

# Shropshire Council Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables



<b>Site details</b>	<b>Site Code</b>	<b>BNT002</b>			
	<b>Address</b>	Clive Barracks, Tern Hill			
	<b>Area</b>	72.1 hectares			
	<b>Current land use</b>	Mixed			
	<b>Proposed land use</b>	Residential and Employment			
<b>Sources of flood risk</b>	<b>Location of site within catchment</b>	The site sits on elevated ground on the left bank of the River Tern, east of the confluence with the Bailey Brook. The A41 bisects the site, cutting through its centre from northwest to southeast.			
	<b>Existing drainage features</b>	<p>The River Tern flows from northeast to southwest along the northern tip and north-western boundary of the site. To the southwest of the A41 and unnamed watercourse runs from east to west through a low-lying topography before turning to flow southwest along the site boundary, following the topography and then entering a culvert. An additional watercourse runs from southeast to west along the southwest site boundary. This watercourse enters a culvert as the channel diverts away from the site boundary which drains directly into the River Tern.</p> <p>The majority of the site lies on elevated ground; a small area at the northernmost tip of the site and a length of the southwest boundary lie are at a lower elevation, following along the river channels.</p>			
	<b>Fluvial</b>	<b>Proportion of site at risk</b>			
		<b>FZ3b</b>	<b>FZ3a</b>	<b>FZ2</b>	<b>FZ1</b>
		<1%	<1%	<1%	99%
		<b>Highest zone of risk (Risk of Flooding from Rivers and Sea)</b>			
		Medium			
		<b>Estimated maximum depth of flooding (m) - 100-year event (1D model results)</b>			
		0 - 1.71			
	<p><i>The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%)</i></p>				

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<b>Surface Water</b>	<p><b>Available data:</b> The Environment Agency's Flood Zone mapping has been used in this assessment. This is based on 2D generalised modelling data where no hydraulic models exist. A 1D hydraulic model of the River Tern was created in 2002; this provides data regarding water levels at model nodes in the River Tern. These levels have been extrapolated across the surrounding topography to show flood extents and estimated flood depths at the development site.</p> <p><b>Flood characteristics:</b> The site is largely unaffected by fluvial flood risk associated with the River Tern and the majority does not fall within Flood Zones 2 or 3 as the site lies on ground elevated above the valley. The area of the site at lowest topography close to the northern boundary fall within Flood Zones 2 and 3, and at the western edge, the site borders Flood Zone 2 and 3. The unnamed watercourses in the southern part of the site are not covered by the Environment Agency's Flood Zone mapping due to the small size of the catchments. It is recommended that these watercourses are considered with a detailed hydraulic model to consider fluvial risk from these watercourses. Flood depths at the northern boundary of the site are estimated to reach a maximum of 1.71m in the 100-year flood event. These estimates were derived from 1D model data.</p>			
	<b>Proportion of site at risk (RoFfSW)</b>			
	<b>30-year</b>	<b>100-year</b>	<b>1,000-year</b>	
	1%	1%	2%	
	<b>Max depths (m)</b>			
	>0.9	>0.9	>0.9	
	<b>Max velocity (m/s)</b>			
	<0.25	>0.25	>0.25	
	<p><i>The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %)</i></p>			
	<p><b>Description of surface water flow paths:</b> Ponding occurs in the area surrounding the unnamed watercourse in the southern part of the site in all surface water flow events, accumulating in the area of low topography that crosses this part of the site. Similarly, surface water ponding occurs close to the watercourse along the southern boundary of the site in all events. Small, isolated areas of ponding can be seen in various places across the site in the 100-year and 1,000-year event and at the junction of Hedley Way and Stokesay Road, northeast of the A41, in the 30-year event. Overall, surface water risk is very low.</p>			

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	<b>Reservoir</b>	The site is not shown to be at risk of reservoir flooding from the available <a href="#">online</a> maps.		
	<b>Flood history</b>	The site is not covered by the Environment Agency's historic flood map.		
<b>Flood risk management infrastructure</b>	<b>Defences</b>	<b>Defence Type</b>	<b>Standard of Protection</b>	<b>Condition</b>
		-	-	-
		This site is not protected by any formal flood defences.		
	<b>Residual risk</b>	A body of standing water is located on the eastern branch of the River Tern directly to the north of the site. If this were to overtop, flood risk to the area of the site at lower lying elevations in the north could increase. There are three culverts in the southwest of the site. If these structures were to become blocked water could back up onto the site increasing flood risk.		
<b>Emergency planning</b>	<b>Flood warning</b>	The northern tip of the site, at low lying elevations is covered by the Environment Agency's Flood Alert for the Tern and Perry Catchments (031WAF104).		
	<b>Access and egress</b>	Safe access and egress to the site can be gained from the A41/ Warrant Road in all surface water and fluvial flooding events as risk is low. The depths, velocities, hazards, durations and speeds of onset of surface water and fluvial flooding along access/ egress routes should be investigated further in a site-specific assessment, to confirm whether access for emergency vehicles could still be obtained.		

