Mapping

Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables

Site details	**Site Code**	Bishops Cleeve – Site 1			
	Area	1.48 hectares			
	Current land use	Predominantly brownfield			
	Proposed land use	Commercial			
Sources of flood risk	**Existing drainage features**	• An unnamed ordinary watercourse / drain flows immediately along the site's southern boundary in a western direction. • An unnamed ordinary watercourse / drain flows 150m to the north of the site in a western direction.			
	Fluvial	**Proportion of site at risk**			
		FZ3b	**FZ3a**	**FZ2**	**FZ1**
		<1%	0%	0%	99%
		The unnamed watercourse to the south of the site inundates a small area of the southern boundary. Extents do not increase significantly in FZ3a or FZ2.			
	Surface Water	**Proportion of site at risk (RoFfSW)**			
		30-year	**100-year**	**1,000-year**	
		0%	<1%	7%	
		Surface water flooding begins to affect the site in the 100-year event with part of the south of the site flooded by surface water associated with the channel of the unnamed watercourse along the southern boundary. Extents increase further in the south of the site in the 1,000-year event.			
	Reservoir	The site is not shown to be at risk of reservoir flooding.			
	Flood history	The Environment Agency's historic flood map does not show the site as having flooded in the past.			
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**	
		-	-	-	
		This site is not protected by any formal flood defences.			
	Residual risk	-			
Emergency planning	**Flood warning**	The site is not covered by the Environment Agency's Flood Warning Service.			
	Access and egress	Dry access and egress for the site via the Cleeve Road to the east is available in all fluvial and surface water events.			
Climate Change	**Climate change allowances for '2080s'**	**River Basin District**		**Higher Central**	**Upper End**
		Severn		35%	70%
	% of site at risk			<1%	<1%
	Implications for the site	Fluvial extents from climate change did not increase significantly when compared with FZ3a. As the site is affected by surface water flooding from the 100-year event, climate change may also increase the extent, depth and frequency of surface water flooding.			

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Bishops Cleeve – Site 1
	Area	1.48 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial

Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	• Geology at the site consists of:
		  ○ Bedrock – Mudstone, siltstone, limestone and sandstone
		  ○ Superficial – Sand, gravel and no deposits in some areas
		• The site is not located within Groundwater Source Protection Zone.
		• Source control techniques are likely to be suitable for this site.
		• Mapping suggest groundwater flooding is unlikely to be an issue at the site, as such infiltration techniques may be suitable.
		• Detention features may be feasible providing site slopes are <5% at the location of the detention feature.
		• Filtration systems are probably suitable providing site slopes are <5% and the depth to the water table is >1m. If the site has contamination issues, then a liner will be required.
		• All forms of conveyance features are likely to be suitable. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
		• The site is not designated by the Environment Agency as previously being a landfill site.

NPPF and planning implications	**Exception Test requirements**	The Sequential Test will need to be passed before the Exception Test is applied. The Exception Test will need to be applied if: • More Vulnerable and Essential Infrastructure development is located in FZ3a and for Highly Vulnerable development located in FZ2. • Highly Vulnerable infrastructure should not be permitted within FZ3a and FZ3b. • More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b. • Essential Infrastructure in Flood Zone 3b will require the Exception Test.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Bishops Cleeve – Site 1
	Area	1.48 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial

	Requirements and guidance for site-specific Flood Risk Assessment	• At the planning application stage, a site-specific Flood Risk Assessment will be required if any development is located within Flood Zones 2 or 3 or is greater than one hectare. Other sources of flooding should also be considered.
		• Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken at an early stage.
		• Resilience measures will be required if buildings are situated in the flood risk area, along the southern boundary. Raising Finished Floor Levels above the design event may remove the need for resilience measures.
		• Onsite attenuation schemes would need to be tested against the unnamed watercourses to the south and north of the site to ensure flows are not exacerbated downstream within the catchment.
		• Developers should ensure that the greenfield run off rate to be used for the design of Attenuation Storage for all storms up to a 1% (1 in 100) annual probability plus 70% allowance for climate change, shall be the 1 in 1-year greenfield runoff rate calculated by using ReFH2 for the whole catchment.
		• New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff.
		• Assessment for runoff should include allowance for climate change effects.
		• Safe access and egress will need to be demonstrated.
		• New development must seek opportunities to reduce overall level of flood risk at the site, for example by:
		  ○ Reducing volume and rate of runoff
		  ○ Relocating development to zones with lower flood risk
		  ○ Creating space for flooding.
		• Green infrastructure should be considered within the mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.

