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Appendix B

1.1. Introduction to the Fens Area

1.1.1. The Fens cover a large area of eastern England, stretching from the Wash out to Lincoln, Peterborough and Cambridge (see figure B1). Five different rivers – the Witham, Welland, Glen, Nene and Ouse, carry water from surrounding uplands through the Fens and into the Wash.

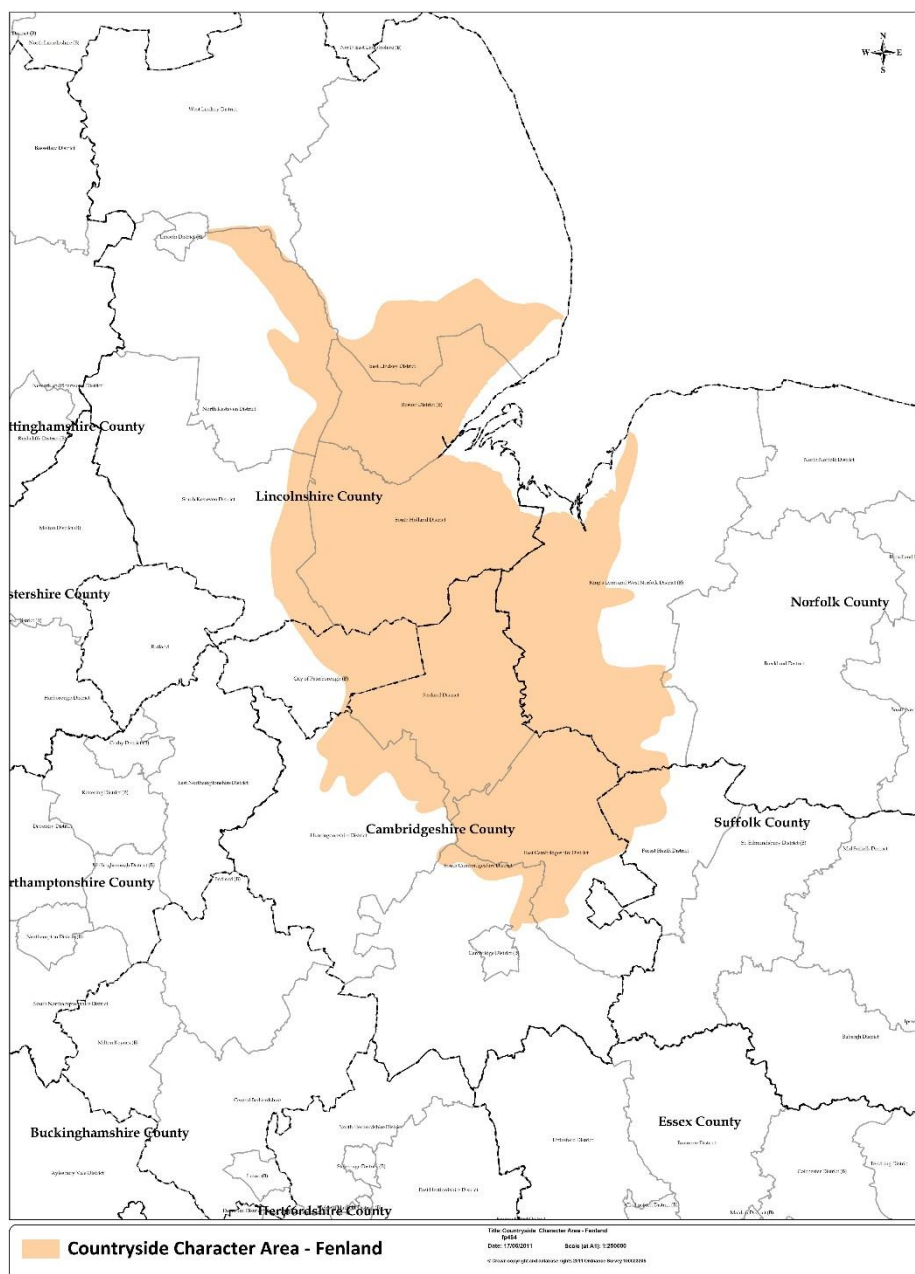


Figure B1: The position of the Fens in eastern England.

1.2. Background to the Fens

An illustration of the Fens before drainage.

