Solihull Metropolitan Borough Council Level 2 Strategic Flood Risk Assessment Flood Risk Assessment Detailed Site Summary Table

<table>
<tr><td rowspan="5">Site details</td><td>Site Code</td><td colspan="4">Site 19</td></tr>
<tr><td>Address</td><td colspan="4">UK Central Hub / HS2 Interchange</td></tr>
<tr><td>Area</td><td colspan="4">152 Hectares</td></tr>
<tr><td>Current Land Use</td><td colspan="4">Greenfield</td></tr>
<tr><td>Proposed Land Use</td><td colspan="4">HS2 Interchange Station
Mixed – Housing and Employment</td></tr>
<tr><td rowspan="4">Sources of flood risk</td><td>Location of site within catchment</td><td colspan="4">The large site is contained within the River Blythe catchment. The River Blythe flows in a northerly direction to the east of the site, towards its confluence with the River Cole and River Tame north east of Coleshill, outside the SMBC study area.</td></tr>
<tr><td>Existing drainage features</td><td colspan="4">The Hollywell Brook flows in an easterly direction across the southern portion of the site. This watercourse flows into the River Blythe around 450m downstream of Chester Road. The River Blythe flows in a northerly direction to the east of the site.
The Hollywell Brook is culverted under the M42 on the western site boundary, under Middle Bickenhill Lane in the centre of the site, under an embankment downstream of the lane and finally under Chester Road (A453) on the eastern site boundary. The fluvial flood risk in the southern portion of the site is associate with the Hollywell Brook. There is also an unnamed tributary of the Hollywell Brook flowing northwards from the southern site boundary.
In the northern corner of the site, there is an unnamed drain that flows in a easterly directions towards the River Blythe. The drain is culverted under the site and the road network to the west and east.
There is a second unnamed drain in the centre of the site which flows in a easterly direction towards the River Blythe. This feature is culverted under Chester Road (A452) on the eastern boundary of the site.</td></tr>
<tr><td rowspan="6">Fluvial</td><td colspan="4">Proportion of Site at Risk</td></tr>
<tr><td>FZ3b</td><td>FZ3a</td><td>FZ2</td><td>FZ1</td></tr>
<tr><td>2.8%</td><td>3.9%</td><td>4.7%</td><td>95.3%</td></tr>
<tr><td colspan="4">Highest Zone of Risk (Risk of Flooding from Rivers and Sea)</td></tr>
<tr><td colspan="4">Majority of site - Very Low
Area around Hollywell Brook – Medium to High</td></tr>
<tr><td colspan="4">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%)</td></tr>
<tr><td colspan="4">Available Data:
As part of the Level 1 SFRA, generalised 2D modelling was completed for the Hollywell Brook using JFlow.
This generalised 2D modelling dataset has not been incorporated into the Environment Agency's Flood for Planning and as a result, flood extents vary between the two datasets. The Environment Agency's Risk of Flooding from Rivers and Sea dataset has also been reviewed as part of this study.
Flood Characteristics:
The generalised 2D model shows that the fluvial flood risk to the site is associated with the Hollywell Brook, which flows in an easterly direction approximately 500m north of the southern site boundary.
In the southern portion of the site, Flood Zones 2 and 3 extend out from the Hollywell Brook, bounded by higher topography to the north and south.
In the 20 year event (FZ3a), flood depths are mainly below 0.5m along the watercourse, with areas of 0.5m to 1.0m depths upstream of Middle Bickenhill Lane and Chester Road. In the 100 year event (FZ3), flooding is still mainly below 0.5m in depth but 0.5m to 1.0m flood depths are more extensive. In the 1000 year event, 1.0 to 2.0m flood depths are modelled upstream of Middle Bickenhill Road and Chester Road.</td></tr>
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Surface Water

Proportion of site at risk (RoFfSW)		
30-year High Risk	**100-year Medium Risk**	**1,000-year Low Risk**
2.0%	3.0%	7.0%
Max depths (m)		
>0.9m	>0.9m	>0.9m
Max velocity (m/s)		
<0.25	>0.25	>0.25

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 %).

Description of surface water flow paths:

In the north of the site, there are small, isolated areas of surface water pooling.

At the northern end of Middle Bickenhill Lane, there are two main areas of surface water pooling to the east and west of an existing motocross track. The extent of pooling increases through the 30 year, 100 year and 1000 year events.

