

Charnwood Borough Council Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables



Site details	Site Code	SH48			
	Address	Former Limehurst Depot			
	Area	0.75 ha			
	Current land use	Brownfield			
	Proposed land use	Residential			
Sources of flood risk	Topography	<p>The site generally slopes from south to north into an area of topographic depression which runs parallel to the east and west site boundary. There is an area of higher ground beyond this immediately north. There is also an area of depression in the far west corner of the site which is part of the Wood Brook.</p> <ul style="list-style-type: none"> • There are some existing buildings located on the site in the south west corner and east of the site which have resulted in poor LIDAR filtering issues. • The ground slope across the site generally has a gradient of less than 5%. 			
	Existing drainage features	The Wood Brook partially intersects the site along the south west site boundary. The Grand Union Canal is also located 13m from this boundary.			
	Fluvial	Proportion of site at risk			
		FZ3b	FZ3a	FZ2	FZ1
3%		3%	28%	72%	
Highest zone of risk (Risk of Flooding from Rivers and Sea)				High	

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		<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> <p>Available data: The site is covered by the latest 2021 Environment Agency Wood Brook hydraulic model. The extent of the Flood Zones predicted by the flood model are different to the extent of the actual flood risk, as there are flood risk management features that change the risk.</p> <p>It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA and updated online Flood Zone mapping will be available later in 2021. Developers should contact the EA for latest information on the Wood Brook.</p> <p>The current EA online Flood Map for Planning shows a different picture of flood risk, as this is based on older outdated modelling, which is due to be updated in 2021 using latest Wood Brook results. This dataset has therefore not been used in this assessment.</p> <p>Flood characteristics:</p> <p>This site is at low fluvial risk in the 100-year undefended Wood Brook (Flood Zone 3a) scenario, where the water is shown to remain in-channel, and the overland flow path from further upstream does not reach the site. Flood Zone 2 affects mostly the north-eastern portion of the site and abuts the southern boundary.</p> <p>The defended 20-year (Flood Zone 3b) and defended 100-year extents are also still in-bank in these scenarios upstream and downstream, with the main culvert running adjacent to the site's western boundary, showing the 'actual' flood risk when flood risk management features are in place. The site boundary does capture this stretch of open channel and therefore there is FZ3 and 3b in the site, even though it is not out of bank flooding.</p> <p>As the defended 100-year extent does not affect the site, the maximum depth for the 100-year plus 30% (higher central) climate change event was considered, but this also does not affect the site – only the +50% climate change scenario marginally encroaches into the far north-eastern boundary and is the end of an outer flood extent, and the maximum depth here is shallow at 0.06m.</p> <p>Velocity and hazard outputs were provided for the 100-year event, but there is no risk to the site in this event, therefore these should be interrogated in the +50% climate change event at site-specific level. It is likely that velocities and hazard will be low given the shallow depths and sparse area of flooding.</p>

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Surface Water	Proportion of site at risk (RoFfSW)			
	30-year	100-year	1,000-year	
	2%	22%	77%	
	Max depths (m)			
	0.6-0.9	0.6-0.9	0.6-0.9	
	Max velocity (m/s)			
	0.25-0.5	1-2	>2	
	<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>Description of surface water flow paths: Surface water flows occur over most of the site area for the 1,000-year event, with isolated pockets not at risk where topography is higher. The 100-year event covers approximately a third of the north-western edge. The 30-year is confined to the Wood Brook channel along the western boundary. Considering the risk away from the channel of the Wood Brook, depths in the 100-year in the site are generally <0.3m and velocities a mix of <0.25m/s and >0.25m/s. In the 1,000-year event, most of the site is <0.3m, but the area covered by the 100-year extent increases to 0.3-0.9m. Higher velocities in this area denote a flow path in a north-easterly direction towards Limehurst Avenue. Loughborough sees a very large overland flow route from surface water in all events, along the course and topography of the Wood Brook, though the Wood Brook itself is largely in culvert through Loughborough. RoFfSW takes account of building footprints so the flood risk may be affected by existing buildings on the site. It also only considers flood risk where the hazard rating is greater than 0.575. The surface water mapping does not account for culverts, structures, channel hydraulics or sewer capacity, and therefore this is deemed to overestimate risk in the Wood Brook valley, and therefore the confidence in this dataset is reduced. It is recommended that developers investigate surface water risk in more detail at the planning application stage and may need to consider undertaking integrated modelling. Therefore, it is recommended that further assessment is undertaken at the site-specific FRA stage.</p>			

