Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

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Site code	PS13
Site name	Central River, Canal Corridor

Site details	**OS Grid reference**	SO 84124 04959
	Area	10.84 ha
	Current land use	Brownfield site
	Proposed site use	Residential/tourism/employment
	Flood risk vulnerability	More vulnerable
Sources of flood risk	**Existing watercourses**	The River Frome flows to the south of the site, and the Stroudwater Canal forms the northern boundary. Painswick Stream, a Main River, also forms a confluence with the Stroudwater Canal at the northern site boundary. Two lakes are located within the centre of the site.
	Flood history	There are no historic outlines of fluvial flooding recorded at the site. An incident of overtopping on the Stroudwater Canal was recorded in the north of the site on 20th July 2007 and led to the flooding of one garage as well as nearby Cainscross Road. One incident of highway flooding was recorded at Frome Hall Lane, at the southern boundary of the site on 4th July 2007, with exceedance of the surface water sewer or drainage system suspected to be the cause. A cluster of flood incidents are recorded beyond the eastern corner of the site, at the junction between A46 Bath Rad and A419 Dr Newton's Way. However, it should be noted that these are postcode-scale incidents, and which have been plotted at the centre of the postcode area, and therefore the location affected may differ. The recorded incidents are as follows: • 14/12/2000 – reported sewer flooding causing internal flooding • 13/02/2001 – reported sewer flooding causing curtilage flooding • 24/06/2007 – reported sewer flooding causing internal, external and highway flooding • 03/11/2011 - reported sewer flooding causing highway flooding • 02/08/2018 – reported fluvial flooding
	Fluvial	

Proportion of the site at risk (%)	**5% AEP**	**1% AEP**	**0.1% AEP**
	30%	43%	54%

Available modelled data: The site is covered by the Environment Agency River Frome 2D detailed hydraulic model, prepared in 2008. The model was further developed as part of the Stroud Valleys modelling study in 2015. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here.

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<table>
<tr><td rowspan="7"></td><td></td><td>Flood characteristics: The site is at high risk of fluvial flooding, with the centre of the site located within the 1 in 20 fluvial extent, the functional floodplain. The centre and east of the site are also predicted to be affected during a 1in 100 and 1 in 1,000 flood event, whereas the western portion of the site remains at very low risk (i.e. within Flood Zone 1).

Peak undefended flood levels on the River Frome at the site range from 38.84mAOD at the southeast corner of the site, to 35.79mAOD at the south west corner, during the 1 in 100 flood event. On the Stroudwater Canal, maximum undefended flood levels range from 39.52mAOD in the north east corner of the site during the 1 in 100 event, to 37.55mAOD in centre of the northern site boundary.</td></tr>
<tr><td rowspan="3">Surface Water</td><td>Proportion of site at risk (RoFSW)</td></tr>
<tr><td><table><tr><th>1 in 30</th><th>1 in 100</th><th>1 in 1,000</th></tr><tr><td>2%</td><td>11%</td><td>42%</td></tr></table></td></tr>
<tr><td>Description of surface water flow paths: The site is at moderate risk of surface water flooding. The central and north eastern areas of the site, between the Stroudwater Canal and River Frome, are at highest risk of flooding, with large areas of ponding predicted to accumulate around the existing buildings during the 1 in 100r and 1 in 1,000 rainfall events.</td></tr>
<tr><td rowspan="3">Groundwater</td><td>Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)</td></tr>
<tr><td><table><tr><th>ASTGWF - Category 2
>=25% <50%</th><th>ASTGWF - Category 3
>=50% <75%</th><th>ASTGWF - Category 4
>=75%</th></tr><tr><td>26%</td><td>29%</td><td>0%</td></tr></table></td></tr>
<tr><td>The site is at moderate groundwater flood risk, being partially located within 1km^2 grid squares with a greater than 25% but less than 75% risk of groundwater emergence during a 1 in 100 event.</td></tr>
<tr><td>Reservoir</td><td>The south western boundary of the site is at risk of reservoir flooding. However, the area of coverage by Reservoir Inundation Mapping is very small.</td></tr>
<tr><td>Canal</td><td>The Stroudwater Canal forms the northern boundary of the site, therefore the site is identified as being potentially at risk of canal flooding.</td></tr>
</table>

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<table>
<tr><td rowspan="5">Flood risk management infrastructure</td><td rowspan="2">Defences</td><td>Defence Type</td><td>Standard of Protection</td><td>Condition</td></tr>
<tr><td colspan="3">There are no flood defences within, or within the vicinity of the site.</td></tr>
<tr><td rowspan="3">Residual risk</td><td>Culvert / structure blockage?</td><td colspan="2">There are no culverts within the site boundary. However, the River Frome appears to be bridged or culverted to the east of the site, where it passes beneath A46 Bath Road.</td></tr>
<tr><td>Impounded water body failure?</td><td colspan="2">A small proportion of the south western boundary of the site is at risk of reservoir flooding, in the event of a breach.</td></tr>
<tr><td rowspan="2">Defence breach / overtopping?</td><td colspan="2">Breach Zone</td></tr>
<tr><td colspan="2">There is a residual risk of flooding due to overtopping of the Stroudwater Canal, which is modelled as part of the undefended flood extent from the River Frome (as represented by the Flood Zones). However, there are no reported incidents of canal breach or overtopping in this location.</td></tr>
<tr><td rowspan="2">Emergency planning</td><td>Flood warning</td><td colspan="3">The site is covered by the following Environment Agency Flood Warning and Flood Alert Areas:
River Frome at Stroud and Ryeford Flood Warning Area
Rivers Frome and Cam Flood Alert Area</td></tr>
<tr><td>Access and egress</td><td colspan="3">The site is likely to be accessed from A46 Bath Road. However, alternative access routes are available on Chestnut Lane and Lodgemoor Lane, to the north. The area of Bath Road at the eastern corner of the site, and the end of Lodgemoor Lane, are identified as at risk of flooding during a 1 in 100 and 1 in 1,000 event on the River Frome. The risk of surface water flooding to all three roads is relatively low, with areas of ponding predicted to occur during a 1 in 1,000 rainfall event only.</td></tr>
<tr><td rowspan="3">Climate Change</td><td rowspan="2">Climate change allowances for ‘2080s’</td><td>River Basin District</td><td>Central</td><td>Higher Central</td><td>Upper End</td></tr>
<tr><td>Severn</td><td>25%</td><td>35%</td><td>70%</td></tr>
<tr><td>Implications for the site</td><td colspan="4">Climate change is expected to increase the extent of the 1 in 100 flood event at the site.</td></tr>
</table>

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Requirement for drainage control and impact mitigation	**Bedrock Geology**	The underlying geology is Lias Group Mudstone, Siltstone, Limestone and Sandstone.	
	Superficial Geology	Landslip deposits are located over the majority of the north and west of the site, with river terrace deposits present across the east and south.	
	Soils	The majority of the site is underlain by slowly permeable and slightly acid, base-rich loamy and clayey soils, which are seasonally wet. The east of the site is covered by slightly acid loamy and clayey soils with impeded drainage	
	SuDS	• As a previously developed site, development should seek to reduce the coverage of impermeable surfaces, to limit the rates and volumes of surface water runoff generate on the site. • Opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. • A desk-based review of the site geology suggests that infiltration techniques may not be suitable at the site. However, the potential for infiltration should be investigated within site-specific infiltration testing. • Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk.	
	Groundwater Source Protection Zone	The site is not located within a designated Source Protection Zone.	
	Historic Landfill Site	There are no historic landfill sites within the development site boundary. However, Farhill Landfill site is located approximately 30mto the north of the site. Cainscross landfill is located approximately 400m to the north west of the site.	
	Opportunities for flood risk betterment	The site provides opportunities for storing flood water from the River Frome, to reduce the flow and delay the timing in which it reaches communities downstream.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		River Frome – Source to Ebley Mill	Medium
Recommend-ations for Local Plan policy	**Sequential Test and Exception Test requirements**		
	The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is anticipated that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied: • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios: • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.		
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers		

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Flood risk assessment:

- A site-specific flood risk assessment will be required because the site is partially within Flood Zones 2 and 3. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications).
- All sources of flooding, particularly the risk of surface water and groundwater flooding, should be considered as part of a site-specific flood risk assessment.
- The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.