It is likely that the surface water mapping is picking up the floodplain of the Hollywell Brook, the unnamed tributary to the south of the main watercourse and the watercourse in the centre of the site, just north of Middle Bickenhill Lane.

In the 30 year event along the Hollywell Brook, there is surface water pooling to the west of Middle Bickenhill Lane and further downstream towards the eastern boundary of the site is Chester Road. In the 100 year event these extents increase slightly. Flood depths are greatest within the channel west of Chester Road.

In the 1000 year event there is surface water pooling along the majority of the watercourse but particularly downstream of Middle Bickenhill Lane and around the two existing ponds that are adjacent to the embankment that the watercourse is culverted under. In all scenarios, flood depths are greatest in the areas upstream of Chester Road and the embankment in the eastern corner of the site.

Reservoir	The site is not shown to be at risk of reservoir flooding from the available online maps.
Groundwater	The Environment Agency Areas Susceptible to Groundwater Flooding dataset, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk: • The southern portion of the site has a < 25% susceptibility to groundwater flood emergence from superficial deposits. • The northern portion of the site and south eastern corner has a >= 25% <50% susceptibility to groundwater flood emergence from superficial deposits. • The north western boundary has a >= 75% susceptibility to groundwater flood emergence from superficial deposits. • The south western boundary has a >= 50% <75% susceptibility to groundwater flood emergence from superficial deposits. This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site specific FRA stage.

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	Flood History	There are no records of historic flooding from the Environment Agency within the recorded flood outlines dataset or historic flooding dataset. However, both datasets recorded flooding on the River Blythe, downstream of the site, in December 1992. Flood history information provided by SMBC also shows no record of historic flooding on the site. No flood incidents were recorded in the vicinity of the site by Severn Trent Water.		
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		-	-	-
		This site is not protected by any formal flood defences. However, the Environment Agency spatial flood defences dataset (AIMS data) shows that there is raised ground located on the left and right banks of the Hollywell Brook through the site and along the River Blythe to the east. The identified raised ground along the Hollywell Brook is likely to act as an informal flood defence on the site. Survey and assessment of these banks would be required as part of a site specific FRA to determine the standard of protection they provide.		
	Residual risk	There are several culverts along the Hollywell Brook within the site boundary and on the eastern and western edges that could become blocked during a flood event. This could cause additional water to build up on the site. JScreen, culvert blockage modelling software, was used in 2016 to look at the impact of culvert blockages on flood risk across the site. The flood extents in the unblocked scenario are greater than in the broadscale 2D modelling. This is likely to be because: • The estimated channel capacity of the broadscale 2D modelling is the 2 year event, whereas JScreen estimate capacity based on the available structure data. For example, the capacity of a pipe will be less than the 2 year flow, meaning that flood extents are greater upstream from JScreen. • Hydrology inputs from AutoFEH may have generated slightly different flows that have been used within the JScreen modelling. In the blocked scenario, flood extents are wider along the Hollywell Brook and there is an additional flow path across the southern boundary of the site associated with a modelled blocked culvert under the A45. There is also a small area of additional flooding which is a result of a modelled blocked culvert on the eastern site boundary, adjacent to where Middle Bickenhill Lane meets Chester Road. The risk of culvert blockage needs further assessment based on site topographical and asset survey at a site specific FRA stage.		
Emergency planning	**Flood warning**	The Environment Agency West Midlands River Blythe in Warwickshire Flood Alert area (033WAF302) extends around the Hollywell Brook in the southern portion of the site. This alert covers low-lying land and roads between Cheswick Green and Blyth End.		
	Access and Egress	The site is bounded by the M42 on the western boundary, Chester Road (A452) on the eastern boundary and East Way leading to Coventry Road (A45) along the southern boundary. Junction 6 of the M42 is located in the south western corner or the site. Middle Bickenhill Lane is located through the centre of the site and currently provides access and egress from East Way and Coventry Road to the south and Chester Road to the east. The centre of Middle Bickenhill Lane is within the fluvial Flood Zones 2 and 3 from the Hollywell Brook. However, there is access and egress from both the northern and southern ends of this lane.		