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<b>Climate Change</b>	<b>Implications for the site</b>	<ul style="list-style-type: none"> <li>Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding.</li> <li>Detailed modelling of the impacts of climate change on fluvial flooding associated with the River Tern has been carried out. Similar to Flood Zones 2 and 3, fluvial flood risk associated with climate change is dictated by the topography surrounding the river channel. Consequently, the site is largely not subject to increased fluvial flood risk due to climate change. A small area at the northern boundary of the site is covered by the climate change modelling outputs showing a slight increase of extent of Flood Zones encroaching into the site boundary.</li> <li>Climate change also needs to be considered for surface water events; at the site-specific stage, the 100-year +40% event is considered as part of surface water drainage strategies, or surface water modelling.</li> <li>The current day 1,000-year surface water flooding extent provides an indication of the likely increase in extent of the more frequent surface water events. This dataset suggests that isolated areas of surface water ponding on the site could become more frequent with 2% of the site impacted by surface water flooding in the 1,000-year surface water event. This would require a detailed FRA to assess the site layout and design.</li> <li>Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.</li> </ul>	
<b>Cumulative Impact of development within the catchment</b>	<b>Level of risk</b>	<b>Catchment</b>	<b>Level of risk</b>
		Tern	Low
	This site crosses the border of two sub-catchments of the River Tern, both of which have been identified as those with a lower sensitivity to the cumulative impacts of development within these catchments.		
	<b>Recommendations</b>	N/A	

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<b>Requirements for drainage control and impact mitigation</b>	<b>Broad scale assessment of possible SuDS</b>	<ul style="list-style-type: none"> <li>• Geology at the site consists of: <ul style="list-style-type: none"> <li>○ Bedrock: Chester Formation – Sandstone and Conglomerate interbedded, Bolin Mudstone Member in the north-west and Bridgnorth Sandstone Formation – Sandstone in the south-west.</li> <li>○ Superficial: Glaciofluvial deposits – Sand and Gravel and Till – Diamicton (west).</li> </ul> </li> <li>• The site is not located within any Environment Agency designated Source Protection Zone.</li> <li>• Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk from groundwater.</li> <li>• Infiltration may be suitable. Mapping suggests a medium risk of groundwater flooding and underlying soils may be permeable. Further site investigation should be carried out to assess potential for drainage by infiltration. If infiltration is suitable it should be avoided in areas where the depth to the water table is &lt;1m.</li> <li>• Mapping suggests that the site slopes are suitable for all forms of detention. A liner maybe required due to the site potential groundwater flooding.</li> <li>• All filtration techniques are likely to be suitable. A liner maybe required to prevent the egress of groundwater.</li> <li>• All forms of conveyance are likely to be suitable. Where the slopes are &gt;5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater (except for in the south-west where gradients are higher).</li> <li>• The site is not designated by the Environment Agency as previously being a landfill site.</li> <li>• Developers should refer to Shropshire Council's '<a href="#">Surface Water Management: Interim Guidance for Developers</a>' and '<a href="#">SuDS requirements for new developments</a>' webpage as well as the Level 1 SFRA, for information on suitable types of SuDS, the management train and opportunities and constraints in site master-planning.</li> </ul>

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<b>NPPF and planning implications</b>	<b>Exception Test requirements</b>	<p>The Local Authority have carried out the Sequential Test in line with national guidance. The Sequential Test will need to be passed before the Exception Test is applied. Residential development is classified as 'More Vulnerable'. It is recommended that proposed development will be sequentially located within Flood Zone 1 areas of the site.</p> <p>The Exception test will need to be applied if:</p> <ul style="list-style-type: none"> <li>• More Vulnerable and Essential Infrastructure development is located in FZ3a and for Highly Vulnerable development located in FZ2.</li> <li>• Highly Vulnerable infrastructure should not be permitted within FZ3a and FZ3b.</li> <li>• More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b.</li> </ul>

