King's Lynn and West Norfolk Borough Strategic Flood Risk Assessment Level 2 Community Level Guidance Tables

Completed by	JBA consulting
Date	March 2019
Author	Freyja Scarborough
Reviewer / Sign-off	Hannah Coogan
Version Number	Version 2.0

Community details	**Community**	King's Lynn including West Lynn			
	Flood Risk Summary	Highest risk flooding mechanism	Tidal / Coastal		
		Most likely source of flooding	Surface Water		
Sources of flood risk	**Existing drainage features**	• Coastline approximately 5km to the north of the community. • The Tidal Great Ouse follows the western boundary of the community. • There are multiple drainage features located within the community and surrounding it in all directions. • There are several small areas of open watercourse between culverts within the community.			
	Fluvial	Flood Zone 3b			
	Tidal	Flood Zone 3a			
	Surface Water	Localised impacts in the 3.3% AEP event with more significant impact in 1% and 0.1% AEP events (with some large areas of inundation).			
	Residual Risk	Large areas of complete inundation from a tidal breach on the River Great Ouse. Main impact on the west of the community.			
	IDB watercourse present?	• Most of this community is covered by the King's Lynn Internal Drainage Board (IDB), in the admin area of the Water Management authorities (WMA). There are a number of IDB drains under the remit of King's Lynn IDB within the community. • East of Ouse Polver & Nar IDB in the south of the community with 2 drains identified within the community boundary.			

	Flood history	• Major tidal flooding in 1953 and 1978
		• Norfolk County Council flood records show evidence of internal flooding on 10th July 2014, 30th November 2016 and 16th September 2015 at different properties. No flood mechanism is provided.
		• An internet search provided textural and visual evidence of flooding:
		  ○ Occurring in 1953 and 1978 caused by high tidal surges.
		  ○ In June 2017 where the worst affected was Nar Ouse Way but standing water was present on roads throughout King's Lynn as a result of surface water flooding.
		  ○ Tidal flooding in December 2013 was a near miss
		• There are records of sewer flooding in this community from 2010 to 2017.			

Flood risk management infrastructure	**Defences**	**Defence Type**	**Flooding Type**	**Standard of Protection**	**Condition**
		Bridge abutment	Fluvial	100	2 (Good)
		Bridge abutment	Fluvial	100	3 (Fair)