Guidance for site design and making development safe:

- A site-specific surface water drainage strategy will be required.
- Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream.
- Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage.
- Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding.
- The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure.
- The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.
- Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

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Site code	PS20
Site name	M5 Junction 13

Site details	**OS Grid reference**	SO 78534 06603
	Area	23 ha
	Current land use	Greenfield
	Proposed site use	Sports stadium/employment/community/open source
	Flood risk vulnerability	Less vulnerable
Sources of flood risk	**Existing watercourses**	The site is formed of two land parcels separated by the A419. There are no watercourses located within the site boundary of the north parcel. However, an ordinary watercourse tributary of the River Frome forms a section of the northern boundary of the parcel. The River Frome forms the south western boundary of the south parcel. In addition, the Stroudwater Canal and a further tributary of the Frome flow in a north westerly direction through the centre of the parcel.
	Flood history	There are no recorded flood events recorded within the north land parcel. The Environment Agency Recorded Flood Outline identifies that the southwestern portion of the south parcel was affected by flooding in July 2007, when the channel capacity of the undefended River Frome was exceeded. Upstream of the site, an incident of overtopping on the Stroudwater Canal was recorded on 19th July 2007 by the Canal and Rivers Trust. The cause of flooding was recorded to be blockage due to high magnitude canal flows and bypasses due to weed growth, causing water to back up and flood the A419.
	Fluvial	**Proportion of the site at risk (%)**: 4% AEP: 12%; 1% AEP: 19%; 0.1% AEP: 21% **Available modelled data:** The site is covered by the Environment Agency River Frome 1D-2D detailed hydraulic model, prepared in 2008. The site does not currently benefit from flood defence, and therefore the undefended scenario is assessed here. As part of the proposed development of this site, works will be carried out to the Stroudwater Canal in this location, which will lead to greater interaction between the canal and the River Frome via a new weir. The impact of these works on the flood risk are currently being modelled, with results due to become available in January 2020. This assessment uses the existing Flood Zones, which are the best available information at this point in time. **Flood characteristics:** The north parcel is at very low risk of fluvial flooding (i.e. within Flood Zone 1). The south western portion of the south parcel is predicted to be at risk of flooding from the River Frome during a 1 in 25, 1 in 100 and 1 in 1,000 flood event. Peak flood levels are greatest at the south western corner of the site, where they reach 13.59mAOD in the 1 in 100 and 13.71mAOD in the 1 in 1,000 event. At the north western corner of the land parcel, maximum flood levels are predicted to range between 12.93mAOD (1 in 100) and 13.06mAOD (1 in 1,000).
	Surface Water	**Proportion of site at risk (RoFSW)**: 1 in 30: 7%; 1 in 100: 13%; 1 in 1,000: 42%

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<table>
<tr><td rowspan="5"></td><td></td><td>Description of surface water flow paths: In the north parcel, surface water flood risk is concentrated in the southern, and north western corners of the site, where ponding occurs against the higher ground of the A419 and M5, during a 1 in 30 rainfall event, and greater return periods. The northern boundary of the parcel is also identified to be at risk of surface water flooding during a 1 in 30 rainfall event. However, the extent of risk appears to represent the floodplain of the unnamed River Frome tributary and therefore may be fluvial in nature.

In the south parcel, the greatest surface water flood risk is concentrated at the north western corner, in a low point where the Stroudwater Canal and a tributary of the River Frome pass below the M5. Flooding is predicted to occur here in a 1 in 30 rainfall event. During the 1 in 100 and 1 in 1,000 rainfall events, the extent of flood risk extends southwards, covering the western portion of the land parcel.</td></tr>
<tr><td rowspan="4">Groundwater</td><td colspan="3">Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)</td></tr>
<tr><td>ASTGWF - Category 2
>=25% <50%</td><td>ASTGWF - Category 3
>=50% <75%</td><td>ASTGWF - Category 4
>=75%</td></tr>
<tr><td>0%</td><td>0%</td><td>45%</td></tr>
<tr><td colspan="3">The majority of the south parcel and north western corner of the north parcel are located within a 1km^2 grid square with a 75% or greater risk of groundwater emergence during a 1 in 100 event, and is therefore identified as at high risk. Elsewhere, the risk of groundwater flooding is low, with a <25% risk of groundwater emergence.</td></tr>
<tr><td>Reservoir</td><td colspan="3">The north western portion and western boundary of the south parcel are identified as at risk of reservoir flooding.</td></tr>
<tr><td>Canal</td><td colspan="3">The Stroudwater Canal flows through the south parcel, and therefore the site is at risk of canal flooding.</td></tr>
</table>

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<table>
<tr><td rowspan="5">Flood risk management infrastructure</td><td rowspan="4">Defences</td><td>Defence Type</td><td colspan="2">Standard of Protection</td><td>Condition</td></tr>
<tr><td colspan="4">There are no defences located within the site. The nearest defence is an earth embankment, built to ‘agricultural standards’ and located on the opposite bank of the River Frome to the south parcel.</td></tr>
<tr><td rowspan="3">Residual risk</td><td>Culvert / structure blockage?</td><td colspan="3">There are no culverts located within the site boundary.
The River Frome and its unnamed tributary at the north parcel are culverted beneath the M5. The RoFSW extent at the site provides a proxy of the residual flood risk to the site, in the event of blockage to these culverts.</td></tr>
<tr><td>Impounded water body failure?</td><td colspan="3">The north western portion and western boundary of the south parcel are identified as at risk of reservoir flooding, in the event of a breach.</td></tr>
<tr><td>Defence breach / overtopping?</td><td colspan="3">Breach Zone
The site may be at residual risk of flooding from canal overtopping or breach.</td></tr>
<tr><td rowspan="2">Emergency planning</td><td>Flood warning</td><td colspan="4">The site is located within the following Environment Agency Flood Alert and Flood Warning Areas:
• River Frome at Fromebridge and Eastington Flood Warning Area
• Rivers Frome and Cam Flood Alert Area</td></tr>
<tr><td>Access and egress</td><td colspan="4">Access is likely to be either via the A419, which runs inbetween the two subsection areas of the site, or via the M5. The A419 is at very low risk of both fluvial and surface water flooding.
The M5 at the south parcel is predicted to be at risk of fluvial flooding during a 1 in 100 and 1 in 1,000 flood event, where the River Frome passes beneath it. The sections of the M5 adjacent to both the north and south parcel is at risk of surface water flooding during a 1 in 30 rainfall and greater return periods.</td></tr>
<tr><td rowspan="3">Climate Change</td><td rowspan="2">Climate change allowances for ‘2080s’</td><td>River Basin District</td><td>Central</td><td>Higher Central</td><td>Upper End</td></tr>
<tr><td>Severn</td><td>25%</td><td>35%</td><td>70%</td></tr>
<tr><td>Implications for the site</td><td colspan="4">Climate change is expected to increase the extent of the 1 in 100 flood event at the site.</td></tr>
</table>

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Site code	PS20
Site name	M5 Junction 13

Requirement for drainage control and impact mitigation	**Bedrock Geology**	The underlying geology is Lias Group mudstone, siltstone, limestone and sandstone.	
	Superficial Geology	Superficial alluvium and river terrace deposits are located over a large area of the site, with the exception of the eastern portion of the north parcel.	
	Soils	The north parcel and the eastern portion of the south pracel are underlain by lime-rich loamy and clayey soils with impeded drainage. The southern and western areas of the south parcel are underlain by loamy and clayey floodplain soils with naturally high groundwater.	
	SuDS	• As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. • Due to the high groundwater levels, and risk of groundwater flooding, infiltration techniques are unlikely to be suitable. However, the potential for infiltration should be investigated within site-specific infiltration testing. • Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. • Below-ground SuDS features in areas of high groundwater on the site may need to be lined, to prevent the ingress of groundwater and loss of attenuation storage.	
	Groundwater Source Protection Zone	The site is not located within a designated Source Protection Zone.	
	Historic Landfill Site	There are no historic landfill sites recorded within the site boundary.	
	Opportunities for flood risk betterment	The site provides opportunities for storing flood water from the River Frome, to reduce the flow and delay the timing in which it reaches downstream. This may provide benefit during periods of high tide or high river level on the River Severn, when the River Frome becomes tide-locked and flows on the river back up.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		River Frome – Ebley Mill to Severn	High
			FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects
	Sequential Test and Exception Test requirements		

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Site name	M5 Junction 13

Recommend-ations for Local Plan policy

The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is expected that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied:

- If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change.
- If Highly Vulnerable development is located in FZ2.

If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:

- Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b.
- More Vulnerable and Less Vulnerable development within FZ3b.

Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers

Flood risk assessment:

- A site-specific flood risk assessment will be required because the site is partially within Flood Zones 2 and 3. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications).
- All sources of flooding, particularly the risk of surface water and groundwater flooding, should be considered as part of a site-specific flood risk assessment.
- The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.
- Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration.

