

Coventry Stadium, Brandon

Flood Risk Assessment

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1.0 INTRODUCTION

- 1.1 This Flood Risk Assessment (FRA) has been produced by Armstrong Stokes & Clayton on behalf of Coventry Stadium, Brandon in support of an outline planning application for the proposed residential redevelopment of the Coventry Stadium site, Brandon, Coventry CV8 3GJ.
- 1.2 This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) and the accompanying Planning Practice Guidance (PPG), and in consultation with the Environment Agency, Severn Trent Water and Rugby Borough Council.

2.0 PLANNING POLICY

National

- 2.1 The NPPF and PPG provide national planning guidance on the management of flood risk in respect to new development.
- 2.2 Paragraph 100 of the NPPF document states *'Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.'*
- 2.3 For the purposes of applying the NPPF, PPG states *'flood risk is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources'.*
- 2.4 For the purposes of applying the NPPF, PPG states *'areas at risk from all sources of flooding are included. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. It can also include an area within Flood Zone 1 which the Environment Agency has notified the local planning authority as having critical drainage problems'.*
- 2.5 PPG states that the key objectives of a site specific FRA is to establish.
- *whether a proposed development is likely to be affected by current or future flooding from any source;*
 - *whether it will increase flood risk elsewhere;*
 - *whether the measures proposed to deal with these effects and risks are appropriate;*
 - *the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;*
 - *whether the development will be safe and pass the Exception Test, if applicable.*

Local

- 2.6 Rugby Borough Council has prepared a joint Strategic Flood Risk Assessment (SFRA) with Stratford-on-Avon District Council, Warwickshire County Council and North Warwickshire Borough Council, dated September 2013. This document provides further more local guidance in respect of flood risk. This FRA has been prepared with reference to the SFRA.

3.0 EXISTING SITE

General

- 3.1 The application site is Brownfield with a total gross area of approx. 10.86 ha, although it should be noted that the developable area will extend to approx. 4.15 ha. An OS based location plan identifying the red line boundary is included within **Appendix A**.
- 3.2 The site consists of the former Coventry Stadium, previously used for speedway and greyhound racing. The premises consist of the stadium itself, a selection of outbuildings and large car parking area.
- 3.3 The site is bound to the north west by Binley Woods, to the north east by Gossett Lane and residential property, to the south east by Speedway Lane and residential property beyond and to the south west by Rugby Road (A428) and residential property.
- 3.4 Shallow open watercourses run along the north eastern and north western boundaries of the site.

Levels

- 3.5 A fully contoured topographical survey of the site, relative to OSBM, has been carried out. A copy of the survey drawing is included within **Appendix B**.
- 3.6 The survey confirms that the site is generally level with a slight prevailing fall from east to west. The highest ground level noted on the survey is approx. 97.04m AOD, towards the eastern corner, with the lowest ground level noted as being approx. 94.81m AOD towards the western corner.

Drainage

- 3.7 An extract of the public sewer records has been obtained from Severn Trent Water and a copy is included within **Appendix C**. The records confirm that there are public foul and surface water sewers located within Rugby Road.

- 3.8 Whilst a drainage survey of the site has not been carried out, we understand that foul drainage from the existing stadium buildings is connected to the public foul sewer network. From a site walkover, it is evident that much of site consists of well compacted unmade surfacing with little evidence of a formal surface water drainage network. It was also noted that some of the existing building rainwater pipes discharge directly onto the ground.
- 3.9 The site lies within the general Greenfield catchment of the open watercourse that runs along the north western boundary of the site. An assessment of Greenfield run-off has been made using the Micro Drainage software suite, adopting the ICP SUDS method. Based on a proposed developable area of approx. 4.15 ha. the results confirm an average (QBAR) run-off rate of 18.2 l/s for the site. A copy of the results is included within **Appendix E**.