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	Groundwater	<p>The Areas Susceptible to Groundwater Flooding dataset shows the southern half of the site is located within a 1 km grid square where $\geq 50\%$ to $< 75\%$ of the area is predicted to be at risk of groundwater flooding. The remainder of the site is located within the grid square where $\geq 75\%$ of the area is predicted to be at risk of groundwater flooding.</p> <p>The AStGWF data should be used only in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist. Ground investigations at the site should be used to confirm groundwater levels to support the design of SUDS features.</p>		
	Reservoir	<p>The available online maps shows that the maximum extent of flooding from reservoirs reaches through the entire site. Reservoir risk is considered low, but this risk should be confirmed in a site-specific Flood Risk Assessment.</p>		
	Flood history	<p>Between 2018-2020, there have been 87 LLFA reports of internal flooding; 32 of which were in Loughborough. There are no records of historic flooding at this site from the Environment Agency. No recorded historical flood incidents occurred within 350m of the proposed development site.</p> <p>Records from Leicestershire County Council detail historical flood incidents from all sources, whereas the Environment Agency dataset only records incidents of fluvial, tidal or coastal flooding.</p> <p>Loughborough is also one of the 40 highlighted priority settlements for the purpose of the Local Flood Risk Management Strategy, coming in the top 5 settlements at risk from surface water, with most properties at risk.</p> <p>The Lead Local Flood Authority should be contacted to obtain further details.</p>		
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition
		High ground	Unknown	Unknown
		High ground is located to the south east of the site and follows the banks of the Wood Brook. This includes part of the site boundary. It is unknown what the standard of protection or condition of the high ground is.		

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	Residual risk	Residual risk is present at the site due to the presence of flood risk management features to the west, which in the event of a breach, could flood the site. There is a potential blockage risk from a culverted Wood Brook, therefore, it is recommended that this is explored further in an FRA.
Emergency planning	Flood warning	The site is situated within the Environment Agency's Loughborough Urban Watercourses Flood Alert area (034WAF426) and the East Midlands Flood Warning area (034FWFWOLUFSOUTH).
	Access and egress	<p>Access and egress is available to the site for modelled fluvial events and the 30-year and 100-year surface water events via Bridge Street to the east corner of the site. Wet access and egress could be available for the site for the 1,000-year surface water event in the same location. This is due to a hazard rating of 0.50 - 0.75 which is considered safe and suitable for emergency services vehicles.</p> <p>East of the site there is land clear of flood risk, and routes north or west should be avoided.</p> <p>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 using the latest Wood Brook model results, to confirm whether access for emergency vehicles could still be obtained in the climate change events.</p>

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Climate Change	Implications for the site	<ul style="list-style-type: none"> Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding. Detailed modelled outputs from the latest 2021 Wood Brook modelling have been used to assess the impact of climate change on fluvial risk. The 100-year 20%, 30% and 50% defended uplifts show a significant increase in flood risk in comparison to the 100-year defended event, as the defended 100-year extent does not affect the site. The extents are slightly larger than the 100-year undefended extent, but do not reach that of the 1,000-year defended flood event. They do however cover the majority of the site and beyond the boundary, so implications of this for flood mitigation and access need to be considered. 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. The current day 1,000-year surface water extent provides an indication of the likely increase in extent of the more frequent events. This would require a detailed FRA to assess the site layout and design, and account for integrated modelling given the national surface water does not represent hydraulic structures. 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	Bedrock Geology	The entire site's bedrock geology consists of mudstone, siltstone and sandstone.
	Superficial Geology	The site is underlain with Alluvium deposits consisting of clay, silt and sand.
	Soils	Loamy soils with naturally high groundwater.
	Source Protection Zone	The site is not located within any Environment Agency designated Source Protection Zone.