Guidance for site design and making development safe:

- A site-specific surface water drainage strategy will be required.
- Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream.
- Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage.
- Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding.
- The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure.
- The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.
- Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

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Site code	PS25
Site name	East of River Cam

Site details	**OS Grid reference**	SO 75131 00558
	Area	7.07 ha
	Current land use	Agricultural land
	Proposed site use	Residential
	Flood risk vulnerability	More vulnerable
Sources of flood risk	**Existing watercourses**	There are no watercourses within the site, however the River Cam flows along the western boundary.
	Flood history	There are no recoded flood incidents within the proposed boundary of the site. The flood extent from July 1968 (which occurred as a result of channel exceedance) is within 10m of the site. In addition, the following sewer flooding events were recorded upstream and downstream of the site: • 22/05/2006, 30/09/2006, 26/06/2007 – external flooding of public open space (GL11 5LQ) • 24/09/1999, 02/02/2004, 03/08/2007 – external flooding of the highway (GL11 5NR – plotted at Station Road)
	Fluvial	**Proportion of the site at risk (%)**: 4% AEP: 2%; 1% AEP: 3%; 0.1% AEP: 5% **Available modelled data:** The site is covered by the Environment Agency River Cam and Wickster's Brook 1D hydraulic model, which was completed in 2007. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here. **Flood characteristics:** The south western border of the site is located within the functional floodplain of the River Cam, defined here as the 1 in 25 flood event, as well as 1 in 100 and 1 in 1,000 flood events. Modelled peak flood levels on the River Cam range from 35.44mAOD (1 in 100) to 36.03mAOD (1 in 1,000) at the northwest corner of the site, to between 35.56mAOD (1 in 100) and 36.18mAOD (1 in 1,000) at the southwest corner.
	Surface Water	**Proportion of site at risk (RoFSW)**: 1 in 30: 2%; 1 in 100: 3%; 1 in 1,000: 7% **Description of surface water flow paths:** The south western border of the site is predicted to experience surface water flooding during the 1 in 30 and greater flood events. However, this is associated with the low-lying floodplain of the River Cam and therefore should not be considered in addition to fluvial risk. Two small surface water flow paths cross the centre and northern edge of the site in a westerly direction during the 1 in 1,000 event, before entering the River Cam.

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Site name	East of River Cam

	Groundwater	**Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)**			
		ASTGWF - Category 2 >=25% <50%	**ASTGWF - Category 3 >=50% <75%**	**ASTGWF - Category 4 >=75%**	
		0%	0%	0%	
		The site is at low risk of groundwater emergence during a 1 in 100 event.			
	Reservoir	The site is not at risk of reservoir flooding.			
	Canal	There are no canals within the site boundary.			
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**	
		There are no flood defences within the site.			
	Residual risk	**Culvert / structure blockage?**	There are no culverts or structures within or adjacent to the site which pose a blockage risk. Middle Mills culvert is located 30m north east of the site, and Station Road culvert is located 95m to the south. However, due to the surrounding topography, blockage of these structures is not considered to pose a risk of flooding to the site.		
		Impounded water body failure?	The site is not at risk of reservoir flooding, in the event of a breach event.		
		Defence breach / overtopping?	**Breach Zone**		
			There are no defences within the		
Emergency planning	**Flood warning**	The site is not included with an Environment Agency Flood Alert Area or Flood Warning Area.			
	Access and egress	Access to the proposed site is likely to be from the south or the west of the site. If access is taken from the south, a connecting road would be required from Upthorpe road, which is at risk of surface water flooding during the 1 in 100 and 1 in 1,000 rainfall events. Alternatively, acess from the west could be via Rowley. Access from this side of the site would require a new access bridge over the River Cam, which would be at high risk of fluvial flooding.			
Climate Change	**Climate change allowances for '2080s'**	**River Basin District**	**Central**	**Higher Central**	**Upper End**
		Severn	25%	35%	70%
	Implications for the site	Climate change is expected to increase the extent of the 1 in 100 flood event at the site. However, it is not expected to increase beyond the extent of the 1 in 1,000 flood event.			

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Site code	PS25
Site name	East of River Cam

Requirement for drainage control and impact mitigation	**Bedrock Geology**	The site is underlain by Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated)	
	Superficial Geology	None recorded on the site.	
	Soils	Soils on the site are slowly permeable, slightly acid, but base-rich loamy and clayey soils, which are seasonally wet.	
	SuDS	• As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. • A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. • Attenuation features must be located outside areas of fluvial flood risk. • The site geology is impermeable in nature and therefore there is likely to be limited potential for discharge of surface water by infiltration. However, the potential for infiltration should be investigated within site-specific infiltration testing.	
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.	
	Historic Landfill Site	There are no historic landfill sites within the proposed boundary.	
	Opportunities for flood risk betterment	The proposed site is in greenfield state, and so runoff volumes should be limited to the current value. Discharge to the River Cam should be limited as far as possible to ensure flood risk downstream is not impacted.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		The Cam – Source to confluence with Gloucester and Sharpness Canal	High FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects
Recommend-ations for Local Plan policy	**Sequential Test and Exception Test requirements**		

Site code	PS25
Site name	East of River Cam

The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is anticipated that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied:

- If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change.
- If Highly Vulnerable development is located in FZ2.

If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:

- Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b.
- More Vulnerable and Less Vulnerable development within FZ3b.

Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers

Flood risk assessment:

- At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required.
- Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage.
- A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications).
- Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water and groundwater.
- The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.
- Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration.

Guidance for site design and making development safe:

- A site-specific surface water drainage strategy will be required.
- Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream.
- Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage.
- Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding.
- The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure.
- The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.
- Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS33
Site name	Northwest of Berkeley

Site details	**OS Grid reference**	SO 68233 00017
	Area	6.51 ha
	Current land use	Greenfield
	Proposed site use	Residential
	Flood risk vulnerability	More vulnerable
Sources of flood risk	**Existing watercourses**	An unnamed ordinary watercourse, which forms a tributary of the Little Avon, flows in a southerly direction along the western boundary of the site.
	Flood history	Flooding occurred along the western boundary of the site, in November 2000, as a result of channel capacity exceedance. Downstream of the site at Berkeley, several sewer flooding incidents occur: • 07/07/2008, 05/09/2008, 24/09/2012, 21/11/2012 - Lynch Road, Berkeley – external flooding to property garden from exceedance of foul/combined sewer network. • 28/10/2013 - James Orchard, Berkeley - external flooding to road and footpath from exceedance of foul/combined sewer network.
	Fluvial	

Proportion of the site at risk (%)	**5% AEP**	**1% AEP**	**0.1% AEP**
	N/A	30%	38%

Available modelled data:
Records indicate that 2D hydraulic modelling has been carried out for the watercourse along the western boundary of the site, which has been included in the Flood Zones. However this model has not been provided by the Environment Agency for use in this study. With the absence of a 1 in 20 or 1 in 25 modelled flood extent for the watercourse, the 1 in 100 flood extent has been used to represent the functional floodplain. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here.

Flood characteristics:
The western portion of the site is identified as at risk of fluvial flooding during a 1 in 100 flood event, with flooding extending further into the centre of the site during a 1 in 1,000 event.

	Surface Water	**Proportion of site at risk (RoFSW)**		
		1 in 30	**1 in 100**	**1 in 1,000**
		3%	5%	10%

Description of surface water flow paths:
The site is at very low risk of surface water flooding overall. However, a small area at the north west corner the site is identified at high risk of surface water flooding during a 1 in 30 rainfall event and greater return periods. South-western corner of the site is also at lower risk of surface water flooding, during the 1 in 1,000 rainfall event.

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS33
Site name	Northwest of Berkeley

<table>
<tr><td rowspan="5"></td><td rowspan="4">Groundwater</td><td colspan="4">Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)</td></tr>
<tr><td>ASTGWF - Category 2
>=25% <50%</td><td colspan="2">ASTGWF - Category 3
>=50% <75%</td><td>ASTGWF - Category 4
>=75%</td></tr>
<tr><td>55%</td><td colspan="2">0%</td><td>0%</td></tr>
<tr><td colspan="4">The southern area of the site is at low to moderate groundwater flood risk, where the chance of groundwater emergence is between 25-50% within a given 1km^2 grid square, during a 1 in 100 event.</td></tr>
<tr><td>Reservoir</td><td colspan="4">The site is not at risk of flooding from reservoirs.</td></tr>
<tr><td>Canal</td><td colspan="4">There are no canals within the site boundary.</td></tr>
<tr><td rowspan="5">Flood risk management infrastructure</td><td rowspan="2">Defences</td><td>Defence Type</td><td colspan="2">Standard of Protection</td><td>Condition</td></tr>
<tr><td colspan="4">There are no defences within the site.</td></tr>
<tr><td rowspan="3">Residual risk</td><td>Culvert / structure blockage?</td><td colspan="3">There are no culverts or structures located within the site boundary.</td></tr>
<tr><td>Impounded water body failure?</td><td colspan="3">The site is not at risk of reservoir flooding.</td></tr>
<tr><td rowspan="2">Defence breach / overtopping?</td><td colspan="3">Breach Zone</td></tr>
<tr><td colspan="3">The site is not at risk of defence breach or overtopping.</td></tr>
<tr><td rowspan="2">Emergency planning</td><td>Flood warning</td><td colspan="4">The site is located within the following Environment Agency Flood Warning and Flood Alert Areas:
Flood Warning Area: Severn Estuary from Sharpness to Oldbury-on-Severn
Flood Alert Area: Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth</td></tr>
<tr><td>Access and egress</td><td colspan="4">The site is likely to be accessed via the B4066 along the northern boundary of the site. The road is at risk of fluvial flooding during a 1 in 100 flood event, where the unnamed Little Avon tributary is culverted below the road due to its raised elevation. The route is not identified as at risk of surface water flooding.</td></tr>
<tr><td rowspan="2">Climate Change</td><td rowspan="2">Climate change allowances for ‘2080s’</td><td>River Basin District</td><td>Central</td><td>Higher Central</td><td>Upper End</td></tr>
<tr><td>South West</td><td>30%</td><td>40%</td><td>85%</td></tr>
<tr><td>Implications for the site</td><td colspan="4">The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 within the site, which indicates that climate change is likely to increase the risk of fluvial flooding to the site. It should be noted that the climate change extents here are represented using the 1 in 1,000 extent and therefore may be conservative in their extents.</td></tr>
</table>

