Reference: GCFRC23/268

Flood Risk Assessment to support planning application

14 Bluebell Close

Abbeymead

Gloucester

GL4 4GP

Flood Risk Consultancy

www.gcfloodrisk.co.uk

[redacted]

Contents:

1.0 Scope of Report:

1.1 The following report is being written in support of the development proposal at 14 Bluebell Close. In line with local and national planning policy, it is necessary that a Flood Risk Assessment (FRA) be undertaken to evaluate the flood risk associated with the proposed development. This FRA has been carried out in line with the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG).

2.0 Site Location:

2.1 The site address is: 14 Bluebell Close, Abbeymead, Gloucester GL4 4GP and the location is NGR: SO 85997 16315. The red-lined boundary for the site can be found in the submitted plans ref: PP002.

2.2 At this location and due to the type of planning application, the Local Planning Authority (LPA) is Gloucester City Council. With this in mind, the following report pays consideration to the relevant policies included emerging Gloucester City Plan.

3.0 Description of Proposal:

3.1 The proposed development would result in the conversion of an existing garage as well as the erection of a detached dwelling two-storey rear extension to an existing residential dwelling.

4.0 Flood Risk Setting:

4.1 As shown in Appendix 1, the proposed development site location is partially in Flood Zone 2 (Medium Risk) according to the Environment Agency (EA) Flood Maps for Planning and as defined by Table 1 in the Flood and Coastal Change section of the Planning Practice Guidance (PPG).

4.2 As the proposal is for and extension to an existing residential dwelling and there is no change of use associated with the development, there is no increase in the flood risk vulnerability associated with the proposal.

5.0 Sequential and Exception Tests:

5.1 National Planning policy dictates that a LPA takes a sequential approach to development planning and control in order to steer new development to the areas with the lowest risk of flooding. In the case of this development, the Sequential Test is not applicable.

5.2 Due to the nature of the proposed development, it is not required to pass the Exception Test in line with Table 3 of the Flood and Coastal Change Section of the PPG.

5.3 Although the development is not required to pass the Exception Test, the development still accords with the principles of the Exception Test by being safe for the duration of its lifetime and does not cause any increased flood risk to third parties.

6.0 Site-Specific Flood Risk:

6.1 Fluvial:

6.1.1 The site is partially in Flood Zone 3 (high risk) and partially in Flood Zone 2 (medium risk) according to the Environment Agency's (EA's) Flood Maps for Planning. According the flood level data provided by the EA (included in the submitted documents), the main source of flood risk for this site is the Wotton Brook. In the case of this proposal, it appears that the footprint of the proposed development would be entirely in Flood Zone 1

6.2 Pluvial:

6.2.1 According to the Environment Agency's Flood Warning Information Service the site is at Low Risk of flooding from surface water.

6.3 Coastal:

6.3.1 According to the Environment Agency's Flood Warning Information Service the site is at Very Low Risk from flooding due to the sea.

6.4 Reservoirs:

6.4.1 According to the Environment Agency's 'Risk of Flooding from Reservoirs Maximum Flood Speed', the site is at Very Low Risk of flooding from reservoirs.

7.0 Climate Change and Design Flood Level (DFL)

7.1 The consideration of flood risk associated on this site should take into account the current guidance for the anticipated effect of climate change on flood levels in this area. For this development, a proportionate approach would be to use the nominal allowances given by the "Flood Risk and Coastal Change: Climate Change allowances for planning (SHWG area)" (June 2022) document.

7.2 This site is located within the Severn River Basin District. The Levels given in the Product 4 Data (see supporting documents) obtained from the EA shows the annual exceedance probabilities for the 20% - 0.1% storm events. For this assessment we will consider the 1% or 1 in 100 storm event and include the tributaries central allowance nominal increase for climate change, which is 300mm. This is in accordance

with the guidance given by the Environment Agency's 'Climate Change allowances for planning (SHWG area)'.

7.3 The nearest node on the Node Point Map (see supporting documents) supplied by the EA shows that Node Point ref: C067 is the closest point to the site. This is the point for which this assessment uses to consider the flood levels given in the Product 4 Data.

7.4 For this assessment and using the above methodology:

DFL = (39.72m AOD + 0.3m) = 40.02m AOD

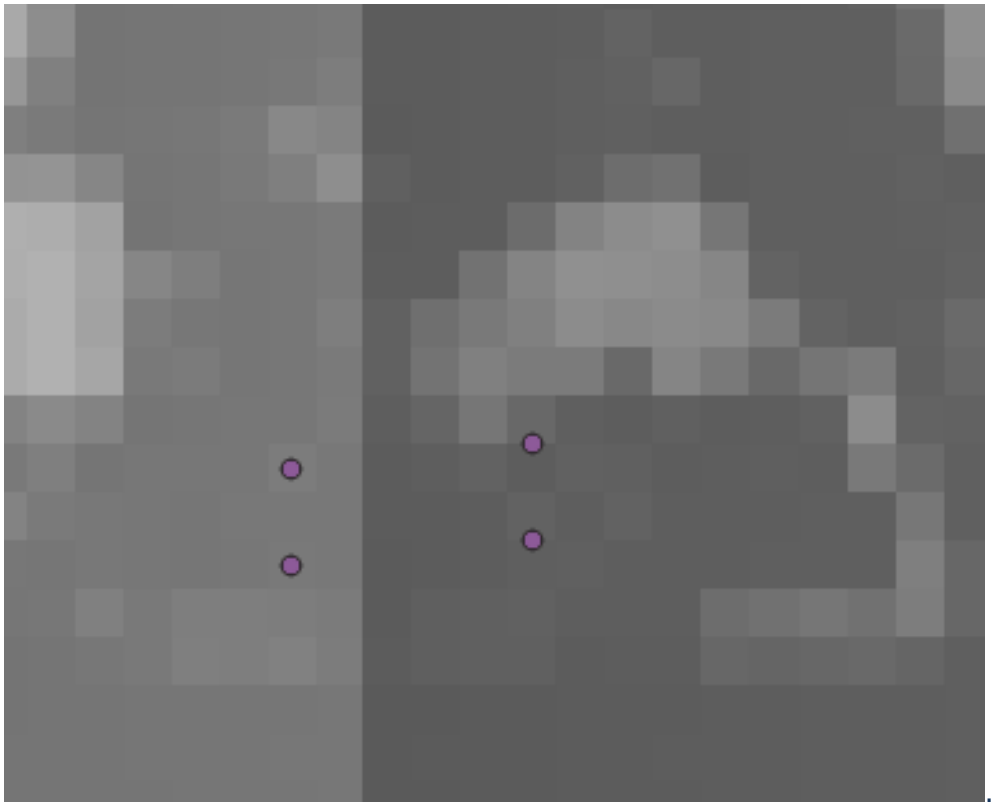
7.5 Below is a table showing the depth of flooding on-site using the EA's LIDAR data (all data gathered using the EA composite 2m spatial resolution LIDAR data). Figures 1 and 2 show where these points are on the site and these points plotted on the EA LIDAR map layer to extract the ground level data, respectively.