4.0 POTENTIAL SOURCES OF FLOODING

Fluvial/Tidal Flooding

- 4.1 The nearest potential source of fluvial/tidal flooding is represented by the River Avon, which is located approx. 1.5 km to the south of the application site. The River Avon is classified as 'Main River'.
- 4.2 An extract of the Environment Agency's on line flood mapping is shown in Figure 1 below. The dark blue areas represent Flood Zone 3, land assessed as having a 1 in 100 or greater annual probability of river flooding ($>1\%$) or a 1 in 200 or greater annual probability of flooding from the sea ($>0.5\%$) in any year. The light blue areas represent Flood Zone 2, land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding ($1\% - 0.1\%$) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding ($0.5\% - 0.1\%$) in any year. All remaining areas are classified as Flood Zone 1, land assessed as having a less than 1 in 1000 annual probability of river or sea flooding ($<0.1\%$) in any year.
- 4.3 The application site location is indicated on the flood mapping extract in Figure 1, confirming that it lies within Flood Zone 1.

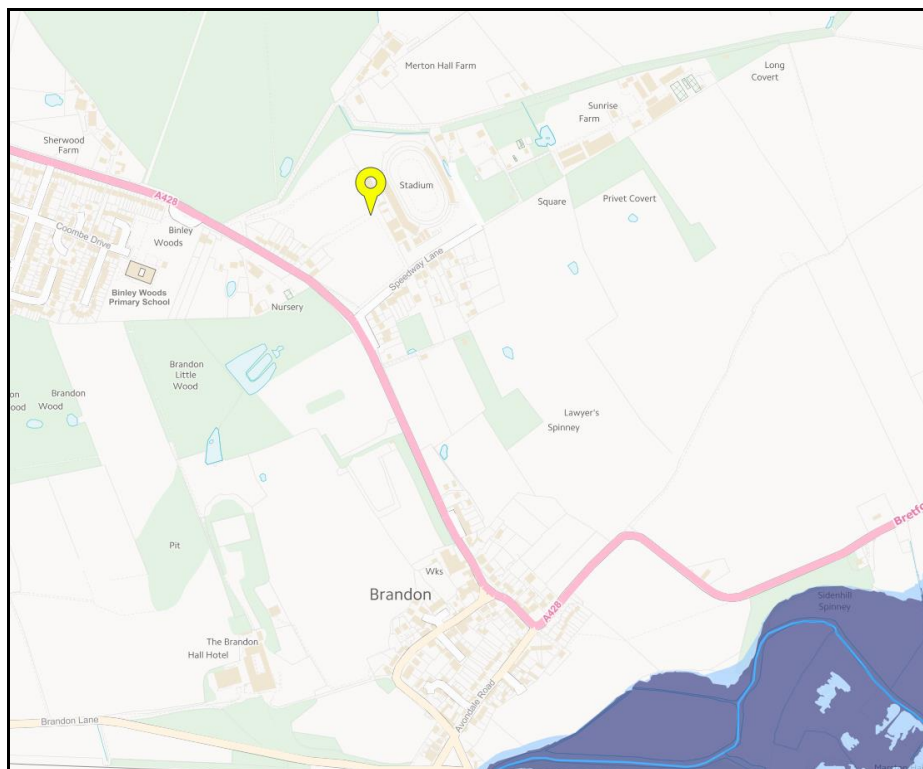


Figure 1 – Environment Agency Floodplain Mapping Extract

Groundwater

- 4.4 Groundwater flooding is highly variable and dependant on localised ground conditions.
- 4.5 The SFRA contains no specific records of groundwater flooding but includes extracts of the Environment Agency's Areas Susceptible to Groundwater Flooding (AStGWF) mapping. This mapping suggests that the site lies within an area with a 25 – 50% risk of groundwater flooding.
- 4.6 Whilst no site specific records of the groundwater levels are currently available, we are not aware of any anecdotal evidence to suggest that the site is particularly prone to groundwater flooding.
- 4.7 The site is not located within an Environment Agency groundwater Source Protection Zone (SPZ).

Overland Flows

- 4.8 The Environment Agency on line surface water flood mapping indicates that the central area of the site is susceptible to surface water flooding. An extract of the mapping is shown in Figure 2 below.