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	Historic Landfill Site	The site is not designated by the Environment Agency as previously being a landfill site.
	Broad scale assessment of possible SuDS	<p>Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.</p> <p>Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints.</p> <p>The following techniques are considered suitable for the site:</p> <ul style="list-style-type: none"> • 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. • Mapping suggests that there is a high risk of groundwater flooding at this location, therefore it is likely infiltration techniques will not be suitable. This should be confirmed via site investigations to assess the potential for infiltration. • This option may be feasible provided site slopes are < 5% at the location of the detention feature. A liner maybe required to prevent the egress of groundwater. • This feature is probably suitable provided site slopes are <5% and the depth to the water table is >1m. 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.

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NPPF and planning implications	Exception Test requirements	<p>The Local Authority have carried out the Sequential Test in line with national guidance. The Sequential Test will need to be satisfied based on fluvial and other sources of flood risk before the Exception Test is applied. Residential development is classified as 'More Vulnerable'.</p> <p>The site is affected by all Flood Zones, though Flood Zone 3b and 3a are due to the Wood Brook channel being in the site; these remain in-bank. Flood Zone 2 affects the north-eastern portion of the site. The Exception Test will need to be applied if the site is residential and in Flood Zone 3. However, the Exception Test is based on 'defended'/'actual' flood risk, and when using the defended 100-year extents, this shows no risk to the site outside of the channel; only the +50% climate change extent affects the site, matching more closely with Flood Zone 2.</p> <ul style="list-style-type: none"> • 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. <p>Development will not be permitted for the following scenario:</p> <ul style="list-style-type: none"> • Highly vulnerable development within FZ3a. • Highly vulnerable, More vulnerable and / or Less vulnerable development within FZ3b. <p>Consideration should be given to the surface water risk within Charnwood Borough, particularly within Loughborough with regards to the Exception Test. For example, a site may pass the test based on fluvial flood risk alone, but greater risk comes from surface water at the four Loughborough sites. However, the national surface water mapping does not account for culverts, structures, channel hydraulics or sewer capacity, and therefore this is deemed to overestimate risk in the Wood Brook valley, and therefore the confidence in this dataset is reduced. It is recommended that developers investigate surface water risk in more detail at the planning application stage and may need to consider undertaking integrated modelling.</p>

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 for this site as development is located within Flood Zone 3b and may be subject to other sources of flooding and the development may introduce a more vulnerable use. It will also be required where development sites:
 - are 1 hectare or more in size;
 - contain land which has been identified by the Environment Agency as having critical drainage problems; or
 - contain land identified in the strategic flood risk assessment as being at increased flood risk in future.
- All sources of flooding must be considered as part of any site-specific Flood Risk Assessment, including surface water and groundwater.
- Consideration should be given to the potential effects of climate change, particularly with respect to surface water. Proposals should consider the opportunity to include measures that provide for a reduction in the predicted surface water flood risk at existing development.
- Flood risk needs to be considered for the lifetime of the development, accounting for climate change.
- Latest modelled outputs from the Wood Brook Environment Agency study show the site is located in the Flood Zones, but not the 100-year defended/ actual risk. Risk to the site is not significant away from the channel.
- Consideration should be given to the surface water risk within Charnwood Borough, particularly within Loughborough with regards to the Exception Test. For example, a site may pass the test based on fluvial flood risk alone, but greater risk comes from surface water at the four Loughborough sites. However, the national surface water mapping does not account for culverts, structures, channel hydraulics or sewer capacity, and therefore this is deemed to overestimate risk in the Wood Brook valley, and therefore the confidence in this dataset is reduced. It is recommended that developers investigate surface water risk in more detail at the planning application stage and may need to consider undertaking integrated modelling.
- The site extents include a Main River (in culvert), where an easement of 8m is required from either side of the bank. In this site, the culvert runs along the western boundary, so a 8-10m easement area will be required from the channel. Developers will be required to apply for a permit and ensure the activity being carried out over this easement would not increase flood risk.
- Any FRA should be carried out in line with the National Planning Policy Framework, Flood Risk and Coastal Change Planning Practice Guidance, Charnwood Council's Local Plan policies and the LLFA's SuDS guidance.
- Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken 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. 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 area. Raising Finished Floor Levels above the design event or existing ground levels may be needed. With the flood risk from surface water being a flow path, residential development may need to be placed on higher levels and any flow paths should not be obstructed so as to displace the risk elsewhere. Design should account for surface water with an element of climate change.
- 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.
- On site attenuation schemes would need to be tested against the watercourse to ensure flows are not exacerbated downstream within the 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.
- New development must seek opportunities to reduce overall level of flood risk at the site, for example by:
 - Reducing volume and rate of runoff
- Example features include green roofs, rainwater capture and reuse and permeable paving.
- 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.
- Efforts should be made to limit runoff to greenfield rates and discharge rates from the site should not increase downstream flood risk.
- The opportunity should be taken to store additional water on development sites in the Wood Brook to alleviate flooding in the wider area, in addition to long term storage requirements. Opportunities to complement and enhance the existing NFM scheme within the catchment should also be investigated. Such schemes may also improve the surface water risk in the catchment, by slowing the fluvial