Table 1:

Description	Grid Reference	X	Y	Ground Level	Flood Depth
Point A	SO 85997 16315	385997	216315	40.319 m(AOD)	0
Point B	SO 85997 16311	385997	216311	39.94m (AOD)	0.08
Point C	SO 86007 16316	386007	216316	40.199m (AOD)	0
Point D	SO 86007 16312	386007	216312	40.369m (AOD)	0

Figure 1:

Figure 2:



8.0 Flood Risk Mitigation and Resilience:

8.1 The finished floor levels of the proposed development should be set no lower than those of the existing dwelling.

8.2 There are no specific resilience measures necessary for this development as the maximum flood depth expected in a design flood event would not exceed 0.08m, but the site for the most part will remain dry.

9.0 Summary

9.1 According to Environment Agency data, in a design flood event with the appropriate allowance for climate change, the site would experience a maximum flood depth of 0.08m (80mm).

9.2 The site is on the furthest extent of Flood Zone 2 and is unlikely to be impacted in a 1-100 year flood event and in a design flood event the impact would be small.

9.3 Looking at the lidar data, any impact to the site is likely to be to the proposed garage and therefore it’s not felt that resilience measures are necessary but it may be prudent to have raised power sockets if power is intended to be provided.

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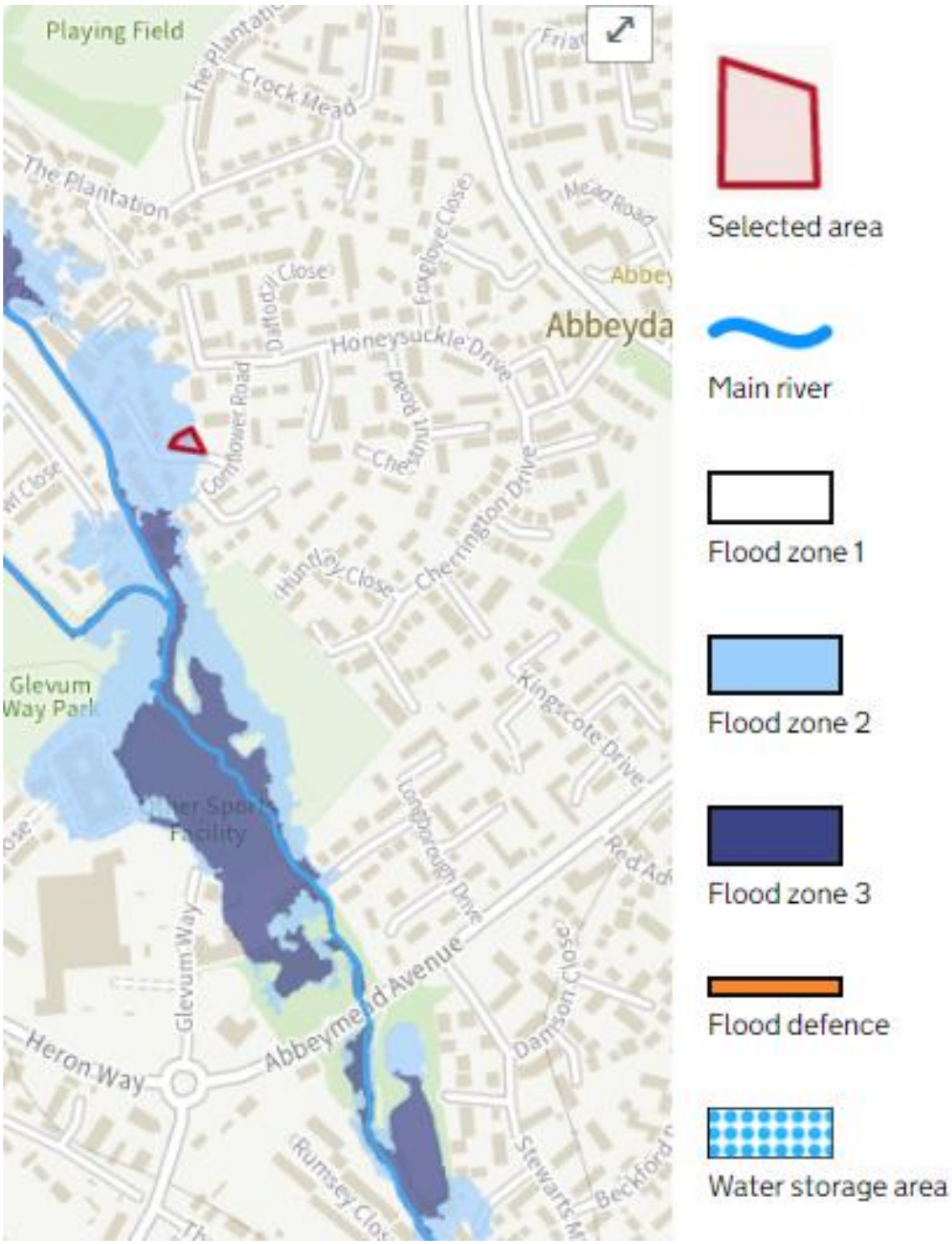
Appendices

Appendix 1: Flood Maps for Planning, location marked:



Flood Risk and Coastal Change

Climate Change allowances for planning (SHWG area)

June 2022

The National Planning Practice Guidance refers to Environment Agency guidance on considering climate change in planning decisions which is available online: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

This has been updated and replaces the March 2016 guidance.