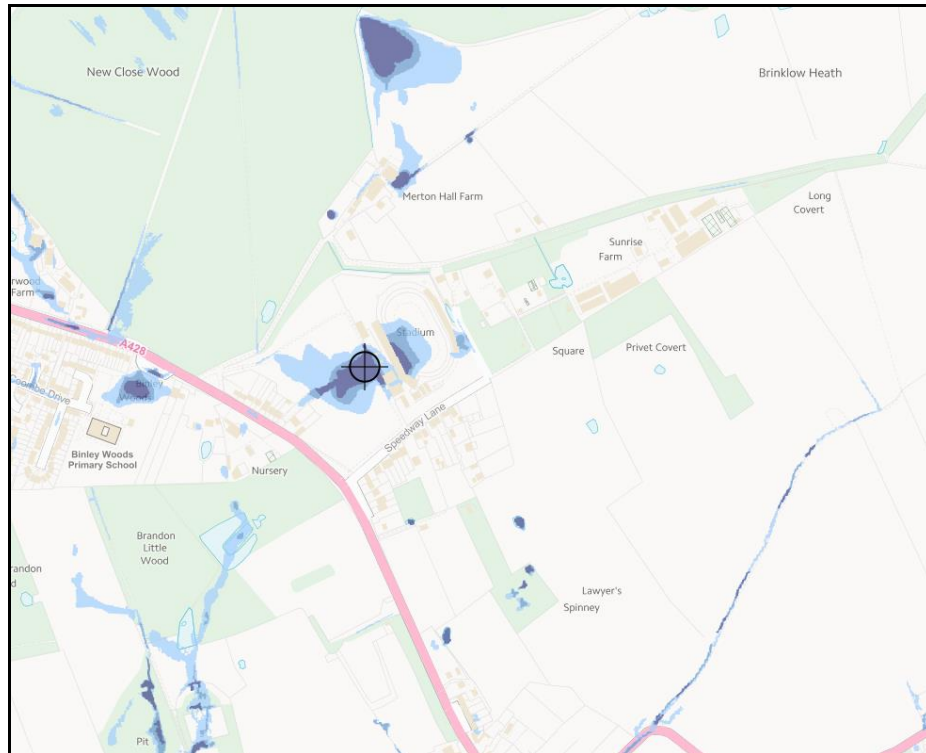


Figure 2 – Environment Agency Surface Water Flood Mapping Extract

- 4.9 Initial on site investigations suggest that the flooding indicated is due to the lack of a surface water drainage system serving the existing large car parking area. Whilst the car park is largely unmade hardcore, and permeable by definition, it has become very well compacted over many years thus becoming impermeable, with no formal drainage arrangements being provided.

Existing Sewers

- 4.10 The SFRA contains sewer flooding mapping based on records supplied by Severn Trent Water within the Borough on a postcode basis from their DG5 register. The mapping suggests that the site lies within an area that has experienced 1 – 5 incidents.
- 4.11 We are not aware of any evidence of flooding problems affecting the site associated with the local public sewer network or any nearby private drainage networks.

Reservoirs, Canals & Other Artificial Sources

- 4.12 There are no artificial sources identified within the vicinity that would pose a flood risk to the site.

5.0 PROPOSED DEVELOPMENT

General

- 5.1 It is proposed to develop the site to accommodate up to 137 No. residential units, together with associated access roads, parking, driveways, gardens and landscaped open spaces.
- 5.2 The proposed development illustrative masterplan, prepared by Barton Willmore, is included within **Appendix D**.

Levels

- 5.3 The proposed finished development levels have yet to be finalised, however, it is expected that they will generally reflect the existing prevailing topography.

Foul Drainage

- 5.4 Based on a proposed development of 137 No. residential dwellings @ 4000 l/unit/day, the peak foul discharge generated will be approx. 6.34 l/s.
- 5.5 Subject to confirmation of available capacity from Severn Trent Water, it is proposed to connect the proposed foul discharge from the new development to the public foul sewer within Rugby Road.
- 5.6 Based on the existing topography and the indicted invert level of the public sewer, it is evident that a gravity connection from all parts of the development will not be feasible. It will therefore be necessary to provide an on site foul pumping station.
- 5.7 It is expected that the proposed main on site foul drainage network, including the pumping station, will be offered to Severn Trent Water for adoption under Section 104 of the Water Industry Act 1991.

