environment Agency

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:

Pre-application Preliminary Opinion:

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

Pre-application Charged Service:

<https://www.gov.uk/government/publications/planning-advice-environment-agency-standard-terms-and-conditions>

Depending on the enquiry we may also provide advice on other issues related to our responsibilities, including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

Flood Risk Assessment (FRA) Guidance

You should refer to the Planning Practice Guidance of the National Planning Policy Framework (NPPF) and the Environment Agency's Flood Risk Standing Advice for information about Flood Risk Assessment (FRA) for new development in the different Flood Zones. These documents can be accessed via:

National Planning Policy Framework Planning Practice Guidance:

<http://planningguidance.planningportal.gov.uk/>

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VAT No: 662 4901 34

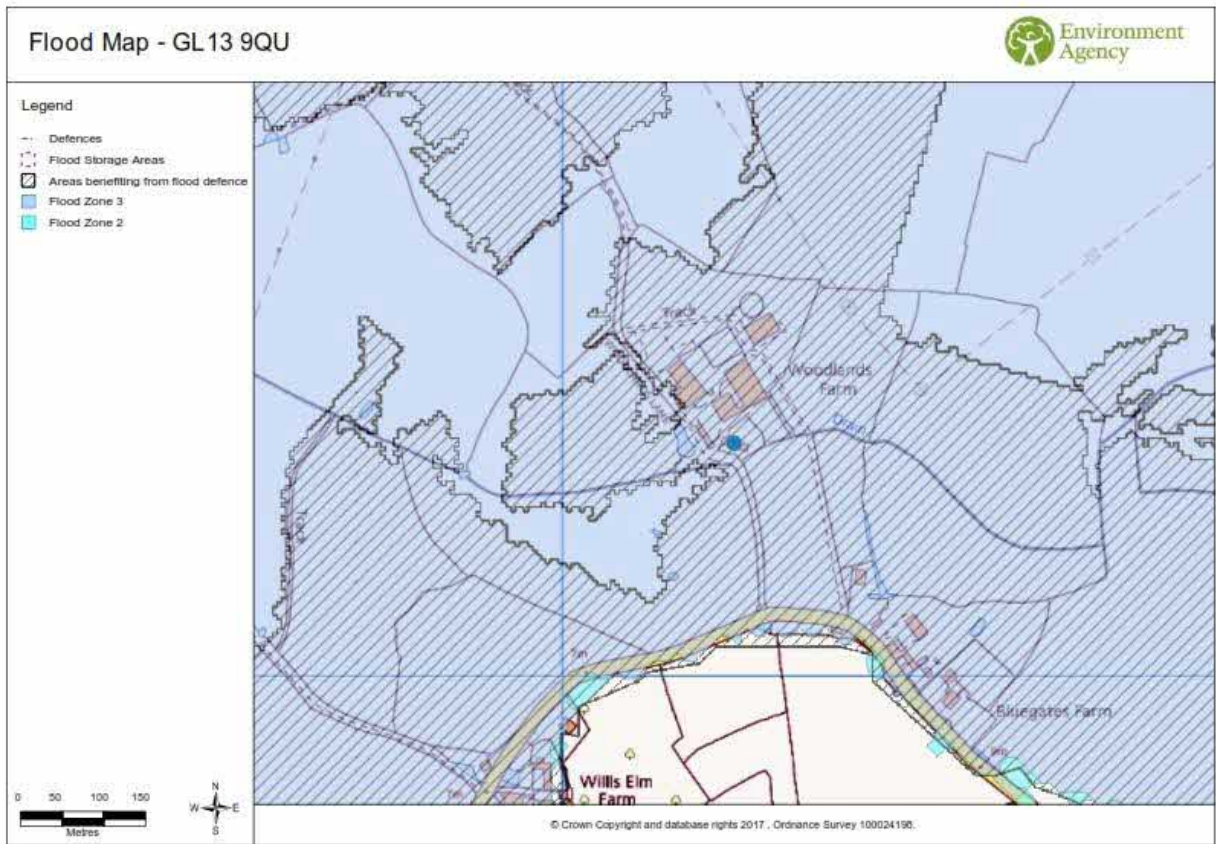
Environment Agency advice on FRAs:

<https://www.gov.uk/flood-risk-assessment-for-planning-applications#when-to-follow-standing-advice>

<https://www.gov.uk/government/publications/planning-applications-assessing-flood-risk>