Mapping Information	
Flood Zones	Flood Zones 2, 3a and 3b have been derived from the 2010 Level 2 SFRA Bishops Cleeve 2D TUFLOW hydraulic model.
Climate change	The upper end climate change allowances for the '2080's were modelled using the 2010 Level 2 SFRA Bishops Cleeve 2D TUFLOW hydraulic model..
Surface Water	The Risk of Flooding from Surface Water has been used to define areas at risk from surface water flooding.
Depth, velocity and hazard mapping	Depth, velocity and hazard mapping for the 1 in 100-year event (Flood Zone 3a) have been taken from the 2010 Level 2 SFRA Bishops Cleeve 2D TUFLOW hydraulic model.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Bishops Cleeve – Site 1
	Area	1.48 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial
Reservoir		The Environment Agency's online 'Long term flood risk information, Flood risk from reservoirs, Extent of flooding' viewer was used to define areas at risk from reservoirs.

Mapping

Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables

Site details	**Site Code**	Bishops Cleeve – Site 2
	Area	13.79 hectares
	Current land use	Greenfield
	Proposed land use	Commercial
Sources of flood risk	**Existing drainage features**	• An unnamed Main River flows across the site in a south easterly to north westerly direction, entering along the eastern boundary and exiting along the northern boundary where it has its confluence with the Deans Brook. Following this, it flows along the site boundary before flowing away from the site in a north-westerly direction. • The Deans Brook flows along the site's northern boundary in a westerly direction. The River has its confluence with the first unnamed Main River along the northern site boundary.
	Fluvial	**Proportion of site at risk**

FZ3b	FZ3a	FZ2	FZ1
4%	29%	15%	52%

The area of FZ3b on the site is associated with the unnamed watercourse that flows across the site. Extents from this watercourse and the watercourse that flows along the northern boundary increase in FZ3a inundating the north and centre of the site. Extents in FZ2 meanwhile cover much of the centre and south of the site.

Surface Water — **Proportion of site at risk (RoFfSW)**

30-year	100-year	1,000-year
0%	<1%	9%

Surface water flooding begins to affect the site in the 100-year event with sporadic pockets of pooling surface water developing in the north of the site. In the 1,000-year event, additional pockets of surface water flooding develop with the greatest concentration in the vicinity of the unnamed Main River that flows across the site and along the northern boundary of the site.

Reservoir	The site is not shown to be at risk of reservoir flooding.
Flood history	The Environment Agency's historic flood map shows the north-west corner of the site as having flooded in July 2007.

Flood risk management infrastructure — **Defences**

Defence Type	Standard of Protection	Condition
-	-	-

This site is not protected by any formal flood defences.

Residual risk	Generalised 2d blockage modelling techniques show the site is at risk in the event of a blockage on two structures to the south-east of the site. Blockage climate change scenario extents on either structure produce greater extents on site when compared against the baseline climate change scenarios, particularly in the southern portion of the site. Detailed hydraulic modelling of the blockage risk should be undertaken by the developer, using channel and structure survey.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Bishops Cleeve – Site 2		
	Area	13.79 hectares		
	Current land use	Greenfield		
	Proposed land use	Commercial		
Emergency planning	**Flood warning**	The site is not covered by the Environment Agency's Flood Warning Service.		
	Access and egress	Dry access and egress for the site via the Stoke Road to the south is available in all fluvial and surface water events.		
Climate Change	**Climate change allowances for '2080s'**	**River Basin District**	**Higher Central**	**Upper End**
		Severn	35%	70%
	% of site at risk		43%	49%
	Implications for the site	Climate change extents show an increase in flooding across the site when compared with FZ3a. The greatest increases are in the south and centre of the site relating to the unnamed watercourse that flows across it. As the site is affected by surface water flooding from the 100-year event, climate change may also increase the extent, depth and frequency of surface water flooding.		

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Bishops Cleeve – Site 2
	Area	13.79 hectares
	Current land use	Greenfield
	Proposed land use	Commercial

Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	• Geology at the site consists of:
		  ○ Bedrock – Mudstone, siltstone, limestone and sandstone
		  ○ Superficial – Sand, gravel and no deposits in some areas
		• The site is not located within a Groundwater Source Protection Zone.
		• Source control techniques are likely to be suitable for this site.
		• Mapping suggest groundwater flooding may be an issue at the site, providing the site is not at medium to high risk from groundwater flooding infiltration techniques may be suitable.
		• Detention features may be feasible providing site slopes are <5% at the location of the detention feature. If groundwater is a risk to the site, then a liner may be required to mitigate against potential contamination issues.
		• Filtration systems are probably suitable providing site slopes are <5% and the depth to the water table is >1m. If the site has contamination issues, or is at risk from groundwater, then a liner will be required.
		• All forms of conveyance features are likely to be suitable. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
		• The site is not designated by the Environment Agency as previously being a landfill site.