This illustration depicts how the Fens landscape might look now had the area not been drained from the medieval period onwards. It has been created using geological, height, and contour information in conjunction with advice and guidance from Cambridgeshire County Council's Ecologist.

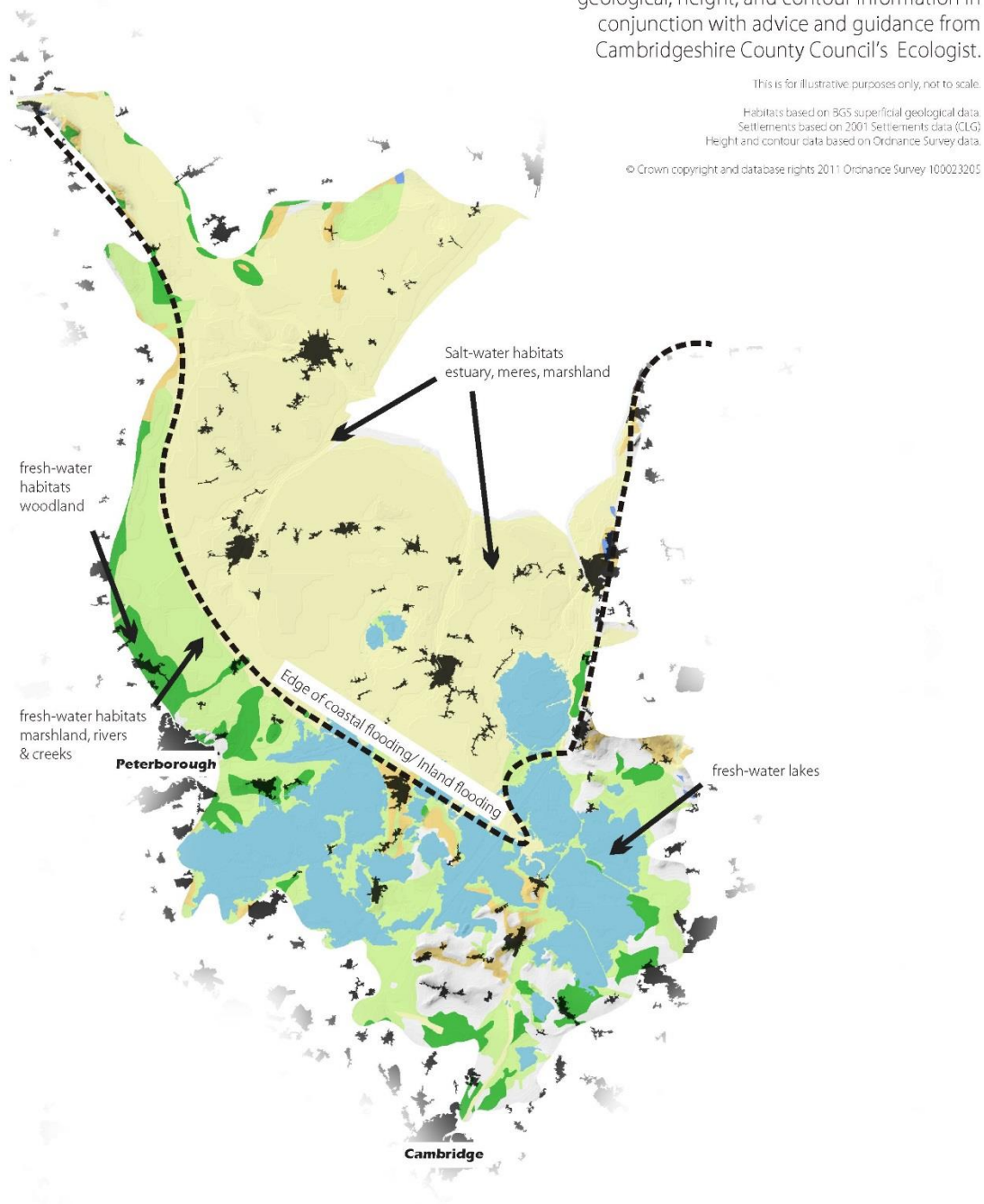


Figure B2: All illustration of the Fens before drainage

- 1.2.1. Localised drainage took place in the fenland landscape from as early as the medieval period. However, large scale drainage of the Fens first began in the 17th

Century, when the 'Fens' as we now know it began to take shape. Today this artificially drained landscape is home to approximately half a million people. The Fens cover an area of almost 1,500 square miles, divided between eleven District and five County Councils. For comparison, figure B2 depicts how the Fens landscape might look now had the area not been drained from the medieval period onwards.