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VAT No: 662 4901 34





Flood Risk Assessment

Bluegates and Woodlands Farms, Clapton, Berkeley

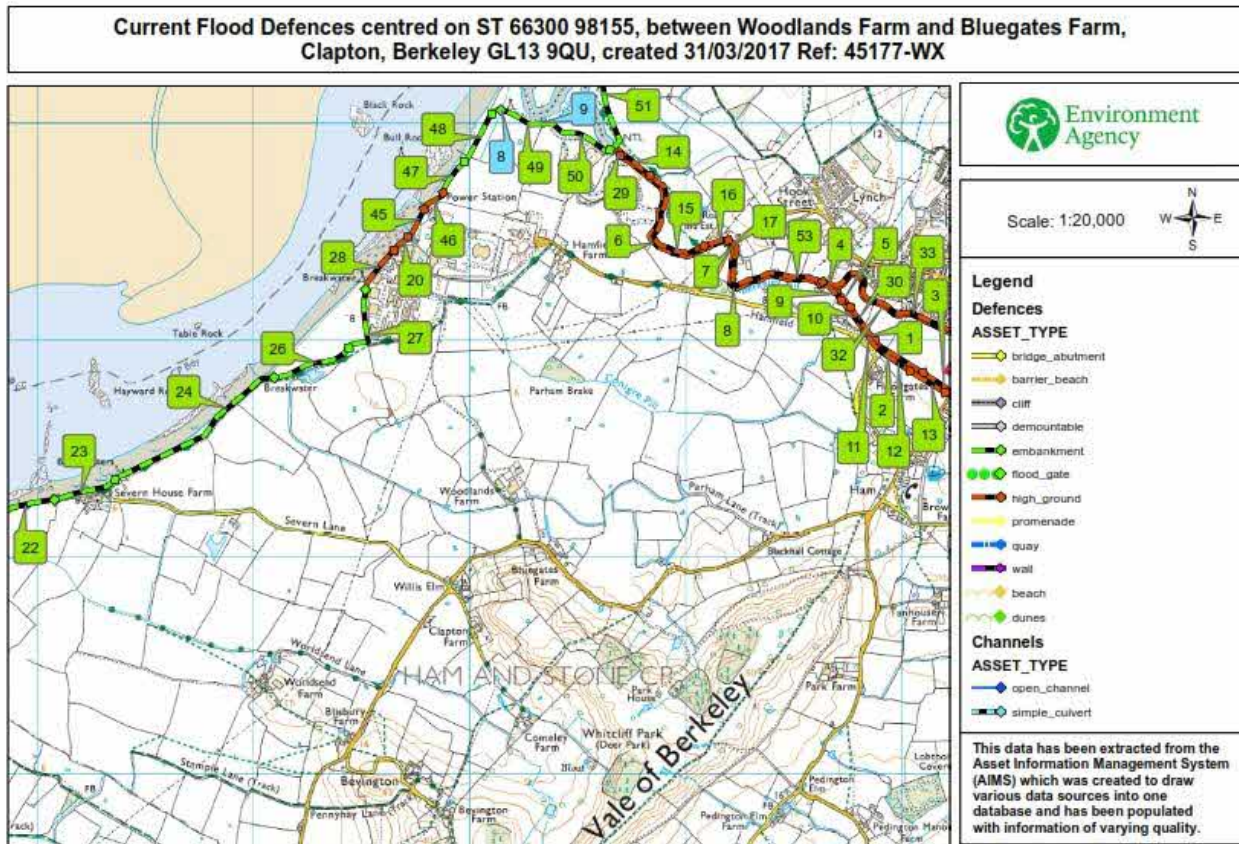
45177-WX - AIMS data

Product 4 - AIMS Information 45177-WX Date: 31/03/2017

Map Ref	Asset ID	Asset Type	Asset Description	Approx length (m)	Right or left bank	Actual flood downstream crest level (m/AGD)	Actual flood downstream crest level accuracy	Actual flood upstream crest level (m/AGD)	Actual flood upstream crest level accuracy	Actual flood coastal crest level (m/AGD)	Actual flood coastal crest level accuracy	NCR	Most recent inspection	Overall condition	
	1	90302	high_ground	Watercourse in Rural Area	7.90	right	DNR	DNR	DNR	DNR	DNR	DNR	ST678005017	26/03/2014	3
	2	90303	high_ground	Natural Channel	271.50	right	DNR	DNR	DNR	DNR	DNR	DNR	ST681739862	26/03/2014	3
	3	90304	high_ground	Watercourse in Rural Area	194.20	right	DNR	DNR	DNR	DNR	DNR	DNR	ST6824098757	26/03/2014	3
	4	90305	high_ground	Watercourse in Rural Location	26.60	right	DNR	DNR	DNR	DNR	DNR	DNR	ST675949362	26/03/2014	3
	5	90301	high_ground	Natural Channel	88.81	right	DNR	DNR	DNR	DNR	DNR	DNR	ST6774488170	26/03/2014	3
	6	90439	high_ground	Natural Channel	897.00	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6871369832	26/03/2014	3
	7	90435	high_ground	Concrete Abutments	18.08	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6771059448	26/03/2014	3
	8	90436	high_ground	Natural Watercourse in Agricultural Area	642.20	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6722469430	26/03/2014	3
	9	90437	high_ground	Natural Watercourse in Agricultural Area	126.57	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6754499253	26/03/2014	3
	10	90438	high_ground	Natural Channel	182.89	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6773269163	26/03/2014	3
	11	90430	high_ground	Maintained Channel	7.90	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6784269817	26/03/2014	3
	12	90440	high_ground	Natural Channel	274.28	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6784759911	26/03/2014	3
	13	90441	high_ground	Natural Channel	100.17	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6806669843	26/03/2014	3
	14	90442	high_ground	Berkeley PII upstream of Salway Culvert	236.15	right	DNR	DNR	DNR	DNR	DNR	DNR	ST6867369563	26/03/2014	3
	15	90512	high_ground	Berkeley PII. Natural Watercourse through Farmland	566.91	right	DNR	DNR	DNR	DNR	DNR	DNR	ST6855269741	26/03/2014	3
	16	90513	high_ground	Channel Floodbank	116.53	right	DNR	DNR	DNR	DNR	DNR	DNR	ST6710799442	26/03/2014	3
	17	90514	high_ground	Concrete Abutments	18.10	right	DNR	DNR	DNR	DNR	DNR	DNR	ST6721769448	26/03/2014	3