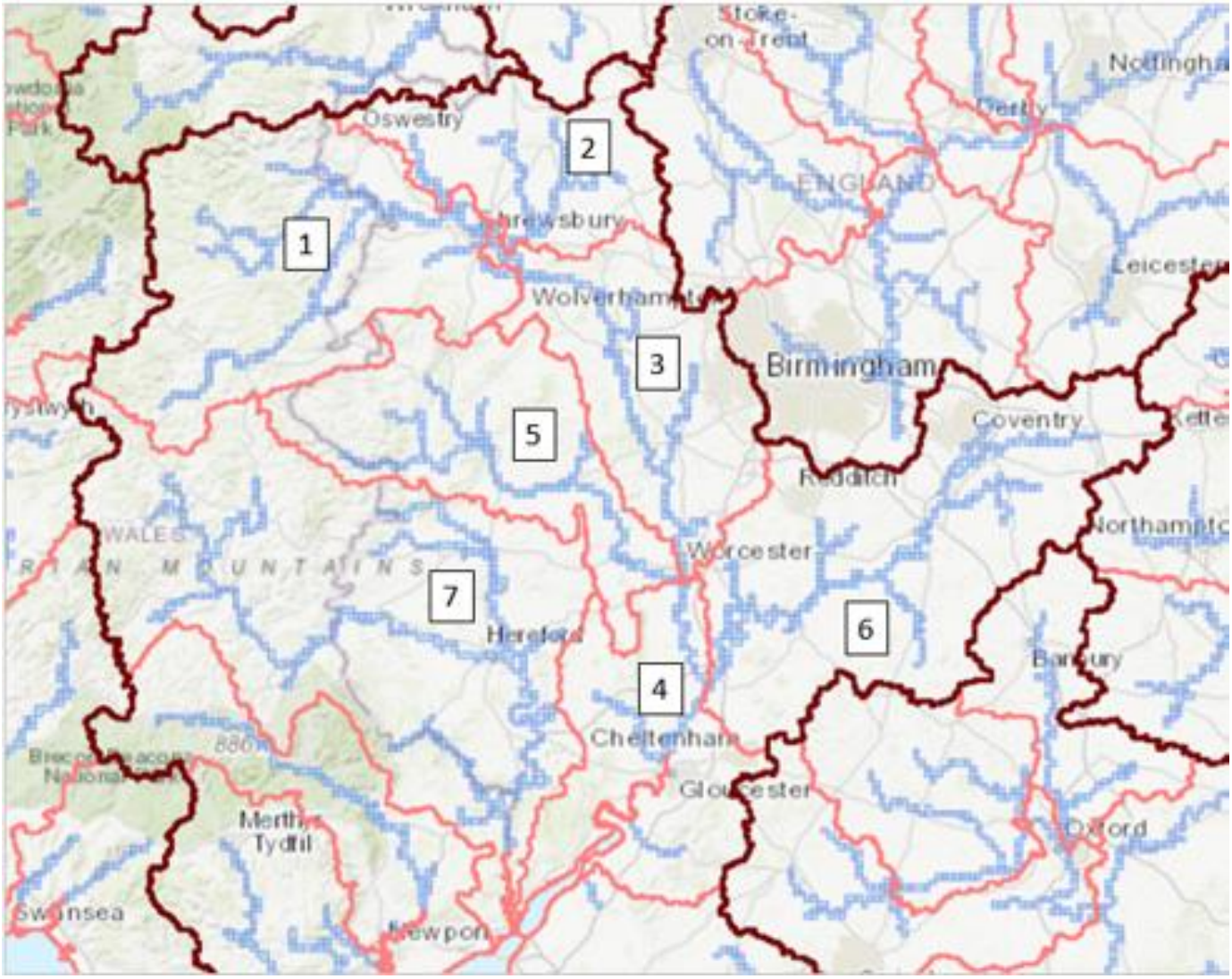
It should be used to help planners, developers and advisors implement the National Planning Policy Framework (NPPF)'s policies and practice guidance on flood risk. It will help inform Flood Risk Assessments (FRA's) for planning applications, local plans, neighbourhood plans and other projects.

Fluvial flooding – peak river flows

NPPG advises that an allowance should be added to 'peak river flows' to account for 'climate change' which should be specific to a 'management catchment' and development type (vulnerability). To work out which management catchment allowances to use, you need to: access the climate change allowances for peak river flow map

In Shropshire, Herefordshire, Worcestershire and Gloucestershire area, we would refer you to the map extract on page 2 below. This outlines the **'peak river flows'** within the specific 'Management catchments' for the Severn River Basin District, and specifies the range of percentage allowances to reflect individual development's vulnerability and lifetime. The following allowances should be used:

Development Vulnerability	Allowance (lifetime)
Essential Infrastructure	Higher Central - 2080's
Highly Vulnerable and More Vulnerable (residential)	Central - 2080's
Less Vulnerable and Water Compatible	Central - 2050's



1. Severn UplandsPeak River Flows	2020's	2050's	2080's
Higher Central	17%	24%	43%
Central	13%	18%	33%

2. Severn Middle Shrops Peak River Flows	2020's	2050's	2080's
Higher Central	20%	25%	44%
Central	15%	18%	33%

3. Severn Middle Worcs River Flows	2020's	2050's	2080's
Higher Central	16%	21%	40%
Central	12%	15%	30%

4. Severn Vale Peak River Flows	2020's	2050's	2080's
Higher Central	20%	28%	53%
Central	14%	19%	37%

5. Teme Peak River Flows	2020's	2050's	2080's
Higher Central	21%	33%	60%
Central	16%	24%	45%

6. Avon Peak River Flows	2020's	2050's	2080's
Higher Central	12%	14%	32%
Central	7%	8%	21%

7. Wye Peak River Flows	2020's	2050's	2080's
Higher Central	19%	27%	49%
Central	14%	20%	37%

Extract: Management Catchments within the Severn River Basin District – refer to interactive peak river flow map for more detail. The Environment Agency also provide these allowances in the peak river flow climate change allowances by management catchment **table** – you have to know your management catchment to get the information you need. (Allowances reflect the latest projections in UKCP18 and subsequent research that models how the latest rainfall projections are likely to affect peak river flows).

Sea Level rise allowances

Table 3 of the guidance (extract below) indicates that net sea level risk is as follows (updated from the 2013 version).

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
South West	Higher central	5.8 (203)	8.8 (264)	11.7 (351)	13.1 (393)	1.21
South West	Upper end	7 (245)	11.4 (342)	16 (480)	18.4 (552)	1.62

Note - For sites utilising the Severn tidal model the above allowances should be considered and applied. As of August 2020, specific updated flood level data is now available for the 2096 to 2125 epoch based upon the Environment Agency's Tidal Severn model within the West Midlands area and will be provided where relevant as part of our Request For Information service; contact [redacted]

Flood Risk Assessment considerations:

The design flood (1% flood level fluvial, or 0.5% tidal, plus climate change allowance) should be used to inform the sequential test, including appropriate location of built development; consideration of flood risk impacts, mitigation/enhancement and ensure 'safe' development.

Vulnerability classification

- Development classed as 'Essential Infrastructure' (as defined within Table 2 - Flood Risk Vulnerability Classification, Paragraph: 066 Reference ID: 7-066-20140306 of the NPPG) should be designed to the 'higher central' climate change allowance (2080).
- For highly vulnerable or more vulnerable development e.g. housing, the FRA should use the 'central' climate change allowance (2080), as a minimum, to inform built in resilience.
- For water compatible or less vulnerable development e.g. commercial, the FRA should use the 'central' climate change allowance (2050), as a minimum, to inform built in resilience.

Assessing off-site impacts and calculating floodplain storage compensation

The appropriate allowance to assess off-site impacts and calculate floodplain storage compensation depends on land uses in affected areas. Use the central 2080 allowance for most cases (including where more vulnerable or highly vulnerable is affected) but apply the higher central allowance when the affected area contains essential infrastructure.

Modelling approach

- **Major Development**:

For 'major' development (as defined within The Town and Country Planning Development Management Procedure (England) Order 2015)*, see definition note below, we would expect a detailed FRA to provide an appropriate assessment (hydraulic model) of the 1% with relevant climate change ranges.
There are two options:

Scenario 1 - Produce a model and incorporate relevant climate change allowances within your Management catchment area location.

Scenario 2 - Re-run an existing model and incorporate relevant climate change allowances as specified in the Management catchment area data.

- **Non Major Development**:

For 'non major' development, we would advise that a model is produced or existing model is re-run, similar to the above approach (Scenario 1 and 2). This would give a greater degree of certainty on the design flood extent to inform a safe development.