- 1.2.2. Well maintained coastal and fluvial flood defences are essential to providing the conditions in which Internal Drainage Boards can maintain extensive artificial drainage of the area. Across the Fens, IDBs maintain 3,800 miles of watercourse, 200 miles of watercourse embankment and 286 pumping stations. Coupled with over 60 miles of coastal sea walls and 96 miles of river embankments, the Fens has a high level of protection, and is classified as a defended flood plain. Climate change, however, poses a serious threat to the Fens and a continued programme of investment in flood defences and drainage systems will be needed for existing standards of protection, including provision for climate change, to be maintained in the medium and long term.
- 1.2.3. The Internal Drainage Boards within the Fens have been established over many years because of the special water level and drainage management needs existing within this area, and the particular need for lowland and inland local flood risk management activities. These local works are funded in the main from funds levied locally by IDBs, and present an effective example of the Government's 'localism' agenda.
- 1.2.4. It is essential for the promotion of sustainable growth that coastal defences and the extensive drainage infrastructure behind them are well maintained. Housing, jobs and services that meet the needs of the market towns and the rural communities can only happen if drainage and flood risk is well managed. Growth in the Fens will need to be embraced in a sustainable way; balancing development needs with the need to promote and protect open spaces, natural habitats, landscapes, the built environment and the unique qualities of the Fens. It is therefore essential that 'Flood Risk Management Authorities', utilities and local communities continue to work closely with local planning authorities, so that consideration of sustainable drainage in particular and flood and water management in general are an integral part of the planning and development control process.
- 1.2.5. Farming contributes significantly to the success of the local economy, supporting a large number of businesses involved in the production of food and rural tourism. The important role that farming plays in the Fens is emphasized by the steady decline in self-sufficiency in the UK, and the Government's renewal of the food security agenda. The Fens account for 50% of all Grade 1 agricultural land in England, producing 37% of all vegetables and 24% of all potatoes grown in the country, as well as enough wheat to make 250 million loaves of bread every year.. The area also supports significant livestock, dairying and outdoor pig production as well as about 18 million hens, ducks, turkeys and geese in the Lincolnshire Fens alone. This supports a large well-established food processing industry. It is critical, therefore, that appropriate flood risk and drainage management measures are taken to protect this nationally important food production area.
- 1.2.6. In addition to food production, the Fens is popular for tourism, attracting more than 15 million visitors a year. The Fens provide a unique and rich habitat for wildlife and include the Ouse and Nene Washes which while providing flood storage capacity, also retain important wetland for birds. There are also major transport networks, road and rail, as well as houses, critical infrastructure, water, gas and electricity that

would be affected if fenland areas were to flood. The Fens also contain heritage sites and form three sides of the Wash, which is internationally designated for animal and plant biodiversity. There are also numerous local sites, ranging from SSSIs to Local Nature Reserves which need to be protected.