Surface Water Drainage

- 5.8 A preliminary ground investigation study has been carried out which suggests that the site is underlain by Dunsmore Gravel superficial deposits over Mercia Mudstone Group bedrock. The study therefore suggests that infiltration SUDS techniques will potentially be feasible to some extent.
- 5.9 At this stage, in the absence of any site specific intrusive investigations and any firm soil infiltration rates, an attenuation based surface water strategy is therefore proposed with a restricted average Greenfield equivalent discharge to the open watercourses that bound the site.
- 5.10 With respect to the attenuation, open features are always preferable to below ground structures where possible as they offer wider ecological and biodiversity benefits. In this instance, due to the generally level topography of the site and the shallow nature of the receiving drainage ditches, it is proposed to provide 2 No. off line balancing ponds which will each serve approx. 50% of the surface water run-off from the development.
- 5.11 Based on a developable area of approx. 4.15 ha, it has been estimated that approx. 2.50 ha (approx. 60%) will potentially become impermeable. This area has been divided into two to provide a maximum contributing impermeable area of 1.25 ha for each pond.
- 5.12 Preliminary attenuation calculations have been carried out using Micro Drainage software suite to assess the likely maximum size of each pond, in order to confirm that sufficient space has been allocated. A summary of the balancing pond design criteria is as follows.
- Contributing Imp. Area – 1.25 ha (50% of the total contributing imp. area)
 - Design Event – 1 in 100 year (plus a 40% allowance for climate change)
 - Max. Discharge – 9.1 l/s (50% of the average Greenfield equivalent rate)
 - Max. Overall Depth – 1.3m (1.0m effective)
 - Bank Slopes – 1 in 4

- 5.13 A copy of the calculation output is included within **Appendix E**. In summary, a storage volume of approx. 763.8m³ would be required within each balancing pond, giving a maximum plan area of approx. 1110.5m² for each pond.
- 5.14 The proposed development illustrative masterplan layout identifies the location of the ponds and confirms that sufficient open space is available.
- 5.15 Whilst infiltration SUDS have been discounted at this stage, they should not be totally dismissed. For instance, should infiltration rates prove favourable, it may be viable to use the attenuation ponds as infiltration basins. The viability of permeable paving for the construction of driveways and private parking areas should also be considered at the detailed design stage. Even if ground conditions prove not entirely suitable for infiltration SUDS, permeable paving can still be used as a valuable initial treatment train and may also reduce the extent of on site attenuation required.
- 5.16 Consideration should also be given to the incorporation of water butts on individual rainwater pipes, with overflows draining to the surface water network. Whilst the incorporation of water butts will not reduce the design criteria of the receiving system, their inclusion will delay the time of entry and provide the facility for some surface water run-off to be stored and used for irrigation.
- 5.17 In terms of other SUDS techniques, the use of green roofs will not be suitable for use on individual properties with standard pitched or hip type roofs. Rainwater harvesting systems are likely to prove cost prohibitive.
- 5.18 Whilst the site does not lie within a groundwater SPZ, the proposed surface water drainage system should be designed in accordance with all relevant Environment Agency Pollution Prevention Guidance (PPG).
- 5.19 It is expected that the proposed main on site surface water drainage network will be offered to Severn Trent Water for adoption under Section 104 of the Water Industry Act 1991. The maintenance of the balancing ponds would be undertaken by a management company in perpetuity.

6.0 VULNERABILITY & COMPATIBILITY

General

- 6.1 In accordance with Table 2: Flood Risk Vulnerability Classification, contained within the PPG, residential usage (Class C3) is classified as 'more vulnerable' development.
- 6.2 More vulnerable development uses are appropriate for location within Flood Zone 1.