NPPF and planning implications	**Exception Test requirements**	The Sequential Test will need to be passed before the Exception Test is applied. The Exception Test will need to be applied if: • More Vulnerable and Essential Infrastructure development is located in FZ3a and for Highly Vulnerable development located in FZ2. • Highly Vulnerable infrastructure should not be permitted within FZ3a and FZ3b. • More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b. • Essential Infrastructure in Flood Zone 3b will require the Exception Test.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Bishops Cleeve – Site 2
	Area	13.79 hectares
	Current land use	Greenfield
	Proposed land use	Commercial

	Requirements and guidance for site-specific Flood Risk Assessment	• At the planning application stage, a site-specific Flood Risk Assessment will be required if any development is located within Flood Zones 2 or 3 or is greater than one hectare. Other sources of flooding should also be considered.
		• Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken at an early stage.
		• As 2D generalised modelling techniques provide a high-level indication of flood risk, developers should confirm the flood risk to the site by undertaking detailed hydraulic modelling using channel topographic survey.
		• Resilience measures will be required if buildings are situated in the flood risk area. Raising Finished Floor Levels above the design event may remove the need for resilience measures.
		• Onsite attenuation schemes would need to be tested against the watercourses that flow through and along the northern boundary of the site to ensure flows are not exacerbated downstream within the catchment.
		• Developers should ensure that the greenfield run off rate to be used for the design of Attenuation Storage for all storms up to a 1% (1 in 100) annual probability plus 70% allowance for climate change, shall be the 1 in 1-year greenfield runoff rate calculated by using ReFH2 for the whole catchment.
		• New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff.
		• Assessment for runoff should include allowance for climate change effects.
		• Safe access and egress will need to be demonstrated.
		• New development must seek opportunities to reduce overall level of flood risk at the site, for example by:
		  ○ Reducing volume and rate of runoff
		  ○ Relocating development to zones with lower flood risk
		  ○ Creating space for flooding.
		• Green infrastructure should be considered within the mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.

Mapping Information	
Flood Zones	Flood Zones 2, 3a and 3b have been derived from a combination of the previous Level 2 SFRA 2010 Bishops Cleeve 2D TUFLOW hydraulic model (northern watercourse) and generalised 2d modelling techniques (watercourse which flows through the site).
Climate change	The climate change allowances for the '2080s' were modelled using the two models detailed above, by upscaling the 100-year inflows.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Bishops Cleeve – Site 2
	Area	13.79 hectares
	Current land use	Greenfield
	Proposed land use	Commercial
Surface Water		The Risk of Flooding from Surface Water has been used to define areas at risk from surface water flooding.
Depth, velocity and hazard mapping		Depth, velocity and hazard mapping for the 1 in 100-year event (Flood Zone 3a) have been taken from the previous Level 2 SFRA 2010 Bishops Cleeve 2D TUFLOW hydraulic model and 2d generalised modelling techniques.
Reservoir		The Environment Agency's online 'Long term flood risk information, Flood risk from reservoirs, Extent of flooding' viewer was used to define areas at risk from reservoirs.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	GLOS Airport
	Area	302.26 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial
Sources of flood risk	**Existing drainage features**	• Norman's Brook flows along the inside of the site's western boundary in a northerly direction until its confluence with Hatherley Brook in the top north-west corner of the site. • Hatherley Brook flows along the inside of the site's northern boundary in a westerly direction. • An unnamed watercourse flows into the site from the eastern boundary before its confluence with Hatherley Brook in the north-east corner of the site. • A small unnamed drain flows within the site in a southerly direction, exiting along the site's southern boundary. This drain has not been considered further as 2D modelling techniques were not suitable.
	Fluvial	**Proportion of site at risk**

FZ3b	**FZ3a**	**FZ2**	**FZ1**
6%	1%	9%	84%

FZ3b extents inundate the western boundary area, north and north east of the site stemming from the Norman's Brook, Hatherley Brook and the unnamed watercourse respectively. Extents increase slightly in FZ3a with a greater increase shown in the FZ2, especially in the northern portion of the site in the vicinity of Hatherley Brook.

Surface Water	**Proportion of site at risk (RoFfSW)**	

30-year	**100-year**	**1,000-year**
5%	8%	20%

Surface water flooding begins to affect the site in the 30-year event with sporadic pooling across the site and flow routes in the channels and on adjacent land of the watercourses. The area inundated by these increases in the 100-year and 1000-year events. Prominent overland flow routes also begin to develop in the 1000-year event across the centre of the site.

Reservoir	The site is not shown to be at risk of reservoir flooding.
Flood history	The Environment Agency's historic flood map shows the site as having flooded twice in the past. In July 1968 as part of flooding from the Severn catchment and in July 2007 as part of flooding from the Hatherley Brook catchment.

Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		-	-	-
		This site is not protected by any formal flood defences.		