	<p><b>Requirements and guidance for site-specific Flood Risk Assessment</b></p>	<p><b>Flood Risk Assessment:</b></p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; Shropshire Council's Local Plan policies, and the LLFA's <a href="#">'Surface Water Management: Interim Guidance for Developers'</a> and <a href="#">'SuDS requirements for new developments' webpage</a>.</li> <li>• Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken at an early stage.</li> <li>• 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. Development must be in line with Table 3: flood risk vulnerability and flood zone compatibility of the NPPG.</li> <li>• Development in FZ3b should be avoided unless appropriate use can be demonstrated in line with NPPF.</li> <li>• Development in FZ3 may require floodplain compensation and this should be confirmed with the EA at FRA stage.</li> </ul> <p><b>Guidance for site design and making development safe:</b></p> <ul style="list-style-type: none"> <li>• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).</li> <li>• Safe access and egress will need to be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. 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.</li> <li>• 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.</li> <li>• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by placing development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond the current greenfield rates.</li> <li>• On site attenuation schemes would need to be tested against the River Tern and the unnamed watercourses to ensure flows are not exacerbated downstream within the catchment.</li> <li>• 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.</li> <li>• Betterment on the existing site runoff rate should be sought to ensure that there is no increase in surface water flood risk elsewhere. Ideally, surface water runoff should be fully attenuated to the greenfield rate.</li> <li>• Developers should refer to Shropshire Council's <a href="#">'Surface Water Management: Interim Guidance for Developers'</a> and <a href="#">'SuDS requirements for new developments' webpage</a>, and the Level 1 SFRA for information on SuDS.</li> </ul>
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		<ul style="list-style-type: none"> <li>• New development must seek opportunities to reduce overall level of flood risk at the site, for example by: <ul style="list-style-type: none"> <li>○ Reducing volume and rate of runoff</li> <li>○ Relocating development to zones with lower flood risk</li> <li>○ Creating space for flooding.</li> </ul> </li> <li>• 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.</li> </ul>
<b>Key messages</b>	<p>The flood risk element of the Exception Test is likely to be passed if:</p> <ul style="list-style-type: none"> <li>• Development is limited to the 99% of the site located outside of the Environment Agency's Flood Zone 3. Development should be focused in the areas of the site at higher elevations, avoiding the low-lying areas along the site boundary in the north and southwest.</li> <li>• Areas in Flood Zone 2 are used for the least vulnerable parts of the development in accordance with Table 2 in the NPPF. No residential development is permitted in Flood Zone 3 and no development at all is permitted in Flood Zone 3b.</li> <li>• If flood mitigation measures are implemented then they are tested to ensure that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).</li> <li>• Space for green infrastructure should be considered in the areas of highest flood risk.</li> </ul> <p>Refer to the detailed 'guidance for developers' section for further information on the measures that are appropriate for this site.</p>	
<b>Mapping Information</b>		
The key dataset used to make planning recommendations regarding this site was the Environment Agency's Flood Map for Planning. More details regarding data used for this assessment can be found below.		
<b>Mapping Information</b>		
<b>Flood Zones</b>	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning; this is based on 2D generalised modelling where no models exist, and detailed models where present. Flood Zone 3b has been taken from the 20-year River Tern 1D hydraulic model output.	
<b>Climate change</b>	Climate change was based on modelling of the EA's latest climate change allowances in the River Tern hydraulic model, upscaling the 100-year flow by 25%, 35% and 70% to represent the 2080s Severn basin scenarios.	

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<b>Fluvial depth, velocity and hazard mapping</b>	<p>Across the majority of the site, there is no fluvial flood risk and hence the Risk of Flooding from Surface Water mapping has been used</p> <p>In the northern area of the site, fluvial flood depths in the 100-year event were estimated by extrapolating river level data from 1D model results across the surrounding topography.</p>	
<b>Surface Water</b>	<p>The Risk of Flooding from Surface Water has been used to define areas at risk from surface water flooding.</p>	
<b>Surface water depth, velocity and hazard mapping</b>	<p>The surface water depth, velocity and hazard mapping for the 1 in 30-year (high risk), 1 in 100-year (medium risk) and 1 in 1,000-year (low risk) events is taken from the Environment Agency's Risk of Flooding from Surface Water mapping.</p>	