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS33
Site name	Northwest of Berkeley

Requirement for drainage control and impact mitigation **Cumulative impacts of development**	**Bedrock Geology**	The site is underlain by Raglan Mudstone Formation, a series of interbedded Siltstone and Mudstone.	
	Superficial Geology	None recorded.	
	Soils	Soils on the site are slightly acid loamy and clayey soils with impeded drainage.	
	SuDS	• As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. • A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. • Attenuation features must be located outside areas of fluvial flood risk. • The site geology is impermeable in nature and there is moderate risk of groundwater flooding, therefore there is likely to be limited potential for discharge of surface water by infiltration. However, the potential for infiltration should be investigated within site-specific infiltration testing.	
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.	
	Historic Landfill Site	There are no historical landfill sites within the proposed boundary.	
	Opportunities for flood risk betterment	Development should seek to strictly limit the rate and volumes of surface water leaving the site, to help alleviate sewer flooding issues at downstream Berkeley. Temporary storage of flood waters on the site would help to reduce and delay the timing of flows entering the Little Avon.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		Little Avon – confluence with Tortworth Brook to mouth	Medium
Recommend-ations for Local Plan policy	**Sequential Test and Exception Test requirements**		
	The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is anticipated that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied: • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios: • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.		

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS33
Site name	Northwest of Berkeley

Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers

Flood risk assessment:

- Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage.
- A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications).
- The impact of the development on flood risk from all sources both on and off-site must be considered and modelled where appropriate. It is recommended that a detailed hydraulic model is carried out for the site to accurately understand risk to the site.
- A detailed assessment of the risk and location of high groundwater levels and groundwater emergence should be undertaken, including groundwater monitoring during the winter months.
- Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future.
- The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.

Guidance for site design and making development safe:

- A site-specific surface water drainage strategy will be required.
- Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream.
- Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage.
- Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding.
- The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure.
- The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.
- Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS34
Site name	Sharpness Docks

Site details	**OS Grid reference**	SO 67206 02559			
	Area	96.23 ha			
	Current land use	Docks and associate infrastructure			
	Proposed site use	Mixed development			
	Flood risk vulnerability	More vulnerable			
Sources of flood risk	**Existing watercourses**	The tidal River Severn forms the western and northern boundaries of the site. The Gloucester and Sharpness Canal crosses the site in a south-easterly direction from the north-eastern corner, before it joins the River Severn estuary. An unnamed ordinary watercourse also joins the canal from the eastern boundary of the site.			
	Flood history	Flooding of the northern and eastern boundaries of the site is recorded to have occurred in July 1968 from the tidal River Severn.			
	Fluvial / Tidal	**Fluvial/Tidal - Proportion of the site at risk (%)**	**1% AEP**	**0.2% AEP**	**0.1% AEP**
			6%	7%	10%
		Available modelled data: The site is covered by the Environment Agency 2007 Tidal River Severn hydraulic model. With the absence of a 1 in 20 flood extent for the watercourse, Flood Zone 3a (1 in 100 event) has been used to represent the extent of Flood Zone 3b, the functional floodplain. **Flood characteristics:** The northern boundary and western corner of the site, which border the River Severn are identified as at risk of integrated fluvial and tidal flooding during a 1 in 100, 1 in 200 and 1 in 1,000 tidal flood event on the River Severn. The flood extent at the western edge of the site increases to meet the Gloucester and Sharpness Canal during the 1 in 1,000 event.			
	Surface Water	**Proportion of site at risk (RoFSW)**			
		1 in 30	**1 in 100**	**1 in 1,000**	
		2%	3%	9%	
		Description of surface water flow paths: Overall, the site is at low risk of surface water flooding. It should be noted that the mapping identities some areas within the Gloucester and Sharpness Canal as being at risk, and so the percentages shown above are likely to overestimate the surface water risk to the site. Discounting these areas, areas along the eastern boundary and at the west of the site are identified as at risk of flooding during the 1 in 30 event and greater return periods. However, these are isolated areas of ponding that appear to accumulate in low-lying areas of the local topography.			
	Groundwater	**Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)**			
		ASTGWF - Category 2 >=25% <50%	**ASTGWF - Category 3 >=50% <75%**	**ASTGWF - Category 4 >=75%**	
		57%	0%	0%	

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS34
Site name	Sharpness Docks

		The site is at low to moderate risk of groundwater flooding, with a 25-50% chance of groundwater emergence within a given 1km^2 grid square, during a 1 in 100 event.		
	Reservoir	The site is not at risk of reservoir flooding.		
	Canal	The Gloucester and Sharpness Canal flows through the site, therefore the site is identified as at potential risk of flooding from canals.		
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		There are no flood defences within the site.		
	Residual risk	**Culvert / structure blockage?**	There is no risk to the site from of culvert or structure blockage.	
		Impounded water body failure?	The site is not at risk of reservoir breach.	
		Defence breach / overtopping?	**Breach Zone**	
			The site is not identified as benefitting from flood defence, therefore there is no residual risk of defence overtopping or breach.	
Emergency planning	**Flood warning**	An area along the northern and western boundary of the site is within EA flood warning and alert areas. • Flood Alert Area: Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth • Flood Warning Areas: Severn Estuary from Sharpness to Oldbury-on-Severn and Sharpness and Lydney Harbour on the Severn Estuary		
	Access and egress	The site is likely to be accessed from Oldminster Road along the eastern boundary of the site. A small section of this route is affected by surface water flooding during a 1 in 1,000 rainfall event. Otherwise, the risk along this access route is low.		
Climate Change	**Climate change allowances for '2080s'**	**River Basin District**	**Central**	**Higher Central** / **Upper End**
		Severn	25%	35% / 70%
	Implications for the site	The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 event within the site, which indicates that climate change is likely to increase the risk of fluvial and tidal flooding to the site.		

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS34
Site name	Sharpness Docks

Requirement for drainage control and impact mitigation	**Bedrock Geology**	The site is underlain by Raglan Mudstone Formation interbedded Siltstone and Mudstone	
	Superficial Geology	The site is overlain by deposits of the Holt Heath Sand and Gravel member	
	Soils	Soils on the site are slightly acid loamy and clayey,with impeded drainage	
	SuDS	• As a large previously developed site, opportunities should be taken to reduce the coverage of impermeable surfaces on the site, and to incorporate above ground SuDS features, which provide multiple benefits. • A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. • Attenuation features must be located outside areas of fluvial flood risk. • The site geology is impermeable in nature and there is moderate risk of groundwater flooding, therefore there is likely to be limited potential for discharge of surface water by infiltration. However, the potential for infiltration should be investigated within site-specific infiltration testing. • Drainage proposals to the Severn should take account of the consequences of tidal effects (such as tide locking of systems and how these will change as a consequence of predicted sea level rise over the lifetime of development)	
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.	
	Historic Landfill Site	There are no historic landfill sites within the site.	
	Opportunities for flood risk betterment	Opportunities to implement systems that can accommodate climate change effects and provide betterment to existing drainage systems and channels.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		Coastal Catchment 1 (not part of a WFD river catchment)	High FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects
	Sequential Test and Exception Test requirements		

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS34
Site name	Sharpness Docks

Recommend-ations for Local Plan policy

The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is anticipated that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied:

- If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change.
- If Highly Vulnerable development is located in FZ2.

If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:

- Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b.
- More Vulnerable and Less Vulnerable development within FZ3b.

Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers

Flood risk assessment:

- At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required.
- Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage.
- A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications).
- Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water, tidal and groundwater.
- The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.
- Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration.