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	GLOS Airport		
	Area	302.26 hectares		
	Current land use	Predominantly brownfield		
	Proposed land use	Commercial		
	Residual risk	A combination of Generalised 2d blockage modelling techniques on the Norman's Brook and detailed blockage modelling on the Hatherley Brook show the site is at risk in the event of a blockage on any one of four structures modelled across the site. Blockage climate change scenario extents on the structures modelled produce greater extents on site when compared against the baseline climate change scenarios, particularly in the north east and north west of the site. Detailed hydraulic modelling of the blockage risk should be undertaken by the developer where generalised 2d blockage modelling techniques were used.		
Emergency planning	**Flood warning**	The site is not covered by the Environment Agency's Flood Warning Service.		
	Access and egress	Dry access and egress for the site via the B4063 to the west and the A40 to the west is available in all fluvial events. In the surface water event, dry access and egress is available by the B4063 to the west up until the 30-year event and the M5 south until the 100-year event. Surface water flooding in the surrounding road network may limit further evacuation from the site.		
Climate Change	**Climate change allowances for '2080s'**	**River Basin District**	**Higher Central**	**Upper End**
		Severn	35%	70%
	% of site at risk		8%	9%
	Implications for the site	Fluvial climate change extents show an increase in the area of the site inundated when compared against FZ3a. This is most apparent in the north east of the site. As the site is affected by surface water flooding from the 30-year event, climate change may also increase the extent, depth and frequency of surface water flooding.		

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	GLOS Airport
	Area	302.26 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial

Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	• Geology at the site consists of:
		  ○ Bedrock – Mudstone, siltstone, limestone and sandstone
		  ○ Superficial – No deposits
		• The site is not located within Groundwater Source Protection Zone.
		• Source control techniques are likely to be suitable for this site.
		• Mapping suggest groundwater flooding is unlikely to be an issue at the site, as such infiltration techniques may be suitable. Due to the presence of landfill on site, further site investigation should be carried out to assess potential for drainage by infiltration.
		• Detention features may be feasible providing site slopes are <5% at the location of the detention feature.
		• Filtration systems are probably suitable providing site slopes are <5% and the depth to the water table is >1m. If the site has contamination issues, then a liner will be required.
		• All forms of conveyance features are likely to be suitable. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
		• Part of the site is underlain by an area designated by the Environment Agency as previously being a landfill site. Site investigations should be conducted to determine the exact location of the landfill.

NPPF and planning implications	**Exception Test requirements**	The Sequential Test will need to be passed before the Exception Test is applied. The Exception Test will need to be applied if: • More Vulnerable and Essential Infrastructure development is located in FZ3a and for Highly Vulnerable development located in FZ2. • Highly Vulnerable infrastructure should not be permitted within FZ3a and FZ3b. • More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b. • Essential Infrastructure in Flood Zone 3b will require the Exception Test.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	GLOS Airport
	Area	302.26 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial

	Requirements and guidance for site-specific Flood Risk Assessment	• At the planning application stage, a site-specific Flood Risk Assessment will be required if any development is located within Flood Zones 2 or 3 or is greater than one hectare. Other sources of flooding should also be considered.
		• Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken at an early stage.
		• As 2D generalised modelling techniques provide a high-level indication of flood risk, developers should confirm the flood risk to the site by undertaking detailed hydraulic modelling using channel topographic survey.
		• Resilience measures will be required if buildings are situated in the flood risk area. Raising Finished Floor Levels above the design event may remove the need for resilience measures.
		• Onsite attenuation schemes would need to be tested against the Norman's Brook, Hatherley Brook and unnamed watercourses on the site to ensure flows are not exacerbated downstream within the catchment.
		• Developers should ensure that the greenfield run off rate to be used for the design of Attenuation Storage for all storms up to a 1% (1 in 100) annual probability plus 70% allowance for climate change, shall be the 1 in 1-year greenfield runoff rate calculated by using ReFH2 for the whole catchment.
		• New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff.
		• Assessment for runoff should include allowance for climate change effects.
		• Safe access and egress will need to be demonstrated.
		• New development must seek opportunities to reduce overall level of flood risk at the site, for example by:
		  ○ Reducing volume and rate of runoff
		  ○ Relocating development to zones with lower flood risk
		  ○ Creating space for flooding.
		• Green infrastructure should be considered within the mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.

Mapping Information	
Flood Zones	Flood Zones 2, 3a and 3b have been derived from a combination of Environment Agency detailed models (Hatherley Brook 1D ISIS) and generalised 2d modelling techniques (Norman's Brook and the unnamed watercourse).
Climate change	The climate change allowances for the '2080's were modelled using a combination of Environment Agency detailed hydraulic models (Hatherley Brook 1D ISIS) and generalised 2d modelling techniques (Norman's Brook and the unnamed watercourse).