However, for 'non major' development only, in the absence of modelled climate change information it may be reasonable to utilise an alternative approach. To assist applicants and Local Planning Authorities we have provided some 'nominal' climate change allowances within the 'Table of nominal allowances' below. These should be considered as appropriate within any FRA. There are three additional options:

Scenario 3 - Where previous modelled data (for a variety of return periods) is available, you could interpolate your own climate change figure (see note iv below).
Scenario 4 - Where the 1% level is available from an existing model add on the relevant 'nominal climate change allowance' provided in the 'Table of nominal allowances' below.
Scenario 5 - Establish the 1% level, for example using topographical levels (including LiDAR) and assessment of watercourse flow and nature and then add on the relevant 'nominal climate change allowances' provided in the 'Table of nominal allowances' below.

– *Note: For definitions of 'major' development see 'Interpretation 2.—(1)', on page 5, at: www.legislation.gov.uk/uksi/2015/595/pdfs/uksi_20150595_en.pdf

Table of Nominal Allowances

Watercourse	Central allowance (2050) Water compatible and Less Vulnerable.	Central allowance (2080) More Vulnerable
Upper Severn	600mm	850mm
River Wye		
River Teme		
River Avon	200mm	400mm
Lower Severn	400mm	600mm
Tributaries and 'ordinary watercourses'	200mm	300mm

Notes to above:-

(i) Watercourse definition:
The "Upper Severn"/"Lower Severn" boundary is taken as Bevere Weir, North of Worcester, (national grid reference SO8376859428). These do not directly relate to management catchments.

Use of the Avon nominal is only valid upstream of the M5 crossing and downstream of that point the Lower Severn nominals should be used.

An 'Ordinary Watercourse' is a watercourse that does not form part of a main river. Main Rivers are indicated on our Flood Map. You can also check the classification of the watercourse with the LLFA, some of which have produced Drainage and Flooding Interactive Maps.

(ii) Where a site is near the confluence of two, or more, watercourses, the FRA should use the larger river climate change allowances.

(iii) We may hold more precise information for some of the "tributaries". We would recommend that you seek this information from us via a 'pre-planning enquiry/data request', to the email address below.

(iv) We would also recommend that you contact us for our modelled '20%' allowances and associated flow data. This is available for some rivers. This data may help inform a more detailed climate change analysis (where necessary), including any interpolation of levels or flow to create a 'stage discharge rating' in order to estimate the required percentage; or be of assistance to inform 'less vulnerable' or 'water compatible' development proposals.

IMPORTANT NOTE
Please note the nominal climate change allowances are provided as a pragmatic approach, for consideration, in the absence of a modelled flood level and the applicant undertaking a detailed model of the watercourse. Use of nominal climate change allowances are not provided/ recommended as a preference to detailed modelling and historical data.

The Local Planning Authority may hold data within their Strategic Flood Risk Assessment (SFRA), or any future updates, which may help inform the above.

FREEBOARD NOTE
It is advised that Finished Floor Levels should be set no lower than '600mm' above the 1% river flood level plus climate change. Flood proofing techniques might be considered where floor levels cannot be raised (where appropriate). This 600mm freeboard takes into account any uncertainties in modelling/flood levels and wave action (or storm surge effects).

Surface Water

The guidance also indicates the relevant surface water allowances that the FRA should consider, for an increase in peak rainfall intensity. The peak rainfall allowances map shows anticipated changes in peak rainfall intensity. Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

Use these for site-scale applications (for example, drainage design), and for surface water flood mapping in small catchments (less than 5 square kilometres) and urbanised drainage catchments. A drainage catchment is urban if the land use is a town or city. If you are unsure if your catchment is urban or rural, please contact the lead local flood authority.

For Development with a lifetime beyond 2100 e.g. residential, use 'upper end' allowances. For development up to 2060, and between 2060 and 2100, use the 'central' allowances. You should ensure development has no impact on surface water and is safe in the design event.

Note - For modelling large areas (larger than 5 square kilometres) with rural land use, direct rainfall modelling is unlikely to be appropriate and fluvial flood risk should be assessed using the peak river flow allowances. Do not use the peak river flow allowances to adjust rainfall totals as they are not compatible.

Produced by: [redacted]

West Midlands Area -
Shropshire, Herefordshire, Worcestershire and Gloucestershire Sustainable Places Team.

Technical design note

Project name	14 Bluebell Close, Abbeymead, Gloucester		
Design note title	Surface Water Drainage Strategy		
Document reference	27232-HYD-XX-XX-TN-D-0001		
Author	[redacted]		
Revision	P02		
Date	19 January 2023	Approved	✓

1. Introduction

1.1 This Technical Note supports a planning application submission for the construction of a new detached garage and store room with associated driveway, and the conversion of an existing garage to living space.

1.2 The conversion of the existing garage does not lead to any increase in drained area however the new garage block will be an additional drained area and therefore it needs to be demonstrated that the building can be adequately drained without any adverse effects elsewhere.

2. Surface Water

2.1 Existing

2.1.1 The new garage block will sit within the front garden of 14 Bluebell Close. The area is currently unpaved and there is no formal drainage serving this part of the property.

2.1.2 An existing surface water drain is located immediately on the southern side of the house, flowing from east to west, and turns to the north west such that it will run between the house and the proposed garage block

2.1.3 Site location plans and site referencing information are shown below.

Site Referencing Information	
Site address	14 Bluebell Close Abbeymead Gloucester GL4 4GP
Grid reference	E. 385995, N. 216321 SO859163 / SO8599516321

Table 1 – Site Referencing Details

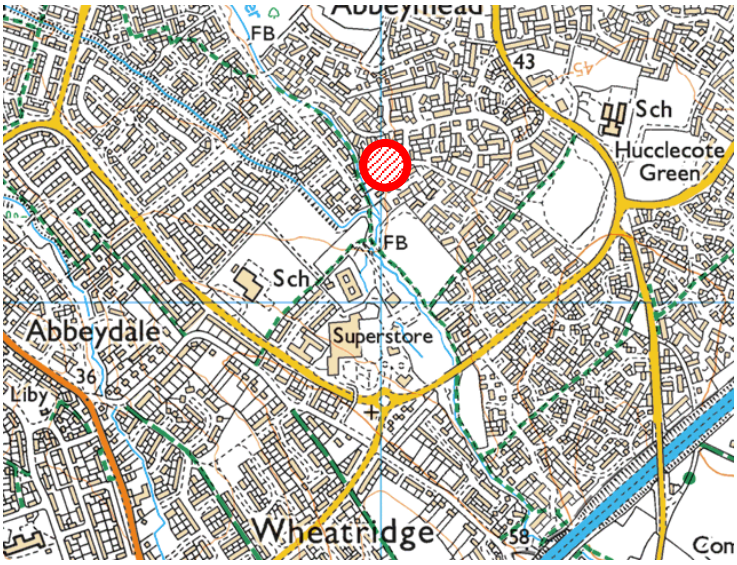


Figure 1 – Site Location

2.2 Proposed Development

2.2.1 The proposal is for the construction of a new detached garage block and integrated store room in the front garden of the property together with a new area of driveway.