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<table>
<tr><td rowspan="16">Community details</td><td>Community</td><td colspan="4">King's Lynn including West Lynn</td></tr>
<tr><td rowspan="15">Flood Risk Summary</td><td colspan="2">Highest risk flooding mechanism</td><td colspan="2">Tidal / Coastal</td></tr>
<tr><td colspan="2">Most likely source of flooding</td><td colspan="2">Surface Water</td></tr>
<tr><td>Bridge abutment (x2)</td><td>Tidal</td><td>200</td><td>3 (Fair)</td></tr>
<tr><td>Embankment</td><td>Fluvial</td><td>50</td><td>2 (Good)</td></tr>
<tr><td>Embankment (x5)</td><td>Fluvial</td><td>50</td><td>3 (Fair)</td></tr>
<tr><td>Embankment</td><td>Fluvial</td><td>50</td><td>4 (Poor)</td></tr>
<tr><td>Embankment</td><td>Fluvial/Tidal</td><td>50</td><td>2 (Good)</td></tr>
<tr><td>Embankment</td><td>Fluvial/Tidal</td><td>50</td><td>3 (Fiar)</td></tr>
<tr><td>Embankment</td><td>Fluvial</td><td>100</td><td>2 (Good)</td></tr>
<tr><td>Embankment (x6)</td><td>Fluvial</td><td>100</td><td>3 (Fair)</td></tr>
<tr><td>Embankment (x6)</td><td>Tidal</td><td>200</td><td>2 (Good)</td></tr>
<tr><td>Embankment (x 18)</td><td>Tidal</td><td>200</td><td>3 (Fair)</td></tr>
<tr><td>Bridge abutment (x2)</td><td>Tidal</td><td>200</td><td>3 (Fair)</td></tr>
<tr><td colspan="4">King's Lynn is mostly covered by the Environment Agency 'Areas benefitting from defences' data.
In response to the 1978 tidal surges sixty flood gates and flood barriers were installed to protect the community. On 5 December 2013 the defences were tested to their limit in that year's storm surge event and held back the floodwater with great success. However, a refurbishment programme was deemed necessary for any future flood events. As well as refurbishing thirty of the gates, 15 new vehicle flood gates and 15 new demountable flood barriers were installed as part of the project.
When flood gates are closed they form a continuous barrier along the town's quay side to protect against tidal flooding.</td></tr>
<tr><td rowspan="2">Opportunities for sustainable development</td><td>Asset management</td><td colspan="4">The North Lynn Pumping Station Pump Refurbishment scheme is close to King's Lynn.</td></tr>
<tr><td>Capital investment policy and regeneration</td><td colspan="4">The Borough Council are working alongside consultants Urban Delivery and Levitate to prepare a delivery plan that will maximise the potential of King's Lynn historic riverfront area. The plan includes residential development of 436 homes and retail and commercial development, utilising 7,659 sqm of commercial space.
Nar Ouse Business Park is located by the A47 in King's Lynn and comprises of 17 hectares of employment land. The site is available for a range of uses, including office, industrial and research and development. It is set to be complete and available for lease in 2019.
King's Lynn Innovation Centre (KLIC) officially opened in 2016 and offers commercial workspace to innovative businesses.</td></tr>
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	Higher level policy	• The Great Ouse Catchment Flood Management Plan highlights that current defences provide significant protection from flooding in the King's Lynn and South Wootton area. However, rises in sea level and other effects of climate change will result in a profound increase of flood risk, due to overtopping of flood defences. The CFMP recommends that the EA work with local planning authorities to ensure that development and urban regeneration helps to manage flood risk. • CFMP/ SMP policies set the high level and strategic direction for flood risk and coastal change management. There is no guarantee that funding will be available from national, regional or local sources to implement the policy. More detailed strategy and scheme work considers funding needs and availability at a community level.	
Emergency planning	**Flood warning**	• The community is mostly covered by the 'King's Lynn, West Lynn and the Wash Frontage EA Alert System'. • Several EA Warning Systems apply to the area: 'Tidal River Great Ouse at West Lynn'; 'King's Lynn river frontage and South Lynn'; and the 'urban area of King's Lynn'.	
	Access and egress	• Localised impacts on access and egress in the 5%/ 3.3% AEP and events for tidal/ surface water flooding. • During the 1%, 0.5% and 0.1% AEP scenarios for both tidal and surface water flooding, many access and egress routes from the community will be blocked.	
Climate Change	**Implications for the community**	• Significant additional impacts from tidal flooding, especially in the western area of the community in climate change scenarios. • Some additional impact from fluvial climate change scenarios in the south-west of the community. • Significant increase in the impact of surface water flooding under climate change scenarios.	
Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	**Bedrock Geology**	Mudstone, siltstone and sandstone
		Superficial Geology	Tidal flat deposits – clay and silt
		Soil Type	Naturally high groundwater
		Groundwater Source Protection Zone	No
		Historic Landfill Site	Yes – 5 areas of historic landfill identified within the community.

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		• Further investigation SuDS on a site-specific basis due to the variety or levels of risk from groundwater identified for this community in the Areas Susceptible to Groundwater Flooding dataset and due to the location of historical landfill sites in some areas of the community. • Source control techniques are likely to be suitable for this community. • Infiltration techniques will be suitable proving there are areas of the site not at high or medium ground water flood risk. As areas of the site have been designated as historic landfill, further site investigation should be carried out to assess potential for drainage by infiltration. • Detention features may be feasible providing site slopes are <5% at the location of the detention feature. If the site has groundwater issues, then a liner will be required. If landfill contamination is a risk to the site, then a liner may be required to mitigate against potential contamination issues. • Filtration systems are probably suitable providing site slopes are <5% and the depth to the water table is >1m. If the site has groundwater issues, then a liner will be required. If the site has contamination issues then a liner will be required. • All forms of conveyance features are likely to be suitable. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.	
NPPF and planning implications	**Existing Local Considerations**	• The SWMP indicates that there is a moderate to high risk of surface water flooding in King's Lynn, including South Wootton, from overland flow and existing watercourses. It also identifies several Local Flood Risk Zones (LFRZs) within the King's Lynn area: Swan Lane, Gaywood; Fairstead; King's Lynn Centre; A47 Saddlebow Roundabout. • There are a number of defences in King's Lynn. Developers should liaise with the Environment Agency and consider whether a financial contribution towards the long-term maintenance and/ or upgrade of the defences would be appropriate to help safeguard against increasing flood risk over the lifetime of the development.	