Guidance for site design and making development safe:

- A site-specific surface water drainage strategy will be required.
- Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk on adjacent land.
- Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage.
- Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding.
- The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure.
- The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.
- Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS36
Site name	New settlement at Sharpness

Site details	**OS Grid reference**	SO 67293 00626
	Area	190.01 ha
	Current land use	Agricultural land
	Proposed site use	Residential
	Flood risk vulnerability	More vulnerable
Sources of flood risk	**Existing watercourses**	The site is formed of two land parcels, located either side of B4066 and the railway line. The River Severn forms the western boundary of the larger, southern land parcel, and the Main River Little Avon forms the southern boundary. Three ordinary watercourses cross the north, west and south of the parcel, and either drain westwards directly into the River Severn or south westwards into the Little Avon. In the smaller northern parcel of land, an ordinary watercourse tributary of the River Severn flows east to west across the site.
	Flood history	The south west of the southern land parcel is recorded as having flooded in November 2012 as a result of fluvial flooding from the Little Avon. The site is not recorded as having flooded from the River Severn directly.
	Fluvial / Tidal	**Fluvial / Tidal (River Severn)**
		Proportion of the site at risk (%) | **1% AEP** | **0.2% AEP** | **0.1% AEP**
		35% | 36% | 40%
		Fluvial (Little Avon)
		Proportion of the site at risk (%) | **5% AEP** | **1% AEP** | **0.1% AEP**
		11% | 22% | 27%
		Range of depths (m) | 0.01 - 0.39 | 0.02 – 0.63 | 0.05 - 1.78
		Maximum hazard | 0.5 – 1.5 | 0.5 – 2.0 | 0.5 – 2.2
		Available modelled data: The site is covered by the Environment Agency 2016 model of the Little Avon as well as the 2007 Tidal River Severn hydraulic models. There are some watercourses that potentially affect the sites that have not been included in the modelling and so further detail is required to understand the extent of Flood Zones and actual flood risk. **Flood characteristics:** This section describes the undefended flood risk to the site. The northern, western and south-western areas of the site are at combined fluvial and tidal flood risk from the River Severn during the 1 in 100, 1 in 200 and 1 in 1,000 flood event. The south western portion of the site is also at risk of fluvial flooding from the Little Avon during a 1 in 5 flood event and greater return periods. Flooding initially occurs around the branched watercourse network at the south of the site, and then extends north westwards during the 1 in 50 event, ponding against the raised defences here, in the defended scenario. Peak flood depths
	Surface Water	**Proportion of site at risk (RoFSW)**
		1 in 30 | **1 in 100** | **1 in 1,000**
		1% | 2% | 7%

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS36
Site name	New settlement at Sharpness

<table>
<tr><td rowspan="5"></td><td></td><td colspan="4">Description of surface water flow paths: Surface water flood risk within the site is relatively low, with surface water mapping identifying the floodplains of small ordinary watercourses.
Excluding these areas, low-lying land adjacent to the River Severn is identified as at risk of surface water flooding during the 1 in 1,000 rainfall event. Small surface water flow paths in both land parcels are predicted to form during the 1 in 1,000 event and flow into the adjacent ordinary watercourses.</td></tr>
<tr><td rowspan="3">Groundwater</td><td colspan="4">Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)</td></tr>
<tr><td>ASTGWF - Category 2
>=25% <50%</td><td colspan="2">ASTGWF - Category 3
>=50% <75%</td><td>ASTGWF - Category 4
>=75%</td></tr>
<tr><td>10%</td><td colspan="2">0%</td><td>0%</td></tr>
<tr><td colspan="4">The site is at low to moderate risk of groundwater flooding, with a 25-50%chance of groundwater emergence within a given 1km^2 grid square, during a 1 in 100 event.</td></tr>
<tr><td>Reservoir</td><td colspan="4">The site is not at risk of reservoir flooding.</td></tr>
<tr><td>Canal</td><td colspan="4">There are no canals witin the site.</td></tr>
<tr><td rowspan="6">Flood risk management infrastructure</td><td rowspan="2">Defences</td><td>Defence Type</td><td colspan="2">Standard of Protection</td><td>Condition</td></tr>
<tr><td>Coastal embankment</td><td colspan="2">1 in 100</td><td>2 – Good</td></tr>
<tr><td colspan="4">Along the western boundary of the larger site there is an embankment that protects against fluvial/tidal flood risk from the River Severn, which entirely defends the southern land parcel against flooding from the 1 in 100 flood event on the River Severn. The limit of defence does not extend to the northern land parcel. The south west of the site remains at risk of flooding from the Little Avon.</td></tr>
<tr><td rowspan="4">Residual risk</td><td>Culvert / structure blockage?</td><td colspan="3">In the smaller parcel of land, the watercourse is culverted below Saniger Lane. The residual flood risk associated with blockage at this location should be considered.</td></tr>
<tr><td>Impounded water body failure?</td><td colspan="3">The site is not at risk of flooding due to reservoir breach.</td></tr>
<tr><td rowspan="2">Defence breach / overtopping?</td><td colspan="3">Breach Zone</td></tr>
<tr><td colspan="3">The west of the site benefits from coastal defence. Therefore, consideration should be given to the possibility of this defence being overtopped, and the risk that this would pose to the southern land parcel.</td></tr>
<tr><td rowspan="2">Emergency planning</td><td>Flood warning</td><td colspan="4">The western areas of the larger site are included within both Flood Alert and Flood Warning areas.
Flood Alert Area: Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth
Flood Warning Area: Severn Estuary from Sharpness to Oldbury-on-Severn</td></tr>
<tr><td>Access and egress</td><td colspan="4">Both of the parcels of land are likely to be accessed via the B4066 which passes between the two. At the northern edge of the larger site, the road is affected by the 1 in 100 fluvial flood event. The site is not at risk of surface water flooding.</td></tr>
<tr><td rowspan="2">Climate Change</td><td rowspan="2">Climate change allowances for ‘2080s’</td><td>River Basin District</td><td>Central</td><td>Higher Central</td><td>Upper End</td></tr>
<tr><td>Severn</td><td>25%</td><td>35%</td><td>70%</td></tr>
</table>

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Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS36
Site name	New settlement at Sharpness

	Implications for the site	The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 event within the site, which indicates that climate change is likely to increase the risk of fluvial and tidal flooding to the site.	
Requirement for drainage control and impact mitigation	**Bedrock Geology**	Raglan Mudstone Formation – Siltstone and Mudstone	
	Superficial Geology	Tidal flat deposits (clay, silt and sand) and Cheltenham sand and gravel along the western border of the larger site.	
	Soils	Along the western border of the larger site there are areas of loamy and clayey soils of coastal flats with naturally high groundwater. The remaining area of the site is slightly acid loamy and clayey soils with impeded drainage.	
	SuDS	• As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. • A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. • Attenuation features must be located outside areas of fluvial flood risk. • The site geology is impermeable in nature and there is moderate risk of groundwater flooding, however there are areas of superficial deposits which may provide opportunity for shallow infiltration. To better understand the infiltration potential at the site, site-specific infiltration testing will be required.	
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.	
	Historic Landfill Site	There are no historic landfill sites within the proposed boundary.	
	Opportunities for flood risk betterment	The site provides opportunities to provide storage of surface water and limit the rate and volume of water discharged from the site into the River Severn. This is likely to provide benefit during periods of high tide or high river level on the River Severn, when tributary watercourses and the Little Avon become tide-locked and back up.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		Coastal Catchment 1 (not part of a WFD river catchment)	High FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects
		Coastal Catchment 2 (not part of a WFD river catchment)	Medium
		Little Avon – confluence with Tortworth Brook to mouth	Medium
	Sequential Test and Exception Test requirements		

Site code	PS36
Site name	New settlement at Sharpness

Recommend-ations for Local Plan policy	The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is anticipated that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied: • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios: • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers
	Flood risk assessment: • At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required. • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water, tidal and groundwater. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • Subject to consultation with the Environment Agency and Lead Local Flood Authority, it is recommended that detailed hydraulic modelling of the unmodelled ordinary watercourse within the northern land parcel is carried out as part of a flood risk assessment. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. **Guidance for site design and making development safe:** • The site benefits from the presence of existing defences. As a consequence of climate change effects the standard of protection afforded by these defences will be reduced. A commitment must be made so appropriate provisions for flood risk management measures are secured for the lifetime of the development. • A site-specific surface water drainage strategy will be required. • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure.

Site code	PS36
Site name	New settlement at Sharpness

	• The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

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Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS37
Site name	New settlement at Wisloe

Site details	**OS Grid reference**	SO 74692 02678
	Area	83.97 ha
	Current land use	Agricultural land and buildings
	Proposed site use	Residential
	Flood risk vulnerability	More vulnerable
Sources of flood risk	**Existing watercourses**	The site is formed of two parcels of land, separated by the A4135 Draycott. In the eastern parcel of land, an ordinary watercourse tributary of the River Cam flows in a northerly direction to join the River Cam. In the western parcel of land, the Lighten Brook, an ordinary watercourse, flows in a north easterly direction through the centre of the site, and is culverted below Bristol Road at the western boundary of the site.
	Flood history	There are no recoded flood incidents at the site. However, the following sewer flooding incidents are recorded in the vicinity of the site: • 22/11/2016, 08/02/2016 – Flooding to open space and property curtilage (GL11 5DH) • 12/01/2008, 17/03/2008, 03/11/2012, 21/12/2012, January 2013 (various), October 2013 (various), December 2013 (various) January – February 2014 (various), 27/12/2017 – flooding to curtilage (GL2 7AT, GL2 7AH). • 23/06/2007 – flooding to highway (GL2 7AL)
	Fluvial	**Proportion of the site at risk (%)**: 5% AEP: N/A; 1% AEP: 0%; 0.1% AEP: 1% **Available modelled data:** The site is included within the Environment Agency 2007 River Cam and Wickster's Brook detailed hydraulic model. There are two watercourses that cross the land that are not modelled. The potential extent of the flood zones and effect on the allocation proposals should be evaluated to enable the application of the sequential approach. **Flood characteristics:** The north-western area of the most eastern parcel of land is identified as at risk during a 1 in 1,000 flood event on the River Cam. The smaller, ordinary watercourses are not covered by detailed hydraulic models. Peak flood levels modelled on the River Cam at the north eastern corner of the eastern land parcel reach 16.0mAOD during a 1 in 100 event, and 16.17mAOD during a 1 in 1,000 event.
	Surface Water	**Proportion of site at risk (RoFSW)**: 1 in 30: 0%; 1 in 100: 1%; 1 in 1,000: 3%