Management plans for the Fens

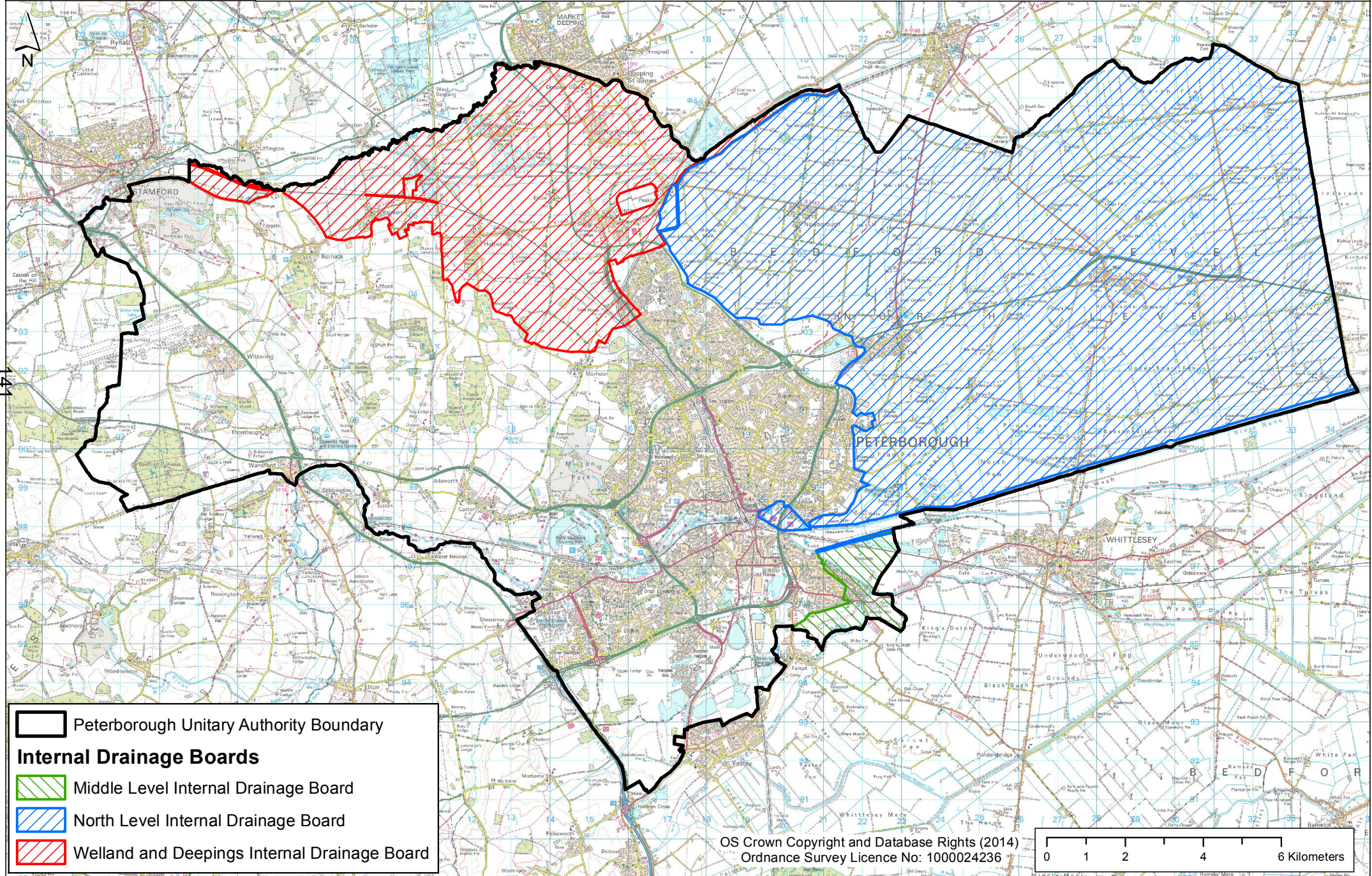
- 1.2.7. The Environment Agency previously developed Catchment Flood Management Plans for the Anglian Region with the aim of taking a broad view of flood risk at catchment level over the next 100 years. Factors such as climate change, future development and changes in land use and land management were taken into account in developing sustainable policies for managing flood risk in the future.
- 1.2.8. The Fens area is covered by four different Catchment Flood Management Plans (CFMPs); one for each of the fenland catchments of the Nene, Welland and Glen, Witham and Great Ouse and also by the Wash Shoreline Management Plan (SMP). All five plans recommended that an integrated plan is produced specifically for the Fens in order to develop a sustainable, integrated and long term flood risk management approach for this landscape area. There was also a need for any future plan to bring together organisations and other plans and projects from across the Fens.
- 1.2.9. Since the development and approval of the CFMPs, the legislative framework for flood risk management landscape has changed considerably, providing opportunities to develop a more integrated approach to upland and lowland flood risk and drainage management from all sources. The introduction of the duties for LLFAs to produce local flood risk management strategies and the Environment Agency to produce flood risk management plans provides an opportunity for integrating and delivering the aims for the Fens.
- 1.2.10. Local flood risk management strategies and flood risk management plans need to integrate the needs and opportunities of the local Fens and fenland communities with those of the rest of the local LLFA area while also promoting a consistent approach across the Fens as a whole. This consistency is crucial, for example, to IDBs, who often span more than one local authority and whose practices will be similar throughout their area. The LLFAs of Lincolnshire, Peterborough, Cambridgeshire, Norfolk and Suffolk have therefore agreed to work together closely to achieve this aim. Forest Heath District Council has been involved on behalf of Suffolk County Council since Suffolk's fenland is principally located in this area.