2.2.2 The site lies within the responsibility of Gloucester City Council as Lead Local Flood Authority.

2.2.3 In accordance with the National Planning Policy Framework (NPPF), surface water runoff from the proposed development is to be captured and managed utilising sustainable methods where possible. As such, the following surface water drainage management strategies will be assessed in direct relation to the site, based on preferential order in accordance with the NPPF, National Planning Policy Guidance (NPPG), Building Regulations and Sewerage Sector Guidance (SSG).

- Infiltration
- Discharge to local watercourse
- Discharge to public surface water sewer
- Discharge to public combined sewer

2.2.4 Reference has been made to the on-line British Geological Society mapping information which indicates that the site is underlain by a bedrock of the Charmouth Mudstone and no superficial depositsl

On the basis of the above, it is anticipated that the use of soakaways will not be applicable and, in any event, it will not be possible to achieve the 5m standoff distance to any structures and public highways.

2.2.5 There are no watercourses in the immediate vicinity of the site.

2.2.6 An existing surface water drain runs through the property which the existing house connects to and therefore it is proposed that the new garage block and associated driveway are discharged to this drain.

2.2.7 The standard requirement is for all new impermeable areas to be restricted to the QBAR greenfield runoff rate however, the proposed areas of building and driveway are so small that this will not be a practical consideration. In view of this, the discharge rate will be restricted by a 30mm diameter orifice to keep flows as low as possible.

2.2.8 The total proposed drained area is 62m² of which 19m² is driveway and 43m² is building.

It is proposed that the driveway be constructed using a suitable permeable paving with a storage sub-base and that the rainwater downpipes be connected into this storage layer.

The outlet from the storage layer will be controlled by a 30mm diameter orifice prior to discharge to the existing surface water drain.

2.2.9 The drainage system has been modelled using the Source Control module in Micro Drainage and the calculation shows that the minimum storage depth requirement will be 205mm.

2.2.10 The system has been modelled for the 1 in 100 year return period storm event including an allowance of +40% for climate change in accordance with the current Environment Agency guidance "Peak rainfall climate change allowances by management catchment" issued on the 9th May 2022 for the Severn Vale Management Catchment area.

2.2.11 The model demonstrates no flooding in this extreme event and that the maximum discharge rate will be 0.8 l/s.

Copies of the above calculations, proposed layout plan and typical construction details are included in Appendix A.

2.2.12 The filtering of water though the storage sub-base will prevent the onward flow of any pollutants and runoff from the driveway will also be treated by the permeable paving.

3. Conclusions

3.1 The area of the proposed building works is currently undeveloped front garden and therefore is assumed not to be formally drained.

3.2 An existing surface water drain runs through the property and the existing house currently connects to this drain.

3.3 The British Geological Society mapping indicates the site to be underlain by a bedrock of mudstone with no superficial deposits therefore it is unlikely that the use of soakaways will be suitable.

3.4 There are no watercourses in the immediate vicinity of the property.

3.5 It is proposed that the new building and paved are be drained to a permeable paved are with a storage sub-base and that flows are restricted by an orifice control prior to discharge to the existing surface water drain.

APPENDIX A

Surface Water Calculations

Drawing No. 27232-HYD-XX-XX-Dr-D-2001-P01

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 14 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	9.654	0.154	0.0	0.7	0.7	0.7	O K
30 min Summer	9.682	0.182	0.0	0.8	0.8	0.9	O K
60 min Summer	9.686	0.186	0.0	0.8	0.8	0.9	O K
120 min Summer	9.665	0.165	0.0	0.7	0.7	0.8	O K
180 min Summer	9.642	0.142	0.0	0.7	0.7	0.7	O K
240 min Summer	9.622	0.122	0.0	0.6	0.6	0.6	O K
360 min Summer	9.593	0.093	0.0	0.5	0.5	0.4	O K
480 min Summer	9.575	0.075	0.0	0.5	0.5	0.3	O K
600 min Summer	9.563	0.063	0.0	0.4	0.4	0.2	O K
720 min Summer	9.554	0.054	0.0	0.4	0.4	0.2	O K
960 min Summer	9.543	0.043	0.0	0.3	0.3	0.1	O K
1440 min Summer	9.535	0.035	0.0	0.2	0.2	0.1	O K
2160 min Summer	9.529	0.029	0.0	0.2	0.2	0.0	O K
2880 min Summer	9.525	0.025	0.0	0.1	0.1	0.0	O K
4320 min Summer	9.520	0.020	0.0	0.1	0.1	0.0	O K
5760 min Summer	9.518	0.018	0.0	0.1	0.1	0.0	O K
7200 min Summer	9.516	0.016	0.0	0.1	0.1	0.0	O K
8640 min Summer	9.515	0.015	0.0	0.1	0.1	0.0	O K
10080 min Summer	9.515	0.015	0.0	0.1	0.1	0.0	O K
15 min Winter	9.672	0.172	0.0	0.7	0.7	0.9	O K
30 min Winter	9.704	0.204	0.0	0.8	0.8	1.0	Flood Risk
60 min Winter	9.700	0.200	0.0	0.8	0.8	1.0	Flood Risk
120 min Winter	9.663	0.163	0.0	0.7	0.7	0.8	O K
180 min Winter	9.630	0.130	0.0	0.6	0.6	0.6	O K
240 min Winter	9.605	0.105	0.0	0.6	0.6	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.448	0.0	1.2	20
30 min Summer	79.010	0.0	1.7	29
60 min Summer	50.812	0.0	2.2	44
120 min Summer	31.621	0.0	2.7	76
180 min Summer	23.637	0.0	3.1	108
240 min Summer	19.105	0.0	3.3	138
360 min Summer	14.037	0.0	3.7	198
480 min Summer	11.286	0.0	3.9	258
600 min Summer	9.522	0.0	4.2	318
720 min Summer	8.282	0.0	4.3	376
960 min Summer	6.640	0.0	4.6	494
1440 min Summer	4.854	0.0	5.1	734
2160 min Summer	3.541	0.0	5.6	1100
2880 min Summer	2.828	0.0	5.9	1468
4320 min Summer	2.055	0.0	6.4	2136
5760 min Summer	1.637	0.0	6.7	2880
7200 min Summer	1.371	0.0	7.0	3560
8640 min Summer	1.186	0.0	7.2	4248
10080 min Summer	1.049	0.0	7.4	5032
15 min Winter	117.448	0.0	1.4	20
30 min Winter	79.010	0.0	1.9	30
60 min Winter	50.812	0.0	2.5	46
120 min Winter	31.621	0.0	3.1	80
180 min Winter	23.637	0.0	3.5	112
240 min Winter	19.105	0.0	3.7	142

Summary of Results for 100 year Return Period (+40%)