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<tr><td>Most likely source of flooding</td><td colspan="2">Surface Water</td></tr>
<tr><td></td><td>Requirements and guidance for site - specific Flood Risk Assessment</td><td colspan="3">

Ensure safe access and egress in all flood events, especially in the western area of the community.
Undertake assessment of resilience measures for new development.
Undertake a flood evacuation plan in liaison with BCKLWN and the Environment Agency.
Early consultation with Downham Market Group of IDBs or the Water Management Alliance (WMA) (dependent on-site location) is strongly recommended.
Detailed hydraulic modelling will need to consider any drains within and surrounding the community that are likely to affect the site to assess fluvial flood risk in the community (including IDB drains). Hydraulic modelling should also seek to understand the impact of residual risk from culvert blockage to any proposed site from structures along these watercourses.
The FRA should address all forms of flood risk impacting this community (coastal inundation, fluvial, surface water and groundwater).
Consider the impacts of climate change on all flooding mechanisms. An FRA should also suggest appropriate mitigation (flood resilience measures).
Consider the impact of a tidal breach by sequentially placing the highest vulnerability part of the development in the areas of lowest flood risk, applying the Councils Flood Risk Design Guidance and creating a site-specific emergency plan for flood events. Should explain how surface water drainage will be managed.
The FRA must demonstrate how the development would provide wider sustainability benefits to the community that outweigh the risk associated with flooding and that the development would be safe for its lifetime without increasing flood risk elsewhere and, where possible, would reduce flood risk overall.
Further investigation SuDS on a site-specific basis due to the variety or levels of risk from groundwater identified for this community in the Areas Susceptible to Groundwater flooding dataset and due to the location of historical landfill sites in some areas of the community.

</td></tr>
<tr><td colspan="2">Conclusions and recommendations</td><td>Tidal and Coastal</td><td>Fluvial</td><td>Surface Water</td></tr>
<tr><td colspan="2"></td><td>5% AEP and Breach</td><td>5% AEP</td><td>3.3% AEP</td></tr>
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		• Large areas in the western area of the community are in Flood Zone 3a. • Improvements to the level of flood defence for the wider community should be promoted through waterfront regeneration • Ensure safe access and egress from the community in fluvial, tidal and surface water events including consideration of flood resilience measures and evacuation plans. • Consideration should be given to providing a contribution to the defences protecting this community, including options that alleviate surface water flood risk • Consider the impacts of tidal breach. • Early consultation with Downham Market Group of IDBs or the WMA (dependent on-site location) is strongly recommended.	
Mapping Information			
Flood Zones		• Flood Zone 3b is comprised of supplied outlines from: the Fenland, 2016 fluvial model; Eastern Rivers MP2 – River Nar, 2016 fluvial model; and The Wash, 2018 tidal model. • Indicative Flood Zone 3b is comprised of outlines from Environment Agency Flood Zone 3 from fluvial and tidal models. • Flood Zone 3a is comprised of supplied outlines from: Eastern Rivers MP2 – River Nar, 2016 fluvial model; The Wash, 2018 tidal model; and outlines from Environment Agency Flood Zone 3 from fluvial and tidal models. • Flood Zone 2 is comprised of supplied outlines from: Eastern Rivers MP2 – River Nar, 2016 fluvial model; The Wash, 2018 tidal model; and outlines from Environment Agency Flood Zone 2 from fluvial and tidal models.	