Aspirations

- 1.2.11. To reflect the importance of the Fens as a highly productive and precious resource the following joint aspirations have been identified for the wider area in respect of flood risk and drainage management:
 - i. Continue to ensure that appropriate flood risk and drainage management measures are taken to protect the nationally important food production areas in the Fens
 - ii. Ensure that where appropriate, current levels of protection are maintained in the Fens taking into account climate change
 - iii. Manage flood risk and drainage in accordance with principles of sustainable development
 - iv. Ensure that development is undertaken appropriately, so that adverse consequences of flood risk are not increased

- v. Contribute towards the protection and enhancement of the environmental heritage and the unique landscape character of the Fens including biodiversity;
- vi. Support promotion and use of the waterways and other areas in the Fens for tourism and recreation
- vii. Develop effective dialogue with local communities to facilitate their involvement in flood risk management in the Fens;
- viii. Work with local planning authorities to help them grow the economy in the Fens, through the early consideration of flood and water management needs.

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Appendix D

1.1. Risk calculation

To give an overall perspective of flood risk in Peterborough, each type of flooding (referred to here as the hazard) has been rated according to the average likelihood and the expected impacts of that type. The results are set out in table C1 in the main report based on a risk matrix calculation. This appendix shows the categories for likelihood, impact and risk that were used for this calculation. The likelihood categories have been developed based on the Environment Agency's classification bands for flood risk. For each source of flood risk, where the risk in Peterborough from this source spans more than one band the highest likelihood band has been chosen.

1.2. Likelihood

After the hazard has been identified, the likelihood of it occurring each year is calculated. The following table outlines the five different probability categories ranging from very low to high.

Table C1: Likelihood score

Level	Descriptor	Likelihood, written as annual probability	
		Annual probability	Annual probability as a percentage chance
5	High	$1/30 \leq X < 1$	$3.3\% \leq X < 100\%$
4	Medium	$1/100 \leq X < 1/30$	$1\% \leq X < 3.3\%$
3	Medium-Low	$1/200 \leq X < 1/100$	$0.5\% \leq X < 1\%$
2	Low	$1/1000 \leq X < 1/200$	$0.01\% \leq X < 0.5\%$
1	Very Low	$1/10000 \leq X < 1/1000$	$0.001\% \leq X < 0.01\%$

1.3. Impact

The following table sets out the Health, Social, Economic and Environmental impact for each impact level. When scoring the overall impact level of a type of a flooding the highest relevant impact (health, social, economic or environmental) level was recorded.

Table C2: Impact explanation

Impact category	Meaning
Health – casualties	Injuries directly attributable to the emergency
Health – fatalities	Deaths directly attributable to the emergency
Social	The social consequences of an event, including availability of social welfare provision; disruption of facilities for transport; damage to property; disruption of a supply money, food, water, energy or fuel; disruption of an electronic or other system of communication; homelessness, evacuation and avoidance behaviour; and public disorder due to anger, fear, and/or lack of trust in the authorities
Economic	The net economic cost, including both direct (e.g. loss of or damage to goods, buildings, infrastructure) and indirect (e.g. loss of business, increased demand for public services) costs

Environmental	Disruption to or destruction of plant or animal life, contamination or pollution of land, water, or air, with harmful biological/chemical/radioactive matter or oil.
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Table C3: Impact scores

Level	Health – casualties	Health – fatalities	Social	Economic (£)	Environmental
1	0-5	0	Limited	Thousands	Insignificant
2	6-10	0	Some / local	Millions	Minor
3	11-50	1-20	Moderate / local – medium to long term	Tens of millions	Limited – long/short term
4	51-200	21-50	Significant local / local and regional	Hundreds of millions	Significant – medium/long term
5	200+	151	Severe local, regional and national	Billions	Serious long term

1.4. Risk calculation

The risk matrix combines both the score from impact and likelihood to give an overall score for the area from a particular known hazard. The numbers correspond to the overall risk rating given in the Peterborough Flood Risk Management Strategy.

Table C4: Risk matrix

Catastrophic 5	Impact	5	10	15	20	25
Significant 4		4	8	12	16	20
Moderate 3		3	6	9	12	15
Minor 2		2	4	6	8	10
Insignificant 1		1	2	3	4	5
		Likelihood				
		Very Low 1	Low 2	Medium - Low 3	Medium 4	High 5

Overall Risk Rating	Low 1-5	Medium 6-9	High 10-14	Very High 15+
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