	20	128347	high_ground	Made up High Ground with some Erosion Protection	89.14	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST686899433	10/12/2009	2
	22	97293	embankment	Earth Embankment with inward Slope Reinforced, Concrete Upstand and Joint Concrete Crest	890.00	coastal	DNR	DNR	DNR	DNR	9.82	+- 1 to 5cm	ST6349998304	26/01/2017	3
	23	90636	embankment	Earth Embankment with inward Slope Reinforced, Concrete Upstand and Joint Concrete Crest	399.20	coastal	DNR	DNR	DNR	DNR	10.03	+- 1 to 5cm	ST6410569269	26/01/2017	3
	24	90637	embankment	Clapton PII to end of Seawall	854.98	coastal	DNR	DNR	DNR	DNR	9.69	+- 1 to 5cm	ST6428098370	26/10/2016	3
	26	126984	embankment	End of Seawall to end of Embankment	362.30	coastal	DNR	DNR	DNR	DNR	9.71	+- 1 to 5cm	ST6512098320	26/10/2016	3
	27	126985	embankment	Embankment	340.12	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST6545769843	10/12/2009	2
	28	126987	high_ground	Made up High Ground with some Erosion Protection	226.31	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST6552269206	10/12/2009	2
	29	126988	high_ground	Berkeley PII. Natural Watercourse in Agricultural Area	73.81	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6662699868	26/03/2014	3
	30	142390	high_ground	Natural Watercourse in Agricultural Area	162.30	right	DNR	DNR	DNR	DNR	DNR	DNR	ST6785359823	26/03/2014	3
	32	142391	high_ground	Natural Channel	837.91	left	DNR	DNR	DNR	DNR	DNR	DNR	ST6767869243	17/02/2015	3
	33	142392	high_ground	Natural Channel	842.72	right	DNR	DNR	DNR	DNR	DNR	DNR	ST6767869253	17/02/2015	3
	41	90961	high_ground	Made up High Ground	150.11	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST6572369460	10/12/2009	2
	46	90962	high_ground	Natural High Ground	123.30	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST6690099825	10/12/2009	2
	47	90963	embankment	Earth Embankment Defence	172.00	coastal	DNR	DNR	DNR	DNR	10.28	+- 1 to 5cm	ST685849723	26/10/2016	2
	48	90964	embankment	Second & Earth Embankment Defence	326.64	coastal	DNR	DNR	DNR	DNR	10.29	+- 1 to 5cm	ST685849724	26/10/2016	2
	49	90965	embankment	Earth Embankment Defence	226.50	coastal	DNR	DNR	DNR	DNR	9.69	+- 1 to 5cm	ST6853099828	26/10/2016	2
	50	90966	embankment	Earth Embankment Defence	300.72	coastal	DNR	DNR	DNR	DNR	9.74	+- 1 to 5cm	ST6623099848	26/10/2016	3
	51	90968	embankment	Earth Embankment Defence	641.22	coastal	DNR	DNR	DNR	DNR	9.38	+- 1 to 5cm	ST6867099850	26/10/2016	2
	53	90299	high_ground	Natural Watercourse in Rural Location	532.52	right	DNR	DNR	DNR	DNR	DNR	DNR	ST6723099436	26/03/2014	3
	6	461306	simple_culvert	Culvert through a Tidal Embankment	34.53		DNR	DNR	DNR	DNR	DNR	DNR	SC6814300048	08/03/2017	3
	14	461340	simple_culvert	Culvert through Embankment	41.30		DNR	DNR	DNR	DNR	DNR	DNR	SC6824300022	08/03/2017	3