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	GLOS Airport
	Area	302.26 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial
Surface Water		The Risk of Flooding from Surface Water has been used to define areas at risk from surface water flooding.
Depth, velocity and hazard mapping		Depth, velocity and hazard mapping for the 1 in 100-year event (Flood Zone 3a) have been taken from the generalised 2d modelling techniques (Norman's Brook and the unnamed watercourse). As the Hatherley Brook is 1D-only, these outputs are not produced by the modelling and therefore will show no data.
Reservoir		The Environment Agency's online 'Long term flood risk information, Flood risk from reservoirs, Extent of flooding' viewer was used to define areas at risk from reservoirs.

Mapping

Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables

Site details	**Site Code**	M5 North - Site 1
	Area	2.38 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial
Sources of flood risk	**Existing drainage features**	Tirle Brook is located 60m to the south of the site and flows in a westerly direction parallel with the site's southern boundary.
	Fluvial	**Proportion of site at risk**

FZ3b	FZ3a	FZ2	FZ1
0%	<1%	1%	98%

FZ3b encroaches up to the southern boundary whilst FZ3a FZ2 inundate a small area of the site slightly beyond the boundary.

Surface Water — **Proportion of site at risk (RoFfSW)**

30-year	100-year	1,000-year
<1%	<1%	3%

Surface water flooding begins to affect the site in the 30-year event with a small area of pooling water in the north-west corner of the site. This area grows slightly in size in the 100 and 1,000-year events. Furthermore, in the 1,000-year event, surface water relating to flows down the Tirle Brook see surface water inundating land immediately within the site's southern boundary.

Reservoir	The site is not shown to be at risk of reservoir flooding.
Flood history	The Environment Agency's historic flood map does not show the site as having flooded in the past.

Flood risk management infrastructure — **Defences**

Defence Type	Standard of Protection	Condition
-	-	-

This site is not protected by any formal flood defences.

Residual risk: Detailed blockage modelling on the Tirle Brook show the site is at risk in the event of a blockage on a structure to the south of the site. Blockage climate change scenario extents on the structures modelled produce greater extents on site when compared against the baseline climate change scenarios.

Emergency planning	**Flood warning**	The site is not covered by the Environment Agency's Flood Warning Service.
	Access and egress	Dry access and egress for the site via the A46 to the north and unnamed road to the west in available in all fluvial and surface water flood events.

Climate Change — **Climate change allowances for '2080s'**

River Basin District	Higher Central	Upper End
Severn	35%	70%
% of site at risk	<1%	2%

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	M5 North - Site 1
	Area	2.38 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial
	Implications for the site	Fluvial climate change extents encroach marginally further into the site when compared against FZ3a, with the coverage of the upper end closely resembling that of FZ2. As the site is affected by surface water flooding from the 30-year event, climate change may also increase the extent, depth and frequency of surface water flooding.

Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	• Geology at the site consists of:
		  ○ Bedrock – Mudstone, siltstone, limestone and sandstone
		  ○ Superficial – No deposits
		• The site is not located within a Groundwater Source Protection Zone.
		• Source control techniques are likely to be suitable for this site.
		• Mapping suggest groundwater flooding may be an issue at the site, providing the site is not at medium to high risk from groundwater flooding infiltration techniques may be suitable.
		• Detention features may be feasible providing site slopes are <5% at the location of the detention feature. If groundwater is a risk to the site, then a liner may be required to mitigate against potential contamination issues.
		• Filtration systems are probably suitable providing site slopes are <5% and the depth to the water table is >1m. If the site has contamination issues, or is at risk from groundwater, then a liner will be required.
		• All forms of conveyance features are likely to be suitable. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
		• The site is not designated by the Environment Agency as previously being a landfill site.

NPPF and planning implications	**Exception Test requirements**	The Sequential Test will need to be passed before the Exception Test is applied. The Exception Test will need to be applied if: • More Vulnerable and Essential Infrastructure development is located in FZ3a and for Highly Vulnerable development located in FZ2. • Highly Vulnerable infrastructure should not be permitted within FZ3a and FZ3b. • More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b. • Essential Infrastructure in Flood Zone 3b will require the Exception Test.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	M5 North - Site 1
	Area	2.38 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial

	Requirements and guidance for site-specific Flood Risk Assessment	• At the planning application stage, a site-specific Flood Risk Assessment will be required if any development is located within Flood Zones 2 or 3 or is greater than one hectare. Other sources of flooding should also be considered.
		• Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken at an early stage.
		• Resilience measures will be required if buildings are situated in the flood risk area. Raising Finished Floor Levels above the design event may remove the need for resilience measures.
		• Onsite attenuation schemes would need to be tested against the Tirle Brook to the south of the site to ensure flows are not exacerbated downstream within the catchment.
		• Developers should ensure that the greenfield run off rate to be used for the design of Attenuation Storage for all storms up to a 1% (1 in 100) annual probability plus 70% allowance for climate change, shall be the 1 in 1-year greenfield runoff rate calculated by using ReFH2 for the whole catchment.
		• New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff.
		• Assessment for runoff should include allowance for climate change effects.
		• Safe access and egress will need to be demonstrated.
		• New development must seek opportunities to reduce overall level of flood risk at the site, for example by:
		  ○ Reducing volume and rate of runoff
		  ○ Relocating development to zones with lower flood risk
		  ○ Creating space for flooding.
		• Green infrastructure should be considered within the mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.

