


<b>Greater Norwich Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables</b>	
<b>Site details</b>	
<b>Site Code</b>	<b>BKE3</b>
<b>Address/Grid Ref.</b>	Brooke Industrial Estate/ 628239,300524
<b>Area</b>	4.74ha
<b>Current land use</b>	Industrial
<b>Proposed land use</b>	Employment
<b>Sources of flood risk</b>	
<b>Location of site within catchment</b>	The site is in the catchment of the Well Beck. The Well Beck is an Environment Agency designated main river and flows in a southerly direction from Poringland towards its confluence with the River Chet.
<b>Existing drainage features</b>	The site is located on the edge of an unnamed tributary of the Well Beck. The river flows in an easterly direction in open channel, before continuing to flow east towards its confluence with the Well Beck. The confluence of another unnamed watercourse with the tributary of the Well Beck is located along the northern boundary of the site. The nearest Environment Agency Main River is the Well Beck which is located 350m east of the site.
<b>Fluvial</b>	<p><b>Proportion of site at risk:</b>  <b>5% AEP event – 0%</b>  <b>1% AEP event – 0%</b>  <b>0.1% AEP event – 3%</b></p> <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%). Additional strategic modelling has been undertaken for this site, which has not been externally reviewed and is therefore not reflected in designated flood zones. Strategic modelling indicates that there is no areas of risk on site beyond existing flood zones.</i></p> <p><b>Available data:</b>          A strategic 2D model was built to inform the flood risk to this site. The model is strategic in nature and topography is informed by OS Mastermap. The model has not been externally reviewed and therefore has not informed the Environment Agency flood zones. Therefore, both SFRA flood mapping and the Environment Agency flood zones (whichever are greater) will need to be used for future development planning. Figures quoted are from the strategic 2D model. The developer should look at the fluvial risk to the site in further detail for a site-specific FRA</p> <p><b>Flood characteristics:</b>          The modelling of the unnamed tributary of the Well Beck shows that the site is not at significant risk of flooding during the 5% AEP, 1% AEP and 0.1% AEP flood events. A very small area of the site, on the northern corner adjacent the watercourse, is flooded during the 1% AEP event, to a shallow depth.</p>
<b>Coastal and Tidal</b>	The site is not at risk from coastal or tidal flooding.

<p><b>Surface Water</b></p>	<p><b>Proportion of site at risk (RoFfSW):</b>  <b>3.3% AEP</b> – 2%  Max depth 0.9-1.2m  Max velocity &lt;0.25m/s  <b>1% AEP</b> – 3%  Max depth 0.9-1.2m  Max velocity &gt;0.25m/s  <b>0.1% AEP</b> – 4%  Max depth 0.9-1.2m  Max velocity &gt;0.25m</p> <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. 1% AEP includes the 3.3% AEP %)</i></p> <p><b>Description of surface water flow paths:</b></p> <p>Surface water flooding from the site predominantly occurs from an overflow of the unnamed tributary of the Well Beck.</p> <p>During the 3.3% AEP flood event, surface water is predominantly associated with the channel of the unnamed tributary of the Well Beck and only affects a very small area of the site. Three small areas of surface water ponding are present around the site. Flood depths along the edge of the site range between 0.3m-1.2m and have a flood hazard rating of 'Dangerous for most'. The areas of surface water ponding on the site have a depth of flooding between 0.3m-0.6m with a flood hazard rating of 'Caution' to 'Dangerous for most'.</p> <p>Flood extents during the 1% AEP event, are similar to those of the 3.3% AEP flood event. Surface water flooding is predominantly associated with the channel of the unnamed tributary of the Well Beck. Three areas of ponding are also present around the site. Flood depths along the northern edge of the site range between 0.3m-1.2m and have a maximum flood hazard rating of 'dangerous for all'. The areas of surface water ponding on the site have a depth of flooding between 0.15m-0.9m with a flood hazard rating of 'caution' to 'dangerous for most'.</p> <p>During the 0.1% AEP flood event, the extent of surface water flooding associated with the unnamed tributary of the Well Beck is marginally increased. Flood depths in this area do not significantly increase and remain between 0.3m-1.2m with a maximum flood hazard rating of 'dangerous for all'.</p>
<p><b>Reservoir</b></p>	<p>The site is not shown to be at risk of reservoir flooding from the available <u>online</u> maps.</p>
<p><b>Groundwater</b></p>	<p>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:</p> <ul style="list-style-type: none"> <li>The entire site is shown to have a &lt;25% susceptibility to groundwater flood emergence.</li> </ul> <p>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.</p>
<p><b>Flood history</b></p>	<p>The Environment Agency's historic flooding and recorded flood outlines datasets do not record of flooding on the site.</p> <p>The site is in a postcode area which has experienced 3 incidences of sewer flooding (as identified in the Level 1 SFRA).</p>
<p><b>Flood risk management infrastructure</b></p>	
<p><b>Defences</b></p>	<p>This site is not protected by any formal flood defences.</p>
<p><b>Residual risk</b></p>	<p>There is no residual risk to the site from flood risk management structures.</p>
<p><b>Emergency planning</b></p>	
<p><b>Flood warning</b></p>	<p>The site is not located in an Environment Agency Flood Warning or Flood Alert Area.</p>
<p><b>Access and egress</b></p>	<p>In terms of fluvial flood risk, the site is not at risk of flooding from fluvial sources therefore access and egress will not be affected. This remains the case even considering the Upper End (+65%) climate change scenario.</p> <p>In terms of surface water flood risk, surface water flooding impacts a small proportion of the site and some of the surrounding road network in the 3.3% AEP and 0.1% AEP modelled events. Access to and from Norwich Road along the eastern boundary will not be restricted during a surface water flooding event however access further north would be restricted by surface water flooding.</p>