Sequential Test

- 6.3 Paragraph 101 of the NPPF states *'The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The SFRA will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.'*
- 6.4 In this instance, the site is considered to be sequentially acceptable as the proposed development will be located within Flood Zone 1.

Exception Test

- 6.5 In accordance with Table 3: Flood risk vulnerability and flood zone 'compatibility', contained within the PPG, the Exception Test is not required in this instance.
- 6.6 Whilst the Exception Test is not required, it should be noted that this FRA demonstrates that, in accordance with paragraphs 102 and 103 of the NPPF, the proposed development will be safe for its lifetime, taking in to account the vulnerability of its users. It also demonstrates that there will be no increase in flood risk to other areas.

7.0 ASSESSMENT OF FLOOD IMPACT

Fluvial/Tidal Flooding

- 7.1 Based on the current Environment Agency indicative flood mapping, the application site is located within Flood Zone 1 so the proposed development can therefore be considered to be at the lowest probability of fluvial flooding (<1%).
- 7.2 We are not aware of any historical records or anecdotal evidence to suggest that the site has been affected by flooding via this source.

Groundwater

- 7.3 No specific information relating to groundwater levels on the site is available, however, there is no evidence to suggest that the site is susceptible to groundwater flooding.
- 7.4 In the absence of any historical records or anecdotal evidence to suggest otherwise, and based on the information contained within the SFRA, the risk of groundwater flooding to the proposed development is therefore considered to be low.

Surface Water/Overland Flows

- 7.5 Whilst the Environment Agency surface water mapping suggests that the central part of the site is susceptible to surface water flooding, as previously stated, it is noted that there is a notable lack of positive surface water drainage provision within the existing development.
- 7.6 The existing scenario will clearly change in the post development scenario, with the proposed development being served by a fully engineered surface water drainage network in accordance with all current requirements.

Existing Sewers

- 7.7 We are not aware of any records or anecdotal evidence to suggest that the development will be subject to flooding resulting from deficiencies with the existing public or any private drainage networks.
- 7.8 The risk of flooding to the proposed development from this source is therefore considered to be low.

Proposed Drainage

- 7.9 There will clearly be an increase in peak foul discharge in the post development scenario. On the basis that Severn Trent Water confirms that sufficient capacity is available within the local public sewer network, no increase in flood risk to other areas via this source is expected.
- 7.10 An attenuation based surface water drainage system restricting the positive surface water discharge from the development to a maximum rate of 18.2 l/s, the Greenfield QBAR equivalent, should ensure no increase in the risk of flooding to the development or other areas via this source in lower order rainfall events, and a reduction in flood risk in more extreme events.

Reservoirs, Canals & Other Artificial Sources

- 7.11 No potential artificial sources of flooding have been identified within the vicinity of the site.

8.0 CONCLUSIONS & RECOMMENDATIONS

General

- 8.1 With consideration of all the information available, including that contained within the SFRA, the risk of flooding to the proposed development from all sources is considered to be low.