Mapping Information	
Flood Zones	Flood Zones 2, 3a and 3b have been derived from the Environment Agency's Tewkesbury Tributaries detailed hydraulic model (Tirle Brook).
Climate change	The upper end climate change allowances for the '2080's were modelled using the Environment Agency's Tewkesbury Tributaries detailed hydraulic model (Tirle Brook).
Surface Water	The Risk of Flooding from Surface Water has been used to define areas at risk from surface water flooding.
Depth, velocity and hazard mapping	Depth, velocity and hazard mapping for the 1 in 100-year event (Flood Zone 3a) have been taken from the Environment Agency's Tewkesbury Tributaries detailed hydraulic model (Tirle Brook).

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	M5 North - Site 1
	Area	2.38 hectares
	Current land use	Predominantly brownfield
	Proposed land use	Commercial
Reservoir		The Environment Agency's online 'Long term flood risk information, Flood risk from reservoirs, Extent of flooding' viewer was used to define areas at risk from reservoirs.

Mapping

Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables

Site details	**Site Code**	Winchcombe Site 4
	Area	1.76 hectares
	Current land use	Greenfield
	Proposed land use	Commercial
Sources of flood risk	**Existing drainage features**	An unnamed ordinary watercourse / drain flows immediately along the site's north-western boundary in a south-westerly direction.
	Fluvial	**Proportion of site at risk**

FZ3b	**FZ3a**	**FZ2**	**FZ1**
3%	1%	<1%	95%

The unnamed watercourse inundates an area along the site boundary showing it to be within FZ3b. Extents increase slightly in the immediate boundary area in FZ3a and FZ2.

Surface Water — **Proportion of site at risk (RoFfSW)**

30-year	**100-year**	**1,000-year**
3%	5%	36%

Surface water ponding begins to affect the site in the 30-year event with overland flow routes along the north western and south-western boundaries, conveying water towards the unnamed watercourse to the north. Extents increase slightly in the 100-year event but with a greater increase in the 1,000-year event with much of the north-western third of the site affected in this scenario.

Reservoir	The site is not shown to be at risk of reservoir flooding.	
Flood history	The Environment Agency's historic flood map does not show the site as having flooded in the past.	

Flood risk management infrastructure — **Defences**

Defence Type	**Standard of Protection**	**Condition**
-	-	-

This site is not protected by any formal flood defences.

Residual risk	Generalised 2d blockage modelling techniques show the site is at risk in the event of a blockage on two bridge structures to the north of the site. Blockage climate change scenario extents on either bridge structure produce greater extents on site when compared against the baseline climate change scenarios, particularly in the north of the site. Detailed hydraulic modelling of the blockage risk should be undertaken by the developer.
Emergency planning — **Flood warning**	The site is not covered by the Environment Agency's Flood Warning Service.
Access and egress	Dry access and egress for the site via the B4078 is available in all fluvial events. Dry access and egress is available in all surface water events however surrounding road infrastructure beyond the site is shown to impacted in the 1000-year event.

River Basin District	**Higher Central**	**Upper End**

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Winchcombe Site 4		
	Area	1.76 hectares		
	Current land use	Greenfield		
	Proposed land use	Commercial		
Climate Change	**Climate change allowances for '2080s'**	Severn	35%	70%
	% of site at risk		3%	4%
	Implications for the site	Fluvial climate change extents show only a minor increase in coverage when compared against FZ3a. As the site is affected by surface water flooding from the 1,000-year event, climate change may also increase the extent, depth and frequency of surface water flooding.		

Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	• Geology at the site consists of:
		  ○ Bedrock – Mudstone, siltstone, limestone and sandstone
		  ○ Superficial – No deposits
		• The site is not located within a Groundwater Source Protection Zone.
		• Source control techniques are likely to be suitable for this site.
		• Providing the site is not at medium to high risk from groundwater flooding infiltration techniques may be suitable.
		• Detention features may be feasible providing site slopes are <5% at the location of the detention feature. If groundwater is a risk to the site, then a liner may be required to mitigate against potential contamination issues.
		• Filtration systems are probably suitable providing site slopes are <5% and the depth to the water table is >1m. If the site has contamination issues, or is at risk from groundwater, then a liner will be required.
		• All forms of conveyance features are likely to be suitable. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
		• The site is not designated by the Environment Agency as previously being a landfill site.		