Notes

- * Overall Condition has been taken from the most recent inspection
- * Inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset
- * Condition 1 = very good, Condition 2 = good, Condition 3 = fair, Condition 4 = poor, Condition 5 = very poor
- DNR = data not recorded



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From: Wessex Enquiries <WessexEnquiries@environment-agency.gov.uk>
Sent: 18 May 2017 13:44
To: [REDACTED]
Subject: 45177-WX : two barns at Clapton, Woodlands Farm and Bluecoates Farm, Clapton, Berkley, GL13 9QU
Attachments: 45177-WX Defence Data.pdf; 45177-WX Defence Map.pdf; 45177-WX Letter.pdf; 45177 Surface Water Flood Risk.pdf; 45177 Flood Map.pdf

[REDACTED] thank you for your enquiry, which we received on 27 April 2017

RE: Request for information under the Freedom of Information Act 2000 (FOIA) / Environmental Information Regulations 2004 (EIR)

-
- 1) Indicative Flood Zone Map centred over the sites;
See attached files
 - 2) Surface water susceptibility map centred over the sites;
See attached files
 - 3) Flood Water Levels at the site for a range of design events for the site (including the 1 in 100 year, 1 in 100 year with allowance for climate change, 1 in 200 year, 1 in 200 year with allowance for climate change and 1 in 1000 year events);
See attached files
 - 4) Records of historic occurrences of flooding at, or in the vicinity of the site from a range of sources (groundwater, surface water, sewer, fluvial, tidal). Please include information about flood extents, flood depths, flood water levels (mAOD) and any photos, notes or reports that may be available;
See attached files
 - 5) Details of flood defence infrastructure providing protection to the site (level of defence(s) in mAOD and design year standard of defence).
See attached files
 - 6) Please provide information regarding the aquifer designations underlying the site – I understand that this can be provided as text, but not images.
This site does not lie over a designated aquifer
 - 7) Please provide information regarding groundwater source protection zones underlying the site – I understand that this also can be provided as text, but not images.
This site does not lie within a designated Groundwater Source Protection Zone
 - 8) Please advise whether the site is located within an area where Environment Agency flood warnings/alerts are supplied.
Both of the barns are located in a tidal Flood Alert and tidal Flood Warning as highlighted below.
Woodlands Farm barn is located within the following:
Flood Alert - Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth
Flood Warning - Severn Estuary from Sharpness to Oldbury-on-Severn, Clapton, Hill and Nupdown areas
Bluecoates Farm barn is located within the following:
Flood Alert - Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth
Flood Warning - Severn Estuary from Sharpness to Oldbury-on-Severn
 - 9) Please advise of the lead time to flooding from issue of flood warning.
Our tidal Flood Alerts and Flood Warnings are issued based on a combination of forecast tide height, wind speed and wind direction. We endeavour to issue them at least six hours before high tide when the peak of flooding would occur.
 - 10) Is there a flood warning gauge or gauging station in the vicinity of the site? If there is, please provide flood water level data for historic flood events at this gauge.
There are no fluvial gauges in the vicinity of the sites. The tidal Flood Alerts and Flood Warnings are issued from a tidal gauge at Avonmouth, some distance away.
-

I hope that we have correctly interpreted your request. Please refer to the [Open Government Licence](#) which explains the permitted use of this information.