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		In terms of surface water flood risk, the centre of Middle Bickenhill Lane has a high risk of surface water flooding (30 year event). However, again there is access and egress from both the northern and southern ends of this lane. At the southern end of Middle Bickenhill Lane, there is surface water flooding during the 30, 100 and 1000 year events on East Way, especially travelling eastwards out of the junction. In the 30 and 100 year events, flood depths on East Way are below 0.3m so access and egress to the site would still be possible. In the 1000 year event, access and egress would be possible westwards along East Way but flood depths could be between 0.3-0.9m in the eastward direction. At the northern end of Middle Bickenhill Lane, there is some surface water flooding on the lane itself and on Chester Road in the northerly direction from the junction. In the 30 year and 100 year event, depths would be less than 0.3m so access and egress to the site would still be possible. In the 1000 year event, surface water flood depths could reach 0.3-0.9m on the lane and Chester Road. Access and egress either eastwards to Chester Road or southwards to East Way have a relatively similar low risk in terms surface water and fluvial flood risk. 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.
Climate Change	**Implications for the site**	• Increased storm intensity and frequency as a result of climate change may increase the extent, depth, velocity, hazard and frequency of fluvial flooding from the Hollywell Brook and surface water flooding. • In the Level 1 SFRA, broadscale 2D modelling was undertaken, including allowances for climate change. For the 1 in 100 year event, the 2080s period was used, and all three allowance categories were modelled (20%, 30% & 50%). Flood extents with allowance for climate change are not significantly greater than the 1 in 100 year extent along the watercourse. • As part of a site-specific Flood Risk Assessment, latest EA climate change allowances will need to be considered in a detailed hydraulic model, to confirm the impact in the site. • Climate change also needs to be considered for surface water events; at the site-specific stage. The 100-year event with a 40% allowance for climate change should be considered as part of surface water drainage strategies, or surface water modelling. • The current day 1,000-year surface water extent provides an indication of the likely increase in extent of the more frequent events. Extents are greater along the Hollywell Brook and the unnamed tributary to the south. Ponding along the watercourse to the north of Middle Bickenhill Lane is also greater suggesting that that site may be sensitive to climate change in terms of surface water flood risk. This would require a detailed FRA to assess the site layout and design. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.
Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	Geology at the site consists of: • Bedrock: Branscombe Mudstone Formation: Mudstone • Superficial: o North - Glaciofluvial Deposits, Devensian - Sand And Gravel o Along Hollywell Brook - Alluvium - Clay, Silt, Sand And Gravel. Soils at the site consist of: • Northern Area: Loamy soils with naturally high groundwater • Southern Area: Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils

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		The site is not located within an EA designated Source Protection Zone. This site contains land designated by the Environment Agency as being a landfill site. A thorough ground investigation will be required as part of a detailed FRA to determine contamination extent and the impact this may have on SuDS. As such proposed SuDS should be discussed with the relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. In the southern portion of the site: • All forms of source control are likely to be suitable. • Infiltration likely to be suitable. Mapping suggests a low risk of ground water flooding however, site investigations should be carried out to assess potential for drainage by infiltration. • Mapping suggests that the site slopes are suitable for all forms of detention. However, additional assessment may be required on the steeper slopes each site of the Hollywell Brook. • All filtration techniques are likely to be suitable. If the site has contamination issues; a liner will be required. • All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. If the site has contamination issues; a liner will be required. In the northern portion of the site: • 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. • 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 <1m. • Mapping suggests that the site slopes are suitable for all forms of detention. A liner maybe required to prevent the egress of groundwater. • Environment Agency Areas Susceptible to Groundwater Flooding dataset suggests that there is a higher susceptibility to groundwater flooding in the north western area of the site. It is likely infiltration techniques will not be suitable. This should be confirmed via site investigations to assess the potential for infiltration. • All filtration techniques are likely to be suitable. A liner maybe required to prevent the egress of groundwater. • All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater. • Site masterplans should be designed to ensure space is made for above ground SuDS features. • Developers should refer to Solihull Metropolitan Borough Council's **Guide to SuDS and Drainage in Solihull** document 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.

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NPPF and Planning Implications	**Exception Test Requirements**	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'. Essential Transport Infrastructure, such as the HS2 Interchange Station is classed as 'Essential Infrastructure'. As the site contains FZ3a, 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 is not be permitted within FZ3a and FZ3b. • More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b.
	Requirements and guidance for site-specific Flood Risk Assessment	**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. • The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; Solihull Council's Local Plan policies, and the LLFA's **Guide to SuDS and Drainage in Solihull**. • Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken at an early stage. • 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. • A detailed hydraulic model will be required to confirm both fluvial and surface water flood risk and flow paths, FZ3b and climate change extents, using channel, asset and topographic survey. The residual risk from culvert blockage should be assessed and suitable mitigation proposed. • 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. • Development in FZ3b should be avoided unless appropriate use can be demonstrated in line with NPPF. • Development in FZ3 may require floodplain compensation and this should be confirmed with the EA at FRA stage. **Guidance for site design and making development safe:** • 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). • 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.

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		• 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. • Culverting should be avoided where at all possible and limited to short lengths for essential infrastructure. The need to ensure both fluvial and surface water flows can pass through the site is essential. • Deculverting of any watercourse assets is also considered a priority. • The impact of culvert blockage needs to be fully assessed. Any new culverts proposed as part of access improvements will need to be designed to ensure they do not increase flood risk up or downstream and will require a Land Drainage Consent outside of the planning process from the LLFA. • As the Hollywell Brook is classified as a Main River, an Environmental Permit will be required from the Environment Agency. • If existing culverts are to be kept, a full CCTV condition survey is required to ensure the culvert will be sound for the lifetime of the proposed development. Improvements should be sought, such as trash screens compliant with the latest Environment Agency guidance and relining where this is appropriate and sustainable option. • For any culverts (old or new), the developer must set out who is adopting and maintaining those culverts throughout the lifetime of the development. The design of the development must take into account the residual risk of blockage e.g. properties should not be placed in the area that could flood if a culvert blocks and the exceedance flows from such an event should be built into the site masterplan. • 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 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 current greenfield rates. • **Areas at risk from fluvial and surface water flooding should ideally be integrated into green infrastructure, which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. An integrated flood risk management and sustainable drainage scheme for the site is advised.** This needs to be modelled to inform the design to ensure that surface water overland flows or fluvial flooding do not overwhelm sustainable drainage features. • New developments 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. • Betterment on the existing site runoff rate should be sought to ensure that there is no increase in surface water flood risk elsewhere. Surface water runoff must be fully attenuated to the greenfield rate,. • Developers should refer to **SMBC's Guide to SuDS and Drainage in Solihull** and the Level 1 SFRA for background information on SuDS.

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Key Messages		The flood risk element of the Exception Test is likely to be passed if: • New development is limited to the 95.3% of the site located within fluvial Flood Zone 1. This is the area to the north and south of the Hollywell Brook where there is fluvial flood risk associated with this watercourse. • Areas in Flood Zone 2 are used for the least vulnerable parts of the development in accordance with Table 2 in the NPPF. • 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). • An integrated flood risk management and sustainable drainage solution is implemented. • New developments 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. • Betterment on the existing site runoff rate should be sought to ensure that there is no increase in surface water flood risk elsewhere. Surface water runoff must be fully attenuated to the greenfield rate. • The site can be accessed from Chester Road to the east and East Way to the south during the 100 year design event (considering climate change) depending on if you are north or south of the Hollywell Brook. Refer to the detailed 'guidance for developers' section for further information on the measures that are appropriate for this site.

Mapping Information

The key datasets used to make planning recommendations regarding this site were the broadscale 2D modelling outputs and the Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below. It should be noted that the outputs of the broadscale 2D modelling vary to the Environment Agency's Flood Map for Planning.

Flood Zones	Flood Zones 2 and 3 have been taken from the broadscale 2D modelling completed as part of the Level 1 SFRA. It is recommended that a more detailed hydraulic model is constructed at the site-specific Flood Risk Assessment stage, to confirm flood risk.
Climate change	Climate change was modelled as part of the Level 1 SFRA broadscale 2D modelling. However, it is recommended that the latest EA's climate change allowances are modelled in a detailed hydraulic model as part of a site-specific Flood Risk Assessment.
Fluvial depth, velocity and hazard mapping	Fluvial depth, velocity and hazard mapping has been taken from the broadscale 2D modelling completed as part of the Level 1 SFRA. This should be explored further at site-specific stage
Surface Water	The Risk of Flooding from Surface Water has been used to define areas at risk from surface water flooding.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity and hazard mapping for the 1 in 100-year event (considered to be medium risk) is taken Environment Agency's Risk of Flooding from Surface Water.