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
360 min Winter	9.574	0.074	0.0	0.5	0.5	0.3	O K
480 min Winter	9.556	0.056	0.0	0.4	0.4	0.2	O K
600 min Winter	9.546	0.046	0.0	0.3	0.3	0.1	O K
720 min Winter	9.541	0.041	0.0	0.3	0.3	0.1	O K
960 min Winter	9.535	0.035	0.0	0.2	0.2	0.1	O K
1440 min Winter	9.529	0.029	0.0	0.2	0.2	0.0	O K
2160 min Winter	9.524	0.024	0.0	0.1	0.1	0.0	O K
2880 min Winter	9.520	0.020	0.0	0.1	0.1	0.0	O K
4320 min Winter	9.517	0.017	0.0	0.1	0.1	0.0	O K
5760 min Winter	9.515	0.015	0.0	0.1	0.1	0.0	O K
7200 min Winter	9.514	0.014	0.0	0.1	0.1	0.0	O K
8640 min Winter	9.513	0.013	0.0	0.0	0.0	0.0	O K
10080 min Winter	9.512	0.012	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.037	0.0	4.1	202
480 min Winter	11.286	0.0	4.4	260
600 min Winter	9.522	0.0	4.7	318
720 min Winter	8.282	0.0	4.9	370
960 min Winter	6.640	0.0	5.2	494
1440 min Winter	4.854	0.0	5.7	732
2160 min Winter	3.541	0.0	6.2	1112
2880 min Winter	2.828	0.0	6.6	1444
4320 min Winter	2.055	0.0	7.2	2128
5760 min Winter	1.637	0.0	7.6	2752
7200 min Winter	1.371	0.0	7.9	3648
8640 min Winter	1.186	0.0	8.2	4312
10080 min Winter	1.049	0.0	8.4	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.006

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002	4	8	0.002	8	12	0.002

Model Details

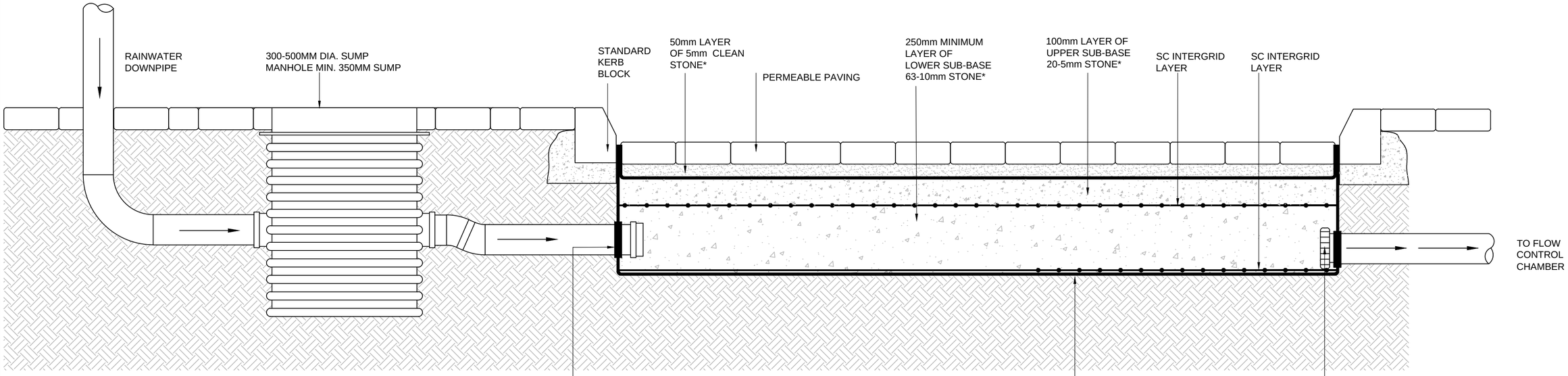
Storage is Online Cover Level (m) 10.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.0
Membrane Percolation (mm/hr)	1000	Length (m)	4.8
Max Percolation (l/s)	5.3	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.500	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.030 Discharge Coefficient 0.600 Invert Level (m) 9.500



NOTES

† SUPPLIED BY WTB GEOTEXTILES

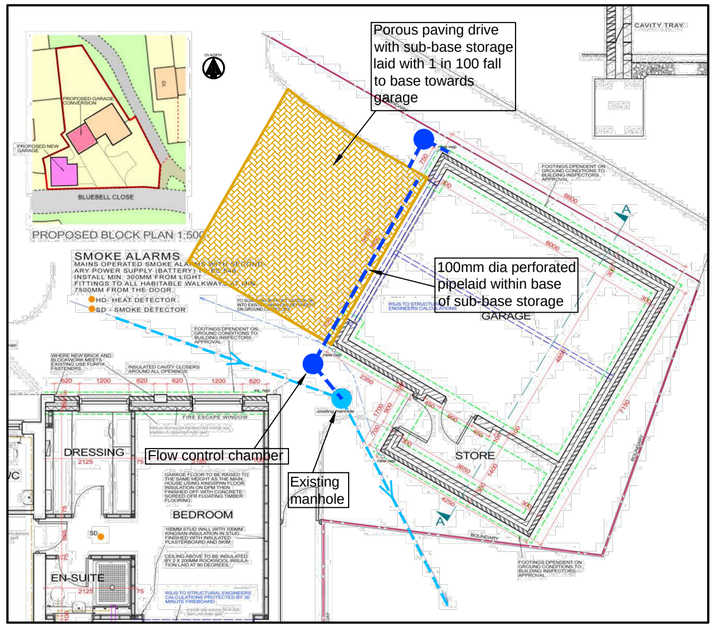
* SPECIFICATION FOR SUB-BASE, LAYING COURSE AND BLINDING LAYER: THE CRUSHED STONE MUST POSSESS WELL DEFINED EDGES AND HAVE A MINIMUM 10% FINES VALUE OF 150K/N WHEN TESTED IN ACCORDANCE WITH BS812 PART 3.

GRADING OF LOWER SUB-BASE STONE

SIEVE SIZE	% PASSING
100mm	100
80mm	80-100
60mm	60-80
40mm	30-50
20mm	0-20
10mm	0-5