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

If you are not satisfied with our response to your request for information you can contact us within two calendar months to ask for our decision to be reviewed.

We would be really grateful if you could spare five minutes to help us improve our service. Please click on the link below and fill in our survey – we use every piece of feedback we receive. Thank you
<http://www.smartsurvey.co.uk/s/EnvironmentAgencyCustomerSurvey/?a=W>

Yours sincerely

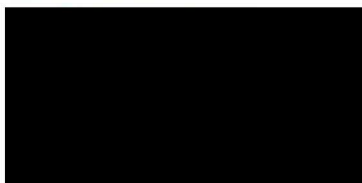
[Redacted]
Customer & Engagement, Wessex Area
Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
Direct Dial: [Redacted]
Email: wessexenquiries@environment-agency.gov.uk



From [Redacted]
Sent: 27 April 2017 11:46
To: Wessex Enquiries <WessexEnquiries@environment-agency.gov.uk>
Subject: RE: 45177 WX: two barns at Clapton, Woodlands Farm and Bluecoates Farm, Clapton, Berkley, GL13 9QU.

[Redacted]
As per my previous correspondence the two barns indicated in red are the subject of the FRA. It would be useful to have mapping centred over both barns and information at and in the vicinity of these barns. The is not a red line boundary as such for this project yet.

Kind regards,



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[REDACTED]

From: [REDACTED]
Sent: 19 June 2017 15:29
To: [REDACTED]
Subject: RE: Flood risk enquiry

Dear [REDACTED]
Thanks for your email.
I've worked for the Lower Severn IDB for 17 years.
I am not aware of flooding or had any reports of flooding at Clapton, Berkeley.
I hope this helps.
Best regards
[REDACTED]

[REDACTED]

Lower Severn Internal Drainage Board
Waterside Buildings
Oldbury Naite
Thornbury
South Glos
BS35 1RF

Tel: [REDACTED]
Fax: [REDACTED]
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From: Admin Enquiries
Sent: 19 June 2017 08:24
To: [REDACTED]
Subject: FW: Flood risk enquiry

From: [REDACTED]
Sent: 17 June 2017 14:35
To: Admin Enquiries <admin@lowersevernidb.org.uk>
Subject: Flood risk enquiry

Dear Sir/Madam,

I am undertaking a flood risk assessment of two barns, one at Woodlands Farm and one at Bluecoates Farm, Clapton, Berkeley, GL13 9QU. I wondered whether you had any information regarding occurrences of flooding in the vicinity of these Farms. I also wondered whether you were aware of any issues relating to tide-locking in the vicinity of these two barns. The nearest Pill to the site is the Conigre Pill.

I look forward to receiving your response.

f

Kind regards,



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Appendix C

Surface Water Runoff Calculations

SURFACE WATER RUNOFF CALCULATION
Bluecoates Farm, Clapton, Berkeley

DATE: 19/06/2017

SITE INFORMATION

AREA

TOTAL	35 m ²	0.000035 km ²	0.00 ha
EXISTING			
IMPERMEABLE	35.00 m ²	0.000035 km ²	0.004 ha
PERMEABLE	0.00 m ²	0.000000 km ²	0.000 ha
PROPOSED			
IMPERMEABLE	35.00 m ²	0.000035 km ²	0.004 ha
PERMEABLE	0.00 m ²	0.000000 km ²	0.000 ha
INCREASE IN IMPERMEABLE	0.00 m ²	0.000000 km ²	0.00 ha

CATCHMENT CHARACTERISTICS

SAAR	738 mm
SOIL	0.45
UCWI	132.2

METHODOLOGY

GREENFIELD RUNOFF USING INSTITUTE OF HYDROLOGY 124 (IOH124) METHODOLOGY

RUNOFF FROM IMPERMEABLE SURFACES USING MODIFIED RATIONAL METHODOLOGY

RUNOFF FROM IMPERMEABLE SURFACES
Existing Scenario
Bluecoates Farm, Clapton, Berkeley

DATE: 19/06/2017

METHODOLOGY

- 1) The Modified Rational Method equation: $Q_p = 2.78 C_r C_v i A$ calculates peak runoff from the proposed development site.
- 2) The area used in the equation is total site area in hectares (ha).
- 3) C_r for design purposes is a value of 1.3
- 4) $C_v = PR/PIMP$; $PR = 0.829PIMP + 25SOIL + 0.078UCWI - 20.7$; $PIMP = A_i / A$.
- 5) $RUNVOL = (PR/100)^2 P A$ calculates runoff volume
- 6) Design rainfall is taken from FEH web service DDF model for a catchment to ST 66650 98200