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		<p>flows in the system allowing the surface water drainage to outfall to the channel.</p> <ul style="list-style-type: none"> • Developers should enter into conversations with the Borough Council/ EA at pre-application stage to understand the latest position with regards to the Environment Agency led Wood Brook scheme. Betterment may be required: <ul style="list-style-type: none"> ○ In the form of additional storage for surface water runoff from development sites on site, ○ In the form of 'in kind' works, such as additional floodplain storage on site, and/ or ○ In the form of a contribution towards wider community flood alleviation works within the catchment.
Key messages		<ul style="list-style-type: none"> • The modelled defended 100-year shows the site to be developable, with no risk shown to the site and low-level flood risk in the climate change and Flood Zone 2 events. • Surface water is a risk to the site, though access to/ from the site looks possible in the 30-year and 100-year events. The site is part of a flow path, so this needs to be maintained and not obstructed in future development design. • Site-specific assessments should investigate surface water risk in more detail using integrated modelling to fully understand the interaction between fluvial and surface water risk and hydraulic structures. • The site extents include a Main River (in culvert), where an easement of 8m is required from either side of the bank. In this site, the culvert runs along the western boundary, so a 8-10m easement area will be required from the channel. Developers will be required to apply for a permit and ensure the activity being carried out over this easement would not increase flood risk. • If flood mitigation measures and flood resilient design are implemented, then they are tested to ensure that they will not displace water elsewhere. <p>Refer to the 'detailed guidance for developers' section (above) for further information on the measures that are appropriate for this site.</p>

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Mapping Information		
<p>The key datasets used to make planning recommendations regarding this site was the Environment Agency's Risk of Flooding from Surface Water mapping. More details regarding data used for this assessment can be found below.</p>		
Flood Zones	<p>The EA Flood Map for Planning does not currently represent the latest Environment Agency's 2021 Wood Brook modelling, which was in progress at the time of the SFRA, and hence the current EA Flood Zones 3a and 2 largely overestimate flood risk along this watercourse, with them being based on the Lower Soar modelling. Due to the significant difference between the EA's current Flood Map for Planning in this area and new Wood Brook model results, the new model results have been used to derive the Flood Zones for the purpose of the L2 SFRA at the four Loughborough sites. The draft defended and undefended 100-year extents have been merged to form a composite Flood Zone 3a extent, and the defended and undefended 1,000-year flood extents have been merged with the Historic Flood Map to form a composite Flood Zone 2 extent. Flood Zone 3b has been derived from the 20-year defended modelled flood extent.</p> <p>It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA and updated online Flood Zone mapping will be available later in 2021. Developers should contact the EA for latest information on the Wood Brook.</p>	
Climate change	<p>Climate change was based on the latest Environment Agency 2021 Wood Brook model and the 1,000-year surface water flood extent.</p> <p>It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA. Developers should contact the EA for latest information on the Wood Brook.</p>	
Fluvial depth, velocity and hazard mapping	<p>The 100-year defended modelled outputs were used to assess depth, velocity and hazard are from the detailed 2021 Wood Brook hydraulic model. These do not affect the site, but the other modelled event outputs were not provided at the time of the study.</p> <p>It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA. Developers should contact the EA for latest information on the Wood Brook.</p>	

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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 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.