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS37
Site name	New settlement at Wisloe

		Description of surface water flow paths: The risk of surface water flood risk across the site is low. Surface water flow paths are predicted to form on both land parcels during a 1 in 30 rainfall event and greater return periods. However, the mapping highlights that these follow the lower topography of the ordinary watercourses within the sites. An area of surface water ponding is also predicted to form on the northern corner of the western land parcel, in a low point adjacent to Bristol Road.			
	Groundwater	**Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)**			
		ASTGWF - Category 2 >=25% <50%	**ASTGWF - Category 3 >=50% <75%**	**ASTGWF - Category 4 >=75%**	
		10%	1%	89%	
		The site is at high risk of groundwater flooding, with a greater than 75% chance of groundwater emergence within a given 1km^2 grid square, during a 1 in 100 event.			
	Reservoir	The north eastern corner of the eastern land parcel is at risk of flooding during a reservoir breach.			
	Canal	There are no canals within the site boundary.			
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**	
		There are no flood defences within the site boundary, or within the vicinity of the site.			
	Residual risk	**Culvert / structure blockage?**	On the western land parcel, the ordinary watercourse which crosses the site is culverted beneath the M5, beyond the south east of the site, and beneath Bristol Road, at the north eastern boundary of the site. Blockage of the culvert beneath Bristol Road is likely to increase flood risk to the site, and should be assessed.		
		Impounded water body failure?	The north eastern corner of the eastern land parcel is at risk of flooding during a reservoir breach.		
		Defence breach / overtopping?	**Breach Zone**		
			There are no flood defences within the site boundary.		
Emergency planning	**Flood warning**	The eastern parcel of land is included within the Environment Agency Flood Alert Area for the River Frome and Cam.			
	Access and egress	The site is likely to be accessed from the A38 Bristol Road, which runs along the western boundary. Near the most western parcel of land, there is ponding on the road which occurs during the 1 in 30 event and greater return periods. North of the eastern site, the road is at risk of flooding during a 1 in 100 and 1 in 1,000 event on the River Cam.			
Change	**Climate change allowances for '2080s'**	**River Basin District**	**Central**	**Higher Central**	**Upper End**
		Severn	25%	35%	70%

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS37
Site name	New settlement at Wisloe

	Implications for the site	The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 event within the site, which indicates that climate change is likely to increase the risk of fluvial and tidal flooding to the site.	
Requirement for drainage control and impact mitigation	**Bedrock Geology**	The site is underlain by Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated)	
	Superficial Geology	Cheltenham Sand and Gravel deposits overlie the bedrock geology on the site.	
	Soils	Soils on the site are freely draining, lime-rich and loamy.	
	SuDS	• As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. • A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. • Attenuation features must be located outside areas of fluvial flood risk. • The site geology is impermeable in nature and there is a high risk of groundwater flooding, therefore infiltration techniques are unlikely to be suitable. However, to better understand the infiltration potential at the site, site-specific infiltration testing will be required. • Below ground attenuation features may require an impermeable liner, to ensure storage capacity is not lost and there is no contamination to underlying groundwater.	
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.	
	Historic Landfill Site	There are no historic landfill sites within the proposed boundary.	
	Opportunities for flood risk betterment	The majority of the proposed site is currently in a greenfield state and therefore post-development greenfield rates and volumes should be restricted to the existing rate. The site provides opportunities for the temporary storage of floodwaters, to reduce peak flows and downstream flood risk on the River Cam.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		The Cam – source to confluence with Gloucester and Sharpness Canal	High
			FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects
	Sequential Test and Exception Test requirements		

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Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS37
Site name	New settlement at Wisloe

Recommend-ations for Local Plan policy

The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is anticipated that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied:

- If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change.
- If Highly Vulnerable development is located in FZ2.

If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:

- Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b.
- More Vulnerable and Less Vulnerable development within FZ3b.

Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers

Flood risk assessment:

- Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage.
- A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications).
- All sources of flooding, particularly the risk of groundwater flooding, should be considered as part of a site-specific flood risk assessment.
- A detailed assessment of the risk and location of high groundwater levels and groundwater emergence should be undertaken, including groundwater monitoring during the winter months, where required.
- Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future.
- Subject to consultation with the Environment Agency and Lead Local Flood Authority, it is recommended that detailed hydraulic modelling of the unmodelled ordinary watercourse within the northern land parcel is carried out as part of a flood risk assessment.
- The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.
  Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration.

Guidance for site design and making development safe:

- Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding.
- The development should be designed using a sequential approach. Development should be steered away from surface water flow routes and areas where groundwater risk is highest, preserving these areas as green infrastructure.
- Safe access and egress should be demonstrated in the 1 in 100 plus 40% climate change rainfall event. Raising of access routes must not impact on flow routes. Consideration should be given to the siting of access points with respect to surface water flood risk areas.
- The design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.
- Mitigation for seasonal high groundwater levels must be considered (for example by raising finished floor levels to an appropriate height above ground level).
- Flow routes would need to be preserved if carrying out land-raising within the surface water risk area.

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Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS37
Site name	New settlement at Wisloe

	• The design of SuDS schemes must take into account the seasonally high groundwater table and low permeability. Infiltration techniques may be ineffective, and may pose a pollution risk. SuDS may need to be shallow and take up larger areas. Above ground conveyance and attenuation can be used but care must be taken that groundwater does not enter the SuDS feature and reduce the storage capacity and structural integrity of the design. • Detailed site investigations will be required including infiltration testing and groundwater monitoring during the winter months (November through to March).

Site code	PS47
Site name	Land west of Renishaw New Mills

Site details	**OS Grid reference**	ST 73537 92666			
	Area	16.18 ha			
	Current land use	Agricultural land and existing property			
	Proposed site use	Employment			
	Flood risk vulnerability	Less vulnerable			
Sources of flood risk	**Existing watercourses**	The Marlees Brook, a Main River and tributary of the Little Avon River, flows along the northern site boundary, from east to west. A large pond is located approximately 500m to the north west of the site.			
	Flood history	There are no historic flood extents or incidents recorded within the site boundary. An incident of groundwater flooding was recorded on 01/11/2014 to the south west of the site, and appears to have affected the B4058. However, there are few details on the property affected.			
	Fluvial				
		Proportion of the site at risk (%)	**5% AEP**	**1% AEP**	**0.1% AEP**
			1%	1%	4%
		Range of depths (m)	0.01 - 1.0	0.01 - 0.84	0.02 - 0.96
		Maximum hazard	0.5 - 1.5	0.5 – 1.6	0.5 - 2.1
		Available modelled data: The Environment Agency detailed 1D-2D hydraulic model of the Little Avon, which was completed in 2016, covers the site. **Flood characteristics:** The northern boundary of the site is at risk of flooding during a 1 in 20 event on the Marlees Brook, and the risk of flooding during a 1 in 100 event covers a very similar flood extent. The risk of flooding during a 1 in 1,000 event extends to the north east corner of the site, covering a larger area.			
	Surface Water	**Proportion of site at risk (RoFSW)**			
		1 in 30	**1 in 100**	**1 in 1,000**	
		1%	2%	4%	
		Description of surface water flow paths: Surface water flood risk to the site is relatively low. The northern and south eastern site perimeters are at risk of flooding during the 1 in 30 rainfall event and greater return periods. In addition, ponding is predicted to occur around the existing buildings at the centre of the site, near Lower Barns Farm. In addition, a surface water flow path is predicted to form in the east of the site during the 1 in 100 and 1 in 1,000 rainfall events, and flows eastwards into the Marlees Brook.			
	Groundwater	**Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)**			
		ASTGWF - Category 2 >=25% <50%	**ASTGWF - Category 3 >=50% <75%**	**ASTGWF - Category 4 >=75%**	
		0%	0%	0%	

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Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS47
Site name	Land west of Renishaw New Mills