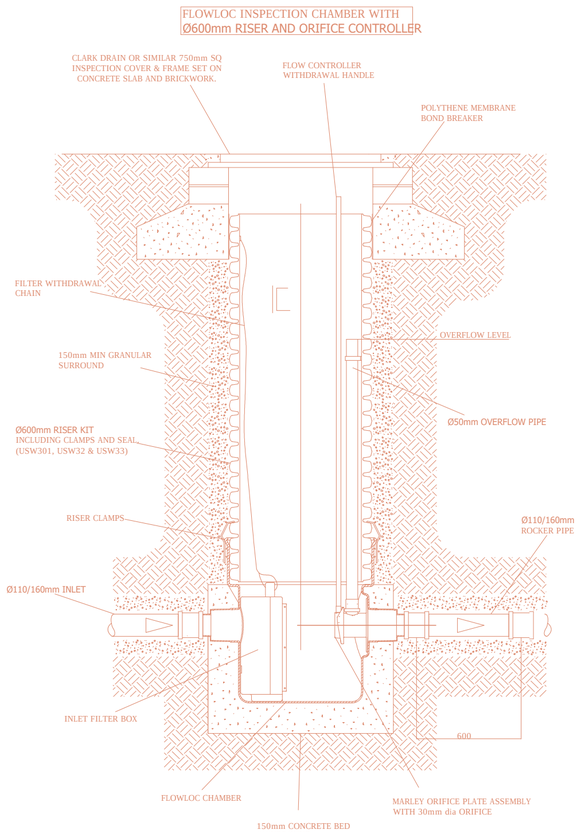
TANKED PERMEABLE PAVING STORAGE DETAIL

SCALE 1:10



PLAN LAYOUT

Scale 1:100



ORIFICE CONTROLCHAMBER

SCALE 1:20

REVISIONS

Rev	Date	Description	By	Ckd	App
P01	17/01/23	First Issue.	RJH		

Hydrock

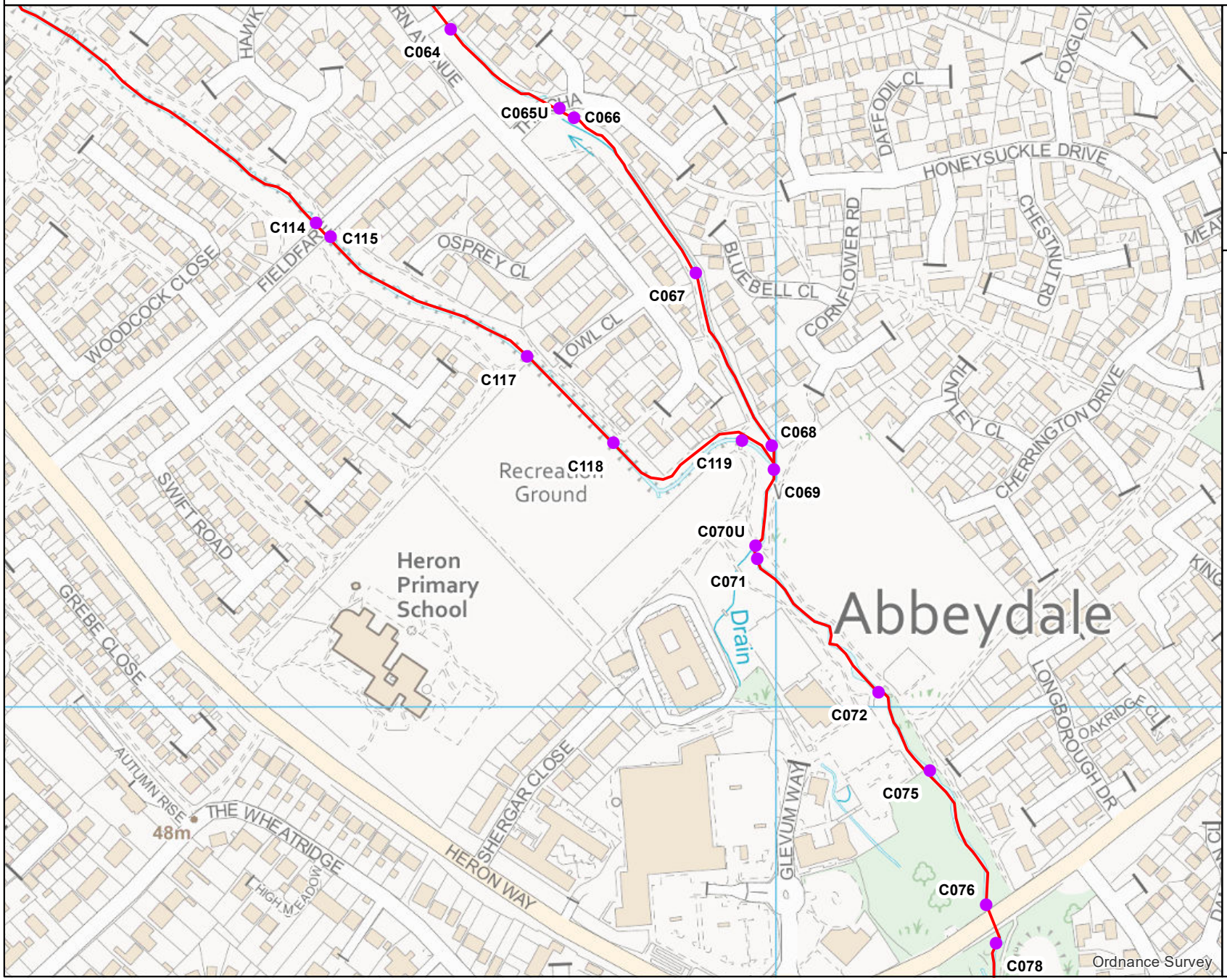
CLIENT
MR & MRS PIGAN

PROJECT
14 BLUEBELL CLOSE
ABBEYMEAD
GLOUCESTER

TITLE
PROPOSED SURFACE WATER DRAINAGE SCHEME

HYDROCK PROJECT NO.	SCALE @ A1
27232-IOCB	As Shown
STATUS DESCRIPTION: FOR APPROVAL	STATUS: S2
DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER): 27232-HYD-XX-XX-DR-D-2001	REVISION: P01

River Twyver Model Nodel Location Map including GL4 4GP - created 20/12/2022 [290377]



Environment Agency

Scale 1: 4000

Legend

- Main River
- River Twyver Model Node Point

West Midlands Area

Created by Partnerships and Strategic Overview Team, West Midlands

Contact us: National Customer Contact Center, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon - Fri 8-6). Email: [redacted]

Product 4 (Detailed Flood Risk Data) for 14 Bluebell Close, Gloucester, GL4 4GP

Reference number: 290377
Date of issue: 21 December 2022

Model Information

The following information and attached maps contain a summary of the modelled information relevant to the area of interest. The information provided is based on the best available data as of the date of issue.

Model Name	Release Date
River Twyver	2006

Flood Map for Planning (Rivers and Sea)

The Flood Map for Planning (Rivers and Sea) indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood event with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring in any year for fluvial (river) flooding (Flood Zone 3). It also shows the extent of the Extreme Flood Outlines (Flood Zone 2) which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater. The Flood Zones refer to the land at risk of flooding and **do not** refer to individual properties. It is possible for properties to be built at a level above the floodplain but still fall within the risk area.

This Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered that flooding may occur from other sources such as surface water, sewers, road drainage, etc.

To find out which flood zone a location is in please use: https://flood-map-for-planning.service.gov.uk/

Definition of flood zones

- **Zone 1** - The area is within the lowest probability of flooding from rivers and the sea, where the chance of flooding in any one year is less than 0.1% (i.e. a 1000 to 1 chance).