CALCULATION

PIMP=A_i/A	PR = 0.829 PIMP + 25 SOIL + 0.078 UCWI -20.7
100.0 %	82.9 11.25 10.3116 20.7
	PR = 83.8 %

C_v=PR/100
0.838

Rainfall Intensity (mm)
6 hour design rainfall

Return Period Event (years)	2	5	10	30	50	100	100+40%
Design Rainfall (mm)	23.74	32.24	38.36	49.18	55.16	64.84	90.78
Rainfall Intensity (i) (mm/hr)	27.04	42.28	52.56	70.08	78.68	92.00	128.80

Q = 2.78 Cr Cv i A
 2.78 1.3 0.838 TABLE 0.00

RESULTS: Qp

Return Period Event (years)	2	5	10	30	50	100	100+40%
Q (l/s)	0.286	0.448	0.557	0.742	0.834	0.975	1.365

RESULTS: RUNVOL RUNVOL=(PR/100)*P*A

Return Period Event (years)	2	5	10	30	50	100	100+40%
vol (m ³)	0.696	0.945	1.125	1.442	1.617	1.901	2.661

SURFACE WATER RUNOFF CALCULATION
Woodlands Farm, Clapton, Berkeley

DATE: 19/06/2017

SITE INFORMATION

AREA

TOTAL	191 m ²	0.000191 km ²	0.02 ha
EXISTING			
IMPERMEABLE	191.00 m ²	0.000191 km ²	0.019 ha
PERMEABLE	0.00 m ²	0.000000 km ²	0.000 ha
PROPOSED			
IMPERMEABLE	191.00 m ²	0.000191 km ²	0.019 ha
PERMEABLE	0.00 m ²	0.000000 km ²	0.000 ha
INCREASE IN IMPERMEABLE	0.00 m ²	0.000000 km ²	0.00 ha

CATCHMENT CHARACTERISTICS

SAAR	738 mm
SOIL	0.45
UCWI	132.2

METHODOLOGY

GREENFIELD RUNOFF USING INSTITUTE OF HYDROLOGY 124 (IOH124) METHODOLOGY

RUNOFF FROM IMPERMEABLE SURFACES USING MODIFIED RATIONAL METHODOLOGY

**RUNOFF FROM IMPERMEABLE SURFACES
Existing Scenario
Woodlands Farm, Clapton, Berkeley**

DATE: 19/06/2017

METHODOLOGY

- 1) The Modified Rational Method equation: $Q_p = 2.78 C_r C_v i A$ calculates peak runoff from the proposed development site.
- 2) The area used in the equation is total site area in hectares (ha).
- 3) C_r for design purposes is a value of 1.3
- 4) $C_v = PR/PIMP$; $PR = 0.829PIMP + 25SOIL + 0.078UCWI - 20.7$; $PIMP = A_i / A$.
- 5) $RUNVOL=(PR/100)*P*A$ calculates runoff volume
- 6) Design rainfall is taken from FEH web service DDF model for a catchment to ST 68650 98200

CALCULATION

PIMP=A_i/A	PR = 0.829 PIMP + 25 SOIL + 0.078 UCWI -20.7
100.0 %	82.9 11.25 10.3116 20.7
	PR = 83.8 %

C_v=PR/100
0.838

Rainfall Intensity (mm)

6 hour design rainfall

Return Period Event (years)	2	5	10	30	50	100	100+40%
Design Rainfall (mm)	23.74	32.24	38.38	49.18	55.16	64.84	90.78
Rainfall Intensity (i) (mm/hr)	27.04	42.28	52.56	70.08	78.68	92.00	128.80

Q = 2.78 Cr Cv i A
 2.78 1.3 0.838 TABLE 0.02

RESULTS: Qp

Return Period Event (years)	2	5	10	30	50	100	100+40%
Q (l/s)	1.563	2.445	3.039	4.052	4.549	5.319	7.447

RESULTS: RUNVOL $RUNVOL=(PR/100)*P*A$

Return Period Event (years)	2	5	10	30	50	100	100+40%
vol (m ³)	3.798	5.158	6.137	7.868	8.825	10.373	14.523



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