		The site is at relatively low risk of groundwater flooding, with a less than 25% risk of occurring within the surrounding 1km^2 grid cell during a 1 in 100 groundwater flood event.		
	Reservoir	The site is not identified as at reservoir flood risk.		
	Canal	The site is not identified as at risk of flooding from canals.		
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		There are no flood defences located within the site boundary or within the vicinity of the site.		
	Residual risk	**Culvert / structure blockage?**	There are no culverted watercourses within the site boundary. However, the Maerlees Brook is culverted or bridged below the two access tracks which are located to the east and west of the site. A blockage to the culvert beneath the western access track may pose a residual flood risk to the north western corner of the site.	
		Impounded water body failure?	The site is not identified at risk of flooding in the event of reservoir failure. However, a large pond is located approximately 500m to the north west of the site. In the event of overtopping of this lake, flood waters would travel south eastwards into the Marlees Brook which could impact flooding at the site.	
		Defence breach / overtopping?	**Breach Zone**	
			There are no flood defences located in the vicinity of the site.	
Emergency planning	**Flood warning**	The site is located within the Environment Agency Little Avon Catchment and the Vale of Berkeley Flood Alert Area.		
	Access and egress	Access to the site is likely to be via the B4058 road, located to the south of the site. The B058 is very at low fluvuial flood risk (within Flood Zone 1). The majority of the road is also at very low risk of surface water flooding, with the exception of the roundabout at the south eastern corner of the site, which is at risk of flooding during a 1 in 30 rainfall event and greater retiurn periods. The two existing access roads located on the east and west site boundary, which could also be used for access. The northern end of these access roads is at risk of flooding during the 1 in 20, 1 in 100 and 1 in 1,000 flood events. The eastern access road is also at risk of surface water flooding during a 1 in 30 event and greater return periods, particularly at the junciton of B4058.		
Climate Change	**Climate change allowances for '2080s'**	**River Basin District**	**Central**	**Higher Central**	**Upper End**
		South West	30%	40%	85%
	Implications for the site	Climate change is expected to increase the extent of the 1 in 100 flood event at the site, with the plus 80% climate change scenario expected to remain within the extent of 1 in 1,000 flood extent.			

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS47
Site name	Land west of Renishaw New Mills

Requirement for drainage control and impact mitigation	**Bedrock Geology**	The majority of the site is underlain by Langport Member and Wilmcote Limestone Member, a series of interbedded Limestone and Mudstone. The eastern portion of the site is underlain by Blue Lias Formation and Charmouth Mudstone Formation. A band of Westbury Formation and Cotham Member Mudstone is located at the western boundary of the site.	
	Superficial Geology	A band of alluvial silt, clay, sand and gravel is located at the northern boundary of the site, and corresponds with the floodplain of Marlees Brook.	
	Soils	The soils within the site are slowly permeable, slightly acid but base-rich loamy and clayey soils which are seasonally wet.	
	SuDS	• As a large, relatively undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits, such as biodiversity, recreation and water resource education, through integration with areas of greenspace. • All development should adopt source control SuDS techniques. Conveyance features should be designed above ground and following natural flow paths where possible Due to the mixed geologies on the site, with variable permeability, the potential for infiltration should be investigated within site-specific infiltration testing. • Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk.	
	Groundwater Source Protection Zone	The site is not located within a desingated Source Protection Zone.	
	Historic Landfill Site	There are no historic landfill sites within the site boundary.	
	Opportunities for flood risk betterment	The site provides opportunities for storing flood water from the Marlees Brook, to reduce peak flows and delay the time in which they reach the Little Avon. This can help to manage the risk of flooding from the Little Avon to downstream settlements, such as Berkeley.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		Ozleworth Brook – source to confluence with Little Avon	Medium
Recommend-ations for Local Plan policy	**Sequential Test and Exception Test requirements**		
	The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is anticipated that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied: • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios: • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.		

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Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	PS47
Site name	Land west of Renishaw New Mills

Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers

Flood risk assessment:

- At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required.
- Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage.
- A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications).
- Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water and groundwater.
- The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.

Guidance for site design and making development safe:

- Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream.
- Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage.
- Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding.
- The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure.
- The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.
- Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	G2
Site name	Land at Whaddon

Site details	**OS Grid reference**	SO 82863 13037
	Area	173.1 ha
	Current land use	Greenfield
	Proposed site use	Residential
	Flood risk vulnerability	More vulnerable
Sources of flood risk	**Existing watercourses**	The Main River Daniel's Brook flows in a north-westerly direction through the site before becoming culverted below the railway embankment along the western boundary. In the south of the site, another ordinary watercourse forms a tributary to the brook. A further ordinary watercourse tributary forms the northern boundary of the site.
	Flood history	There are no historical flood events associated with the site.
	Fluvial	

Proportion of the site at risk (%)	**5% AEP**	**1% AEP**	**0.1% AEP**
	5%	5%	7%

Available modelled data: The site is covered by the Environment Agency 2007 Daniel's Brook 1D-only hydraulic model. Additional modelling of watercourses on the site is being undertaken, as part of a planning application for the site.

Flood characteristics: The central portion of the site is within Flood Zone 3a, 3b and Flood Zone 2, associated with the floodplain of Daniel's Brook. An additional area at the northern corner of the site is located within Flood Zone 3b, 3a and Flood Zone 2. Here, peak flood levels range reach 25.91mAOD during a 1 in 100 event, to 25.91mAOD during a 1 in 1,000 event. The site contains a "dry island" and it is unlikely that development will be appropriate on this land unless appropriate provisions are made with respect to safe access and egress.

River flow and level data associated with the Daniel's Brook were not available from the Environment Agency.

Surface Water

Proportion of site at risk (RoFSW)		
1 in 30	**1 in 100**	**1 in 1,000**
5%	13%	15%

Description of surface water flow paths:

The surface water flood risk across the site is largely associated with the fluvial flood extents of Daniel's Brook and its tributary watercourses. However, a number of additional surface water flow paths are predicted to form in the south, north and east of the site during a 1 in 1,000 rainfall event, and drain into the nearest watercourse. In addition, some isolated ponding is predicted to occur on natural low points within the site.

Groundwater

Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
ASTGWF - Category 2 >=25% <50%	**ASTGWF - Category 3 >=50% <75%**	**ASTGWF - Category 4 >=75%**
0%	0%	0%

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	G2
Site name	Land at Whaddon

		The site is at low risk of groundwater flooding, with a less than 25% risk of occurring within the surrounding 1km^2 grid cell during a 1 in 100 groundwater flood event.		
	Reservoir	The site is not at risk of reservoir breach.		
	Canal	There are no canals within the site boundary.		
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		There are no flood defences within the site.		
	Residual risk	**Culvert / structure blockage?**	Consideration should be given to potential residual risk posed by blockage on the railway culvert at the west of the site.	
		Impounded water body failure?	The site is not at risk of flooding in the event of reservoir breach.	
		Defence breach / overtopping?	**Breach Zone**	
			There are no defences within the site.	
Emergency planning	**Flood warning**	The site is covered by the Environment Agency Rivers in North Gloucestershire Flood Alert Area		
	Access and egress	The site is likely to be accessed via Stroud Road (A4173) which is along the eastern boundary of the site. This route is is intersected by surface water flow paths from the east during the 1 in 30 event. At higher return periods, highway flooding occurs in some parts along the road. However, the road is at low fluvial flood risk and remains within Flood Zone 1.		
Climate Change	**Climate change allowances for '2080s'**	**River Basin District**	**Central**	**Higher Central**	**Upper End**
		Severn	25%	35%	70%
	Implications for the site	The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 within the site, which indicates that climate change is likely to increase the risk of fluvial flooding to the site. It should be noted that the climate change extents here are represented using the 1 in 1,000 extent, due to the lower confidence in the hydrological inflows for the Daniel's Brook, and therefore are likely to be conservative in their extents.		

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	G2
Site name	Land at Whaddon

Requirement for drainage control and impact mitigation	**Bedrock Geology**	The site is underlain by Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated).	
	Superficial Geology	The bedrock geology is overlain by Cheltenham sand and gravel deposits in the south east of the site.	
	Soils	The site has a range of soil types. In the centre there is an area of freely draining lime-rich soils, whereas the north and south of the site are covered by areas of lime-rich loamy and clayey soils with impeded drainage.	
	SuDS	• As a large, undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits, such as biodiversity, recreation and water resource education, through integration with areas of greenspace. • All development should adopt source control SuDS techniques. Conveyance features should be designed above ground and following natural flow paths where possible. • A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. • Attenuation features must be located outside areas of fluvial flood risk. • The site geology is impermeable in nature, therefore infiltration techniques are unlikely to be suitable. However, the presence of more permeable superficial deposits may allow shallow infiltration techniques. To better understand the infiltration potential at the site, site-specific infiltration testing will be required.	
	Groundwater Source Protection Zone	The site is not inlcuded within a Source Protection Zone.	
	Historic Landfill Site	There are no historical landfill sites within the proposed boundary.	
	Opportunities for flood risk betterment	The majority of the proposed site is currently in a greenfield state and therefore post-development greenfield rates and volumes should be restricted to the existing rate. The site provides opportunities for the temporary storage of floodwaters, to reduce peak flows and downstream flood risk Daniel's Brook. The proposals should take account of any land that would potentially be needed to provide affordable mitigation of flood risk in the lower reaches of the catchment in particular with respect to climate change.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		Daniel's Brook – Source to Gloucester and Sharpness Canal	Medium
		Coastal Catchment 2 (not part of a WFD river catchment)	Medium
	Sequential Test and Exception Test requirements		