NPPF and planning implications	**Exception Test requirements**	The Sequential Test will need to be passed before the Exception Test is applied. The Exception Test will need to be applied if: • More Vulnerable and Essential Infrastructure development is located in FZ3a and for Highly Vulnerable development located in FZ2. • Highly Vulnerable infrastructure should not be permitted within FZ3a and FZ3b. • More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b. • Essential Infrastructure in Flood Zone 3b will require the Exception Test.		

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Winchcombe Site 4
	Area	1.76 hectares
	Current land use	Greenfield
	Proposed land use	Commercial

	Requirements and guidance for site-specific Flood Risk Assessment	• At the planning application stage, a site-specific Flood Risk Assessment will be required if any development is located within Flood Zones 2 or 3 or is greater than one hectare. Other sources of flooding should also be considered.
		• Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken at an early stage.
		• Resilience measures will be required if buildings are situated in the flood risk area. Raising Finished Floor Levels above the design event may remove the need for resilience measures.
		• Onsite attenuation schemes would need to be tested against the unnamed watercourse to the north west of the site to ensure flows are not exacerbated downstream within the catchment.
		• Developers should ensure that the greenfield run off rate to be used for the design of Attenuation Storage for all storms up to a 1% (1 in 100) annual probability plus 70% allowance for climate change, shall be the 1 in 1-year greenfield runoff rate calculated by using ReFH2 for the whole catchment.
		• New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff.
		• As 2D generalised modelling techniques provide a high-level indication of flood risk, developers should confirm the flood risk to the site by undertaking detailed hydraulic modelling using channel topographic survey.
		• Assessment for runoff should include allowance for climate change effects.
		• Safe access and egress will need to be demonstrated.
		• New development must seek opportunities to reduce overall level of flood risk at the site, for example by:
		  ○ Reducing volume and rate of runoff
		  ○ Relocating development to zones with lower flood risk
		  ○ Creating space for flooding.
		• Green infrastructure should be considered within the mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.

Mapping Information	
Flood Zones	Flood Zones 2, 3a and 3b are based on generalised 2D modelling techniques for the purposes of the SFRA. The mapping provides a strategic assessment of flood risk – developers should undertake detailed modelling of climate change allowances as part of a site-specific FRA.
Climate change	The climate change allowances for the '2080s' were modelled using generalised 2D modelling techniques for the purposes of the SFRA. The mapping provides a strategic assessment of climate change risk – developers should undertake detailed modelling of climate change allowances as part of a site-specific FRA.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Winchcombe Site 4
	Area	1.76 hectares
	Current land use	Greenfield
	Proposed land use	Commercial
Surface Water		The Risk of Flooding from Surface Water has been used to define areas at risk from surface water flooding.
Depth, velocity and hazard mapping		Depth, velocity and hazard mapping for the 1 in 100-year event (Flood Zone 3a) have been taken from 2d generalised modelling techniques.
Reservoir		The Environment Agency's online 'Long term flood risk information, Flood risk from reservoirs, Extent of flooding' viewer was used to define areas at risk from reservoirs.

Mapping

Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables

Site details	**Site Code**	Winchcombe Site 5
	Area	1.01 ha
	Current land use	Predominantly greenfield
	Proposed land use	Commercial
Sources of flood risk	**Existing drainage features**	An unnamed ordinary watercourse / drain flows immediately along the site's north-west boundary in a south-west direction.
	Fluvial	**Proportion of site at risk**

FZ3b	FZ3a	FZ2	FZ1
<1%	<1%	2%	97%

A small area in the north west of the site is shown to be within FZ3b of the unnamed ordinary watercourse. The extents increase slightly in FZ3a and FZ2.

Surface Water	**Proportion of site at risk (RoFfSW)**	

30-year	100-year	1,000-year
14%	20%	48%

Surface water ponding begins to affect the site in the 30-year event, with ponding in the centre of the site and overland flow routes along the southern and northern boundaries conveying water towards the unnamed watercourse to the west. Extents increase slightly in the 100-year event, in addition to another area of ponding emerging in the north-east of the site. In the 1,000-year event, nearly all of the site's boundary area is inundated by surface water, along with the north-western half of the site.

Reservoir	The site is not shown to be at risk of reservoir flooding.
Flood history	The Environment Agency's historic flood map does not show the site as having flooded in the past.

Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		-	-	-
		This site is not protected by any formal flood defences.		
	Residual risk	Generalised 2d blockage modelling techniques show the site is at risk in the event of a blockage on the bridge structure to the north of the site. Blockage climate change scenario extents from the structure produce greater extents on site when compared against the baseline climate change scenarios, particularly along the north west and western boundary areas. Detailed hydraulic modelling of the blockage risk should be undertaken by the developer.		
Emergency planning	**Flood warning**	The site is not covered by the Environment Agency's Flood Warning Service.		
	Access and egress	Dry access and egress for the site via the B4078 is available in all fluvial events. It is available up to the 100-year surface water event but is lost in the 1000-year surface water event.		

		River Basin District	**Higher Central**	**Upper End**

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Winchcombe Site 5		
	Area	1.01 ha		
	Current land use	Predominantly greenfield		
	Proposed land use	Commercial		
Climate Change	**Climate change allowances for '2080s'**	Severn	35%	70%
	% of site at risk		1%	3%
	Implications for the site	Fluvial climate change extents show only a minor increase in coverage when compared against FZ3a. As the site is affected by surface water flooding from the 1,000-year event, climate change may also increase the extent, depth and frequency of surface water flooding.		

Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	• Geology at the site consists of:
		  ○ Bedrock – Mudstone, siltstone, limestone and sandstone
		  ○ Superficial – No deposits
		• The site is not located within a Groundwater Source Protection Zone.
		• Source control techniques are likely to be suitable for this site.
		• Providing the site is not at medium to high risk from groundwater flooding infiltration techniques may be suitable.
		• Detention features may be feasible providing site slopes are <5% at the location of the detention feature. If groundwater is a risk to the site, then a liner may be required to mitigate against potential contamination issues.
		• Filtration systems are probably suitable providing site slopes are <5% and the depth to the water table is >1m. If the site has contamination issues, or is at risk from groundwater, then a liner will be required.
		• All forms of conveyance features are likely to be suitable. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
		• The site is not designated by the Environment Agency as previously being a landfill site.		

NPPF and planning implications	**Exception Test requirements**	The Sequential Test will need to be passed before the Exception Test is applied. The Exception Test will need to be applied if: • More Vulnerable and Essential Infrastructure development is located in FZ3a and for Highly Vulnerable development located in FZ2. • Highly Vulnerable infrastructure should not be permitted within FZ3a and FZ3b. • More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b. • Essential Infrastructure in Flood Zone 3b will require the Exception Test.		

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Winchcombe Site 5
	Area	1.01 ha
	Current land use	Predominantly greenfield
	Proposed land use	Commercial

	Requirements and guidance for site-specific Flood Risk Assessment	• At the planning application stage, a site-specific Flood Risk Assessment will be required if any development is located within Flood Zones 2 or 3 or is greater than one hectare. Other sources of flooding should also be considered.
		• Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage.
		• Resilience measures will be required if buildings are situated in the flood risk area.
		• Onsite attenuation schemes would need to be tested against the unnamed watercourse to the north west of the site to ensure flows are not exacerbated downstream within the catchment.
		• Developers should ensure that the greenfield run off rate to be used for the design of Attenuation Storage for all storms up to a 1% (1 in 100) annual probability plus 70% allowance for climate change, shall be the 1 in 1-year greenfield runoff rate calculated by using ReFH2 for the whole catchment.
		• New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff.
		• As 2D generalised modelling techniques provide a high-level indication of flood risk, developers should confirm the flood risk to the site by undertaking detailed hydraulic modelling using channel topographic survey.
		• Assessment for runoff should include allowance for climate change effects.
		• Safe access and egress will need to be demonstrated.
		• New development must seek opportunities to reduce overall level of flood risk at the site, for example by:
		  ○ Reducing volume and rate of runoff
		  ○ Relocating development to zones with lower flood risk
		  ○ Creating space for flooding.
		• Green infrastructure should be considered within the mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.

Mapping Information	
Flood Zones	Flood Zones 2, 3a and 3b are based on generalised 2D modelling techniques for the purposes of the SFRA. The mapping provides a strategic assessment of flood risk – developers should undertake detailed modelling of climate change allowances as part of a site-specific FRA.
Climate change	The climate change allowances for the '2080s' were modelled using generalised 2D modelling techniques for the purposes of the SFRA. The mapping provides a strategic assessment of climate change risk – developers should undertake detailed modelling of climate change allowances as part of a site-specific FRA.
Surface Water	The Risk of Flooding from Surface Water has been used to define areas at risk from surface water flooding.

Mapping	**Tewkesbury Borough Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables**	

Site details	**Site Code**	Winchcombe Site 5
	Area	1.01 ha
	Current land use	Predominantly greenfield
	Proposed land use	Commercial
Depth, velocity and hazard mapping		Depth, velocity and hazard mapping for the 1 in 100-year event (Flood Zone 3a) have been taken from 2d generalised modelling techniques.
Reservoir		The Environment Agency's online 'Long term flood risk information, Flood risk from reservoirs, Extent of flooding' viewer was used to define areas at risk from reservoirs.