Mitigation Measures

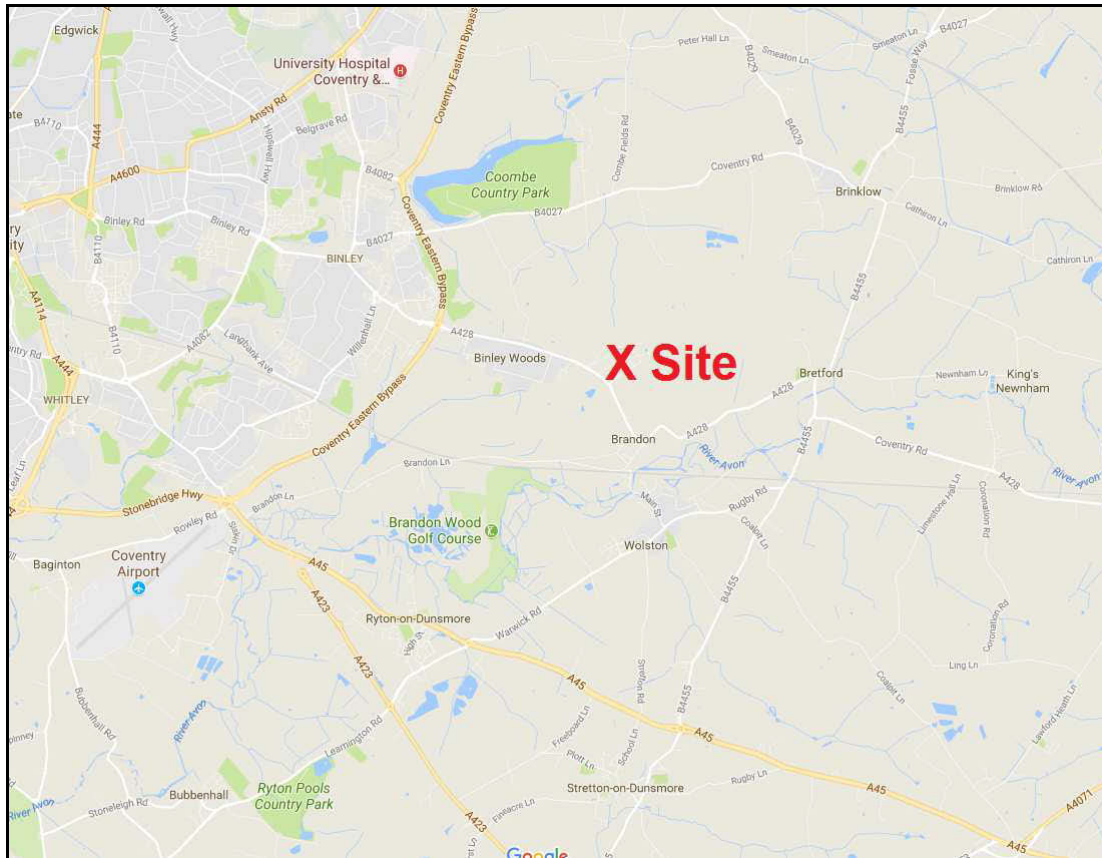
- 8.2 As the proposed development will be located within Flood Zone 1, it will not displace floodwater in the 1 in 100 year event. No floodwater storage mitigation measures are therefore proposed.
- 8.3 The implementation of an attenuation based sustainable surface water drainage strategy, as outlined within Section 5 of this report, will ensure that there is no increase in flood risk to surrounding areas resulting from the disposal of surface water run-off in the post development scenario during lower order rainfall events and a reduction in flood risk in more extreme events.
- 8.4 A safe dry route of access/egress will be readily available from all parts of the proposed development.

Residual Flood Risk

- 8.5 Whilst flood risk can never be entirely eliminated, it is considered that the residual flood risk to the development from all sources will be low.
- 8.6 There will be no increase in the residual flood risk to other areas as a result of the development proposals.

APPENDICES

APPENDIX A



APPENDIX A – LOCATION PLAN (NTS)

APPENDIX B

The survey has been organized by the Q-Challenge Survey (Q.S.) National Center (QCSNC), via its Global Positioning System (GPS) and the Q.S. Admin Network (Q.S. ANet). A trans OCSNC connection has been established near to the core centers via a transmission medium using the OSI/NAT-2 QSGS/IGMP synchronization models. The survey has been coordinated to the point and a further core or minor OCSNC points established to create a tiered core or minor OCSNC network.

No such survey has been applied to the survey therefore the coordination factors are arbitrary at first tier Q.S. Coordinates which form a basic factor applied.

Please refer to Survey Station 1 file to enable establishment of the one-tier GPS.

ID Information Access on layer TRIANGLES

Age Group	No opinion	Not a good idea	Good idea	Very good idea	Excellent idea
18-24	10%	15%	45%	25%	5%
25-34	10%	15%	45%	25%	5%
35-44	10%	15%	45%	25%	5%
45-54	10%	15%	45%	25%	5%
55-64	10%	15%	45%	25%	5%
65+	10%	15%	45%	25%	5%

Rev A: additional information added to northern boundary.
june 14

Coventry

1 of 2

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