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	G2
Site name	Land at Whaddon

Recommend-ations for Local Plan policy	The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is anticipated that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied: • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios: • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers
	Flood risk assessment: • Consultation with the LLFA should be undertaken at an early stage • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • The impact of the development on flood risk from all sources, including surface water and groundwater, both on and off-site must be considered and modelled where appropriate. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. **Guidance for site design and making development safe:** • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	G1
Site name	South of Hardwicke

Site details	**OS Grid reference**	SO 79768 12585
	Area	67.85Ha
	Current land use	Agricultural
	Proposed site use	Residential
	Flood risk vulnerability	More vulnerable
Sources of flood risk	**Existing watercourses**	The Shorn Brook passes through the central and western land parcels of the site. The majority of the Shorn Brook is classified as an ordinary watercourse, however the lower reach, at the boundary of the western parcel, is designated as a Main River. The Gloucester and Sharpness Canal is adjacent to the boundary of the western land parcel. Two ponds lie within Herbert's Plantation, located at the centre of the largest land parcel.
	Flood history	The site is not located within an Environment Agency recorded flood outline, which reflects the classification of the Shorn Brook as an ordinary watercourse at this location. The following flood incidents recorded by Gloucestershire County Council are located adjacent to the site: • 11/05/2012 - Pound Lane (GL2 4RJ) – source of flooding unknown • Date unknown - Green Lane (GL2 4QA) – fluvial flooding causing internal flooding. • 16/07/2016 - B4006 Bristol Road (GL2 4RA) – source of flooding unknown
	Fluvial	

Proportion of the site at risk (%)	**5% AEP**	**1% AEP**	**0.1% AEP**
	N/A	7%	8%

Available modelled data: The site is not covered by a detailed hydraulic model, with the Flood Zones generated from generalised national scale mapping. In the absence of detailed modelling information, the Flood Zones have been used to assess risks to the site during the 1 in 100 and 1 in 1,000 fluvial flood events. However, the Flood Zones do not extend beyond Sticky Lane, the access track bordering the eastern land parcel. Therefore, the potential extent of the Flood Zones and effect on the allocation proposals should be evaluated to enable the application of the sequential approach.

Flood characteristics: The upper portion of the central land parcel is predicted to be affected during a 1 in 100 flood event, where the Shorn Brook passes through the site, with the extent of flooding extending northwards during a 1 in 1,000 event. Church Lane, which separates the central and western parcels, is predicted to flood during a 1 in 100 event. However, the lower reach of the Shorn Brook, which borders the western land parcel, has not been assessed by flood modelling and so the potential presence of a flood zone has not been determined.

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	G1
Site name	South of Hardwicke

<table>
<tr><td rowspan="8"></td><td rowspan="3">Surface Water</td><td colspan="3">Proportion of site at risk (RoFSW)</td></tr>
<tr><td>1 in 30</td><td>1 in 100</td><td>1 in 1,000</td></tr>
<tr><td>2%</td><td>13%</td><td>15%</td></tr>
<tr><td colspan="3">Description of surface water flow paths: The site is at moderate risk of surface water flooding, with dispersed areas of ponding predicted to occur in low points across the site.
With the exception of an area of ponding against Green Lane during a 1 in 30 rainfall event, the eastern land parcel is identified as at low risk of surface water flooding. The central land parcel is at higher risk of surface water flooding, with areas of ponding predicted to occur during a 1 in 30 rainfall event in the centre of the site alongside Shorn Brook, as well as in the north and south against Green Lane and Pound Lane, respectively.
Surface water flood risk in the western land parcel is concentrated against the embankment of the Stroudwater and Sharpness Canal, where ponding forms during a 1 in 30 rainfall event, and extends to a continuous line during the 1 in 1,000 rainfall event.</td></tr>
<tr><td rowspan="4">Groundwater</td><td colspan="3">Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)</td></tr>
<tr><td>ASTGWF - Category 2 >=25% <50%</td><td>ASTGWF - Category 3 >=50% <75%</td><td>ASTGWF - Category 4 >=75%</td></tr>
<tr><td>0%</td><td>0%</td><td>0%</td></tr>
<tr><td colspan="3">The site is identified as at low risk of groundwater flooding.</td></tr>
<tr><td>Reservoir</td><td colspan="3">The site is not identified as at risk from reservoir flooding.</td></tr>
<tr><td>Canal</td><td colspan="3">The Gloucester and Sharpness Canal is located adjacent to the western land parcel, and therefore the site is identified as at potential risk of flooding from canals.</td></tr>
</table>

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	G1
Site name	South of Hardwicke

Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		There are no flood defences within the site.		
	Residual risk	**Culvert / structure blockage?**	The Shorn Brook is culverted beneath Church Lane and adjacent to the Gloucester and Sharpness Canal, which may pose a risk of flooding to the central land parcel, in the event of blockage. This residual risk should be assessed in further detail.	
		Impounded water body failure?	The site is not at risk of reservoir breach.	
		Defence breach / overtopping?	**Breach Zone**	
			The site is not identified as benefitting from flood defence. However, the residual risk of flooding to the site in the event of breach or overtopping of the Gloucester and Sharpness Canal should be assessed in further detail.	
Emergency planning	**Flood warning**	The site is not covered by an Environment Agency Flood Warning or Flood Alert Area.		
	Access and egress	The site may be accessed from five roads: B4008 Bristol Road, Green Lane, Church Lane, Pound Lane and Sticky Lane. Sticky Lane and Church Lane are identified as at risk of flooding from the Shorn Brook during the 1 in 100 and 1 in 1,000 fluvial flood events, as well as being at risk of flooding during a 1 in 30 rainfall event. Therefore, access via these roads is likely to be restricted during times of flood. Green Lane and Pound Lane are at low risk of fluvial flooding. However they are at risk of surface water flooding during a 1 in 30 rainfall event and greater return periods, with extensive flooding predcted to affect Pound Lane. The B4008 Bristol Road is at low risk of fluvial and surface water flooding.		
Climate Change	**Climate change allowances for '2080s'**	**River Basin District**	**Central**	**Higher Central**	**Upper End**
		Severn	25%	35%	70%
	Implications for the site	The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 within the site, which indicates that climate change is likely to increase the risk of fluvial flooding to the site. It should be noted that the climate change extents here are represented using the 1 in 1,000 extent and therefore may be conservative in the area of land that is indicated to be affected.		

Site code	G1
Site name	South of Hardwicke

Requirement for drainage control and impact mitigation	**Bedrock Geology**	The site is underlain by the Lias Group Mudstone, Siltstone, Limestone and Sandstone.	
	Superficial Geology	There are no superficial geology deposits recorded at the site.	
	Soils	The site is overlain by lime-rich loamy and clayey soills with impeded drainage.	
	SuDS	• As a large, relatively undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. • A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. • Attenuation features must be located outside areas of fluvial flood risk. • The site geology is impermeable in nature, therefore there is likely to be limited potential for discharge of surface water by infiltration. However, the potential for infiltration should be investigated within site-specific infiltration testing.	
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.	
	Historic Landfill Site	There are no historical landfill sites within the proposed boundary.	
	Opportunities for flood risk betterment	Development should seek to strictly limit the rate and volumes of surface water leaving the site, to help to reduce and delay the timing of flows entering the Shorn Brook. Opportunities should be taken to daylight culverts on the Shorn Brook wherever possible.	
	Cumulative impacts of development	**Water Framework Directive Catchment**	**Sensitivity to cumulative impacts**
		Epney Rhyne – source to confluence with River Severn Estuary	High
			FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects
	Sequential Test and Exception Test requirements		

Stroud District Council

Level 2 SFRA Detailed Site Summary Tables – DRAFT DOCUMENT

Site code	G1
Site name	South of Hardwicke

Recommend-ations for Local Plan policy

The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. **It is anticipated that proposed development will be sequentially located within Flood Zone 1**. For this site, the Exception Test must be satisfied:

- If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change.
- If Highly Vulnerable development is located in FZ2.

If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:

- Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b.

More Vulnerable and Less Vulnerable development within FZ3b.

Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers

Flood risk assessment:

- Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage.
- A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications).
- The impact of the development on flood risk from all sources both on and off-site must be considered and modelled where appropriate. It is recommended that a detailed hydraulic model of the Shorn Brook is carried out for the site to accurately understand risk to the site.
- Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future.
- The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.
- Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration.

Guidance for site design and making development safe:

- A site-specific surface water drainage strategy will be required.
- Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream.
- Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage.
- Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding.
- The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure.
- The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.
- Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes.

Site code	G1
Site name	South of Hardwicke

	Consideration should be given to the siting of access points with respect to areas of surface water flood risk. • Opportunities should be taken to de-culvert, or 'daylight' existing culverts within the site.