- **Zone 2** - The area which falls between the extent of a flood with an annual probability of 0.1% (i.e. a 1000 to 1 chance) fluvial and tidal, or greatest recorded historic flood, whichever is greater, and the extent of a flood with an annual probability of 1% (i.e. a 100 to 1 chance) fluvial / 0.5% (i.e. a 200 to 1 chance) tidal. (Land shown in light blue on the Flood Map).
- **Zone 3** - The chance of flooding in any one year is greater than or equal to 1% (i.e. a 100 to 1 chance) for river flooding and greater than or equal to 0.5% (i.e. a 200 to 1 chance) for coastal and tidal flooding.

Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the Strategic Flood Risk Assessment when considering location and potential future flood risks to developments and land uses.

Areas Benefitting From Defences

Where possible we show the areas that benefit from the flood defences, in the event of flooding:

- from rivers with a 1% (1 in 100) chance in any given year, or;
- from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there these areas would flood. Please note that we do not show all areas that benefit from flood defences.

The associated Dataset is available here: https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-areas-benefiting-from-defences

Node Data/ Modelled Levels

The attached map will show a selection of 1D model node points near to your site. The fluvial levels for these node points are shown below.

Fluvial Flood Levels (m AOD)

The modelled levels are given in m AOD (N), m AOD indicates metres Above Ordnance Datum (Newlyn).

The information is taken from the model referenced above and does not include the updated climate change figures.

			Annual Exceedance Probability - Maximum Water Levels (m AOD) (defended)							
Node Label	**Easting**	**Northing**	**20% (1 in 5)**	**10% (1 in 10)**	**4% (1 in 25)**	**2% (1 in 50)**	**1.33% (1 in 75)**	**1% (1 in 100)**	**1% (1 in 100) inc. 20% increase in inflows**	**0.1% (1 in 1000)**
C078	386161	215828	41.90	41.98	42.14	42.26	42.33	42.39	42.58	43.12
C076	386154	215856	41.76	41.81	41.87	41.88	41.88	41.88	41.88	42.14
C075	386113	215953	41.31	41.38	41.47	41.54	41.58	41.61	41.64	41.79
C072	386075	216010	40.63	40.74	40.91	41.01	41.06	41.09	41.19	41.51
C071	385987	216108	40.19	40.29	40.48	40.57	40.62	40.64	40.71	41.10
C070U	385986	216117	40.15	40.24	40.43	40.55	40.60	40.63	40.71	41.12
C069	385999	216173	39.81	39.87	39.99	40.10	40.16	40.20	40.29	41.06
C068	385997	216190	39.66	39.74	39.97	40.12	40.19	40.25	40.41	40.63
C067	385942	216316	39.18	39.23	39.43	39.58	39.66	39.72	39.87	40.24
C066	385853	216430	36.57	36.67	37.19	37.59	37.66	37.70	37.79	38.07
C065U	385842	216436	36.50	36.62	37.19	37.59	37.66	37.70	37.79	38.06
C064	385763	216494	35.86	35.96	36.34	36.69	36.77	36.82	36.95	37.29

Email: [redacted]
Website: www.gov.uk/government/organisations/environment-agency

C119	385976	216194	38.84	38.91	38.90	38.91	38.91	38.89	38.89	39.54
C118	385882	216192	36.86	36.93	37.02	37.07	37.08	37.09	37.12	37.24
C117	385819	216255	35.27	35.34	35.43	35.48	35.50	35.52	35.58	35.72
C115	385676	216342	33.18	33.27	33.35	33.40	33.42	33.43	33.48	33.70
C114	385665	216353	33.16	33.25	33.32	33.37	33.39	33.40	33.45	33.64

Email: [redacted]
Website: www.gov.uk/government/organisations/environment-agency

Modelled Flood Extents

Available modelled flood outlines produced as part of the detailed modelling have been provided to you in GIS format, these show modelled flood extents. Climate change will increase flood risk due to overtopping of defences.

https://ea.sharefile.com/d-s348d020367974eff933264523535fa5c

Climate Change

The 'Flood Risk Assessments: Climate Change Allowances' are published on gov.uk. This is in replacement of previous climate change allowances for planning applications. The data provided in this product does not include the new allowances. You will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding. The climate change factors are now more complex and a single uplift percentage across England cannot be justified.

The Environment Agency will incorporate the new allowances into future modelling studies. For now it remains the applicant's responsibility to demonstrate through their proposal and flood risk assessments that new developments will be safe in flood risk terms for its lifetime.

Recorded Flood Outlines

Following examination of our records of historical flooding we have no record of flooding in the area. The absence of coverage for an area does not mean that the area has never flooded, only that we do not currently have records of flooding in this area. It is also possible that the pattern of flooding in this area has changed and that this area would now flood or not flood under different circumstances.

You may also wish to contact your Local Authority or Internal Drainage Board, to see if they have other relevant local flood information.

Flood Defences

Flood defences do not completely remove the chance of flooding. They can be overtopped by water levels which exceed the capacity of the defences.

If flood defences are located in your area you can access this data here:
https://data.gov.uk/dataset/spatial-flood-defences-including-standardised-attributes

Planning developments

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 Flood Risk Assessments.

You can also request pre application advice:

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

Supporting Information

River modelling: technical standards and assessment guidance

The link below contains standards for the flood risk management industry on how to build and review hydraulic models and provide evidence for flood risk management decisions.

https://www.gov.uk/government/publications/river-modelling-technical-standards-and-assessment

Surface Water

Managing the risk of flooding from surface water is the responsibility of Lead Local Flood Authorities. The 'risk of flooding from surface water' map has been produced by the Environment Agency on behalf of government, using information and input from Lead Local Flood Authorities.

You may wish to contact your Local Authority who may be able to provide further detailed information on surface water.

It is not possible to say for certain what the flood risk is but we use the best information available to provide an indication so that people can make informed choices about living with or managing the risks. The information we supply does not provide an indicator of flood risk at an individual site level. Further information can be found on the Agency's website:

https://flood-warning-information.service.gov.uk/long-term-flood-risk

Flood Risk from Reservoirs

The Flood Risk from Reservoirs map can be found on the Long Term Flood Risk Information website:

https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?map=Reservoirs

Flood Alert & Flood Warning Area

We issue flood alert/warnings to specific areas when flooding is expected. If you receive a flood warning you should take immediate action. You can check whether you are in a Flood Alert/Warning Area and register online using the links below:

https://www.gov.uk/check-flood-risk

https://www.gov.uk/sign-up-for-flood-warnings

If you would prefer to register by telephone, or if you need help during the registration process, please call Floodline on 0345 988 1188.

The associated dataset for flood warning areas is available here:
https://data.gov.uk/dataset/flood-warning-areas3

The associated dataset for flood alert areas is available here:
https://data.gov.uk/dataset/flood-alert-areas2

Flood Risk Activity Permits

We now consider applications for works, which may be Flood Risk Activities, under Environmental Permitting Regulations. This replaces the process of applying for a Flood Defence Consent. You may need an environmental Permit for flood risk activities if you want to do work:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence

Please go to this website to find out more about how to apply:
https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.

Please be aware that Bespoke and Standard Rules permits can take up to 2 months to determine and will incur a charge.

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather