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 1</td></tr>
<tr><td>Address</td><td colspan="4">Barretts Farm</td></tr>
<tr><td>Area</td><td colspan="4">91 Hectares</td></tr>
<tr><td>Current Land Use</td><td colspan="4">Greenfield/Agricultural</td></tr>
<tr><td>Proposed Land Use</td><td colspan="4">Residential</td></tr>
<tr><td rowspan="8">Sources of flood risk</td><td>Location of site within catchment</td><td colspan="4">This large site located to the east of Balsall Common in the River Blythe catchment. The upstream extents of the Bayley’s Brook converge on the site and flow north westwards towards the River Blythe.</td></tr>
<tr><td>Existing drainage features</td><td colspan="4">Two upstream extents of the Bayley’s Brook, a tributary of the River Blythe, converge and flow from the south east to the north west of the site. A portion of eastern watercourse is culverted just upstream of the confluence and there is also a short drain located along the eastern site boundary that flows into the eastern watercourse.
After the confluence, the Bayley’s Brook flows in a north westerly direction through the site, under the railway line located along the northern site boundary and towards the River Blythe, which is approximately 4.5km downstream.</td></tr>
<tr><td rowspan="7">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>11.3%</td><td>12.0%</td><td>13.0%</td><td>87.0%</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 the Bayley’s 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 2 SFRA, 2D strategic modelling has been completed for the watercourses associated with this site using TUFLOW. Limitations of the strategic modelling are discussed in the SFRA Strategic Modelling Report and summarised in the Mapping Information section at the end of this table.
Survey data, including dimensions and invert levels, were collected for the culvert under the Birmingham – Coventry railway line on the northern site boundary. This survey data has been incorporated into the strategic model. Dimensions have been estimated for the culvert on the Bayley’s Brook within the site boundary and the upstream culvert under the railway line. Invert levels for these structures have been inferred from the IHM dataset.
Flood Characteristics:
The strategic modelling shows that there are two defined areas of fluvial flood risk across the site, following the flow paths of the upstream extents of the Bayley’s Brook and the drain along the eastern site boundary.
There is very little variation in the flood extents and depths across the 20, 100 and 1000 year events. However, flood extents are slightly greater on both watercourses upstream of the confluence in the 100 and 1000 year events.
Flood depths are most significant towards the northern corner of the site in all events, where greater than 1.0m of flooding is modelling in some areas. Flood depths are significantly shallower upstream of the central confluence, where modelling shows depths to be largely less than 0.1m.
Culverts under the Birmingham – Coventry railway and former Berkswell – Kenilworth railway line (now a Country Park known as Kenilworth Greenway but also part of the route of HS2) affect the flood risk to the site.
It is recommended that if flood risk is assessed in the future via a detailed site-specific assessment, that further information on the channel and floodplain features is included to help better understand the flood mechanisms of the area.</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**
		3%	5.4%	13.6%
		Max depths (m)		
		0.3 – 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: There are surface water flow paths corresponding with the Bayley's Brook which flows north westwards through the site. There are also flow paths associated the drain that flows along the eastern site boundary. The mapping is likely to be picking up the natural floodplains but not likely to be picking up how the watercourse is culverted under the railway . In the 30 year event, small, isolated areas of surface water ponding are modelled along the identified watercourses ,with depths less than 0.3m. In the north of the site, just upstream of the northern site boundary, there is a larger area of surface water flooding shown. Flood depths here could reach 0.3 to 0.9m in the 30 year event. In the 100 year event, surface water flooding is modelled along each of the watercourses present, with some isolated pooling in the south of the site and along the eastern drain. This flooding is still modelled to be largely less than 0.3m in depth. The main area of surface water pooling is slightly more extensive during this event and depths could be greater than 0.9m in some areas. In the 1000 year event, surface water flood extents are slightly greater than in the 100 year event. Some additional flow paths are also seen in the north of the site. Flood depths on the watercourses are still modelled to be less than 0.3m with isolated areas of deeper flooding. In the main area of surface water flooding, a larger area is modelled to reach depths on greater than 0.9m.		
	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 northern and eastern portions of the site have a < 25% susceptibility to groundwater flood emergence from superficial deposits. • The western portion of the site has a >= 25% <50% 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	Two incidents of historic flooding have been identified in datasets from SMBC. One event, on the 24th November 2012, was recorded on Meeting House Lane which runs along the western site boundary. The second event was recorded on 21st November 2012 on Truggist Lane under the railway bridge, just outside the northern site boundary. There is relatively frequent and deep flooding to Truggist Lane on the underpass under the railway line. Some flood incidents have been recorded around the site. The following historic events have been identified around the site: • Station Road to the west – in 1997 • Hodgetts Lane to the north east – in 1998 • Kenilworth Road to the west – 4 clustered incidents in 2006 Ponding of water has been observed on the site beside the public footpath near Truggist Lane.		
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		-	-	-
		This site is not protected by any formal flood defences.		
	Residual risk	There are two main culverts that may impact the site if blockages were to occur. The first is located on the northern site boundary where the watercourse flows northwards under the Birmingham to Coventry railway line. There is also a culvert located on the second watercourse just upstream of the central confluence, under the Kenilworth Greenway and route of HS2. If these structures were to become blocked, there is potential for increased surface water and fluvial flooding across the site. The potential for blockage will need to be considered in any future site-specific assessment.		
Emergency planning	**Flood warning**	The northern portion of the site around the Bayley's Brook is contained within the River Blythe in Warwickshire Flood Alert area (033WAF302). This Flood Alert areas contains low-lying land and roads between Cheswick Green and Blyth End.		
	Access and Egress	The site is bounded by a railway line along the northern boundary and cannot be accessed from this direction. Waste Lane (B41010) runs along the southern boundary. Meeting House Lane and Sunnyside Lane are located to the west of and Barretts Lane is already contained within the western edge of the site, accessed from Sunnyside Lane. Station Road runs along the north western boundary of the site. In terms of fluvial flood risk, the model outline show flooding across Station Road adjacent to the northern corner of the site. This flow path would impact access and egress northwards from Station Road to Truggist Lane and aligns with an area of known past flooding. The western portion of the site could access and egress from the rest of Station Road and Meeting House Lane to the west. Land between the two upstream extents of the Bayley's Brook in the south eastern portion of the site is cut off by flow paths to the west, north and east. Access and egress must be provided from Waste Lane to the south if this area of the site is to be developed. In terms of surface water flood risk, surface water flooding impacts the site and some of the surrounding road network in all modelled events. In the 30 year event, surface water flooding should not impact access and egress from the site. There is very minor surface water pooling modelled on Station Road to the north west and Waste Lane to the south, but this flooding is isolated in area and likely to be less than 0.3m in depth.		

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		In the 100 and 1000 year events, surface water flooding on Station Road, Meeting House Lane and Waste Lane is modelled to be slightly more extensive but depths are still likely to be less than 0.3m. Two surface water flow paths are modelled across Waste Lane adjacent to the eastern corner of the site. The western wider flow path is likely to be shallow with modelled flood depths of less than 0.3m. The narrower eastern flow path could be between 0.3 and 0.9m in depth. In terms of fluvial and surface water flood risk, the surrounding road network is not significantly affected by flooding and any surface water pooling is likely to be shallow in most events, with the exception of the ponding under the railway underpass at Truggist Lane. Site access should be provided along either Station Road or Meeting House Lane. Access should also be provided on Waste Lane for the portion of the site cut off by fluvial flooding associated with upstream extents of the Bayley's Brook. This should be provided to the east of the surface water flood extents that impact this road. 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 Bayley's Brook and surface water flooding across the site. • 2D strategic modelling has been completed for the watercourses covering this site using TUFLOW, 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%). Within the site boundary, there is very little change in the 100 year flood extent when climate change allowances are applied suggesting that there is low sensitivity to climate change. • 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. The impact of watercourse and drainage work associated with the HS2 railway embankment on the route of Kenilworth Greenway should also be taken into account for site specific Flood Risk Assessment work. • 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. It is likely that surface water flooding will impact a larger portion of the site in the future, this is especially true for the southern portion of the site. The surrounding road networks are also likely to be affected more frequently. A detailed FRA would be required to assess the site layout and design in relation to the impact of climate change of surface water flooding. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.

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Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	Geology at the site consists of:
		• Bedrock: Mercia Mudstone Group - Mudstone
		• Superficial: None Recorded
		  o Eastern Area: Till, Mid Pleistocene – Diamicton
		  o Southern Area: Oadby Member - Diamicton
		  o Along Watercourse: Alluvium - Clay, Silt, Sand And Gravel
		The site is not located within an EA designated Source Protection Zone. The site is also not designated by the Environment Agency as previously being a landfill 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 in the south west of the site.
		• Infiltration likely to be suitable for the majority of the site where mapping suggests a low risk of ground water flooding. In the south west of the site, infiltration may be suitable, but mapping suggests a medium risk of groundwater flooding. 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.
		• 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.

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'. It is anticipated that proposed development will be sequentially located outside of Flood Zone 3. As the site contains extended areas of Flood Zone 3 associated with the Bayley's Brook and residential development is proposed, 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 fluvial, 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 impact of watercourse and drainage work associated with the HS2 railway embankment on the route of Kenilworth Greenway should be considered for site specific Flood Risk Assessment work. It is recommended that conversations are held with HS2 to establish further the nature of these works at an early stage. • 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. • Resilience measures will be required if buildings are situated in the flood risk areas. Raising Finished Floor Levels above the design 1 in 100 year flood event with allowance for climate change 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. • 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 consider 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

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		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.
Key Messages		The flood risk element of the Exception Test is likely to be passed if: • Development is limited to the 87.0% of the site located outside of the Environment Agency's Flood Zone 2 and 3. • Areas in Flood Zone 1 and then 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) • Green infrastructure should be considered in the areas of highest flood risk. • 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. • Safe access and egress routes must not be in the areas of high surface water risk or the 100-year fluvial design flood event (taking into account climate change). In terms of surface water flood risk, the surrounding road network is not significantly affected by flooding and any surface water pooling is likely to be shallow in most events. The site would be best accessed from Station Road and Meeting House Lane to the west and Waste Lane to the south as a result of fluvial flooding dividing the site. Refer to the detailed 'guidance for developers' section for further information on the measures that are appropriate for this site.

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Mapping Information	
The key datasets used to make planning recommendations regarding this site were the strategic 2D modelling outputs and the Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below.	
Flood Zones	Flood Zones 2 and 3 have been taken from strategic 2D modelling completed as part of the Level 2 SFRA. It is recommended that a more detailed hydraulic model is constructed at the site-specific Flood Risk Assessment stage, to confirm flood risk. The majority of the site is covered by the IHM DTM and as such basic assumptions have been applied to stamp features into the DTM for this assessment. There is potential that features within the floodplain are misaligned or not accurately represented by the dataset. Assumptions regarding the connectivity of the watercourse (e.g. culvert inlet levels) also have a degree of uncertainty as they are based on the IHM dataset. It is recommended that if required that flood risk should be assessed via a detailed site-specific assessment which further information on the channel and floodplain features to help better understand the flood mechanisms of the area.
Climate change	Climate change was modelled as part of Level 2 SFRA strategic 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 strategic 2D modelling completed as part of the Level 2 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.