<p><b>Dry islands</b></p>	<p>The site is not located on a dry island.</p>
<p><b>Climate change</b></p>	
<p><b>Implications for the site</b></p>	<ul style="list-style-type: none"> <li>The site is not affected by an increase in fluvial flows from the unnamed tributary of the Well Beck resulting from climate change.</li> </ul> <p><b>Proportions of the site in Future Flood Zones can be found in Table 6-2 of the Greater Norwich Level 2 SFRA Report</b></p>
<p><b>Requirements for drainage control and impact mitigation</b></p>	
<p><b>Broad scale assessment of possible SuDS</b></p>	<p><b>Geology &amp; Soils</b></p> <ul style="list-style-type: none"> <li>Geology at the site consists of: <ul style="list-style-type: none"> <li>Bedrock – Crag Group - Sand and Gravel.</li> <li>Superficial – Lowestoft Formation - Sand and Gravel.</li> </ul> </li> </ul> <p><b>SuDS</b></p> <ul style="list-style-type: none"> <li>Most source control techniques are likely to be suitable. Mapping suggests that slopes may be unsuitable for selective source control techniques.</li> <li>Infiltration is 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. Further site investigation should be carried out to assess potential for drainage by infiltration. If infiltration is suitable proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints given that the site is located within a Source Protection Zone.</li> <li>Detention is unlikely to be feasible as mapping suggests mean site slopes are &gt;5%. Feasibility of such options should be assessed as part of a site-specific assessment. If detention is feasible and the site is found to have contamination issues, a liner will be required.</li> <li>This option is unlikely to be feasible as mapping suggests mean site slopes are &gt;5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible it should be located where the depth to the water table is &gt;1m. Additionally, if the site has contamination issues, a liner will be required.</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. If the site has contamination issues, a liner will be required.</li> <li>Developers should investigate and consider in full all SuDS options and demonstrate that SuDS are not appropriate where they are not implemented.</li> <li>This site has an area within its boundary (at the South end)) 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 the extent of the contamination 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.</li> </ul>
<p><b>Opportunities for wider sustainability benefits and integrated flood risk management</b></p>	<ul style="list-style-type: none"> <li>Due to the size of the site, there is likely to be limited space for green infrastructure. It is recommended that areas of hard paving are designed to ensure that flood water can be stored during a flood event alongside the use of green features such as rain gardens and tree pits.</li> </ul>
<p><b>NPPF and planning implications</b></p>	
<p><b>Exception Test requirements</b></p>	<p>The Local Authority will need to confirm that the sequential test has been carried out. The Sequential Test will need to be passed before the Exception Test is applied.</p> <p>Commercial development is classified as 'Less Vulnerable'. As only a small area of the site is in Flood Zone 3, the Exception Test will only be required should development be proposed in this area.</p>

	As the development is close to existing Flood Zones it is recommended that a precautionary approach is taken and any development is accompanied by a site specific flood risk assessment.
<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 should development be proposed within Flood Zone 3.</li> <li>• All sources of flooding, particularly the risk of fluvial and surface water should be considered as part of a site-specific flood risk assessment.</li> <li>• The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance, Norwich City Council's Local Plan policies, and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document.</li> <li>• Consultation with the Local Authority, Lead Local Flood Authority and the Environment Agency should be undertaken at an early stage.</li> <li>• The development should be designed to ensure that mitigation measures are in place to ensure the development does not flood.</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 0.1% AEP plus climate change rainfall events, using the depth, velocity and hazard outputs. Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. 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>• 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.</li> <li>• Areas at risk from 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. It is essential that a detailed model of surface water flooding, using the existing drainage system, topographical and asset survey is constructed at the FRA stage. This will determine the risk from surface water flooding further and to ensure that overland flows do not overwhelm future sustainable drainage features.</li> <li>• Brownfield sites should discharge surface water at the original pre-development (greenfield) runoff rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA).</li> <li>• Developers should refer to Norfolk County Council's 'Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning Guidance Document' and the Level 1 SFRA for information on SuDS for guidance on the information required by the LLFA from applicants to enable it to provide responses to planning applications.</li> </ul>

**Key messages**

The development is likely to be able to proceed if:

- Development is located outside of areas at risk of flooding.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- Brownfield sites should discharge surface water at the original pre-development (greenfield) runoff rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA, IDB or Anglian Water).

**Mapping Information**

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

<b>Flood Zones</b>	A strategic 2D model was built to inform the flood risk to this site. The model is strategic in nature and topography is informed by OS Mastermap. The model has not been externally reviewed and therefore has not informed the Environment Agency Flood Zones. Therefore, both SFRA flood mapping and the Environment Agency flood zones (whichever are greater) will need to be used for future development planning. The developer should look at the fluvial risk to the site in further detail for a site-specific FRA
<b>Climate change</b>	Climate change was modelled as part of the further modelling to apply recent climate change uplifts to the fluvial model of the unnamed tributary of the Well Beck.
<b>Fluvial depth, velocity and hazard mapping</b>	Fluvial depth and hazard mapping has been taken from the strategic modelling of the unnamed tributary of the Well Beck. This has not been externally reviewed and should be explored further at site-specific stage.
<b>Surface Water</b>	The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding.
<b>Surface water depth, velocity and hazard mapping</b>	The surface water depth and hazard mapping for the 1 in 0.1% AEP event is taken Environment Agency's Risk of Flooding from Surface Water mapping.