

## Flood area 9 – Brough

Key information	
Size of flood area	389 ha
Number of properties in floodplain	483
Area of agricultural land	148 ha
Length of defences	6.1 km
Current standard of protection	Varies, western end (new defences) 0.5% (1 in 200), eastern end 2.5% (1 in 40)
Remaining life of defence	Varies, western end 20 years or more, eastern end 10 to 20 years
Defences managed by	Environment Agency

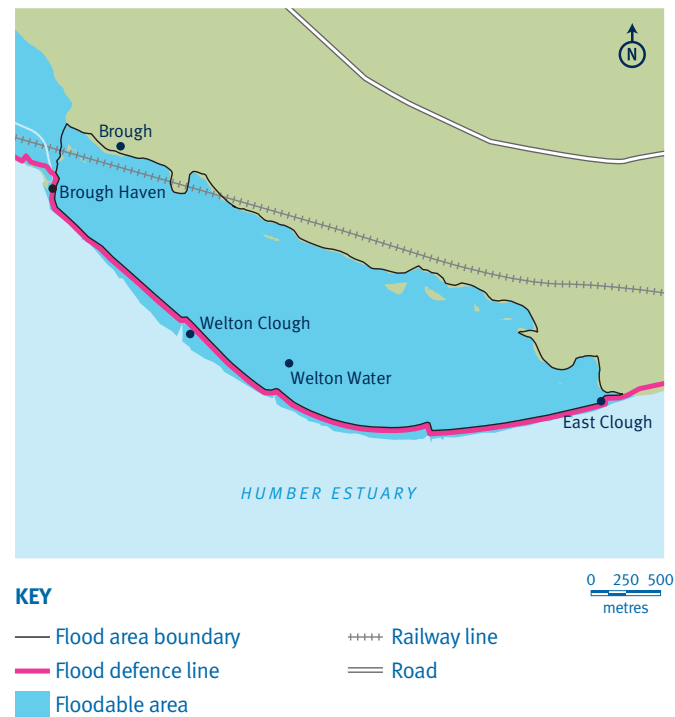
Most of the properties are residential and are located in Brough, at the western end of the area, which also contains an important factory and airfield owned by BAe. The eastern end contains old gravel/clay extraction pits, which are now used for recreation (fishing, sailing) or nature conservation and a landfill site. Although not a flood defence issue, the landfill site is being eroded by waves and tides, which could release contaminants into the estuary.

### Existing flood defences

The defences at the western end have been improved within the last 10 years and as a result are in good condition and provide a good standard of protection. Work is needed to improve the condition of the remaining defences and the standard they provide.

### Proposed management approach

We will continue to protect Brough and the BAe factory and will improve the standard they receive by building a new defence from the end of the recently completed one across the airfield to high ground behind Welton Water. We cannot justify spending public money on maintaining the defences at the eastern end of the area, as they protect very few properties. After giving due notice we will withdraw from these defences. Although we may not be able to carry on maintaining the existing defences, others may be able to obtain the approvals



needed to do so while complying with the Habitats Regulations. If anyone does we will provide all the advice and information we can to help them.

We are reviewing the risk of allowing the erosion of the landfill site to continue. Any work needed as a result will be separate from the flood defence strategy.

## Flood area 10 – Brough Haven to Weighton Lock

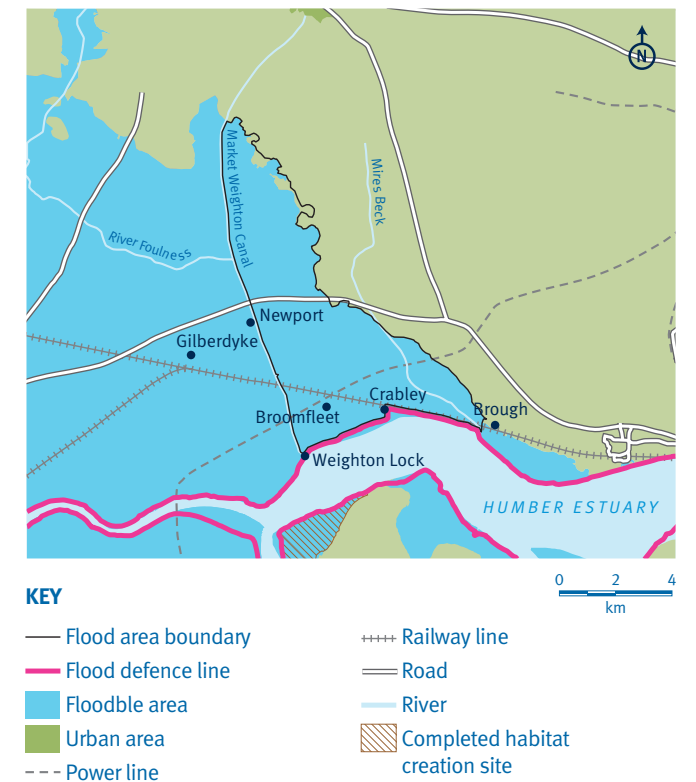
Key information	
Size of flood area	4259 ha
Number of properties in floodplain	697
Area of agricultural land	4208 ha
Length of defences	6.5 km
Current standard of protection	Varies, eastern end (new defences) 0.5% (1 in 200), western end 10% (1 in 10) locally
Remaining life of defence	Varies, eastern end 20 years or more, western end 10 to 20 years
Defences managed by	Environment Agency, Associated British Ports and others

The properties are scattered throughout the area, which is largely devoted to farming but also contains key infrastructure including road and rail links to Hull and high-voltage power lines. The land is drained by a system of ditches flowing either to the estuary by gravity or to the Market Weighton Canal, which itself flows into the estuary by gravity through Weighton Lock.

### Existing flood defences

The defences between Brough Haven and Crabley Farm have been improved within the last 10 years and as a result are in good condition and provide a good standard of protection.

The remaining defences are owned by others and are in fair to poor condition and are narrow and difficult to maintain. They are likely to need improvement in the next 15 to 20 years.



### Proposed management approach

We will continue to inspect all the defences and to maintain and improve the ones for which we are responsible as necessary. We will also keep in touch with those responsible for the other defences, telling them about any maintenance or improvements needed.

We are considering the possibility of keeping some lengths of the defences lower than others, so that we will know which areas will be flooded during a major event and can take steps to minimise the damage. We will look carefully at all the implications of this approach, taking into account the benefits of the lower river levels that will result from any overtopping that occurs or from the flood storage schemes that have been identified in the Humber and Ouse strategies. Before deciding whether or not to adopt the approach we will discuss the issues it raises with all those who might be affected.

## Flood area 11 – Weighton Lock to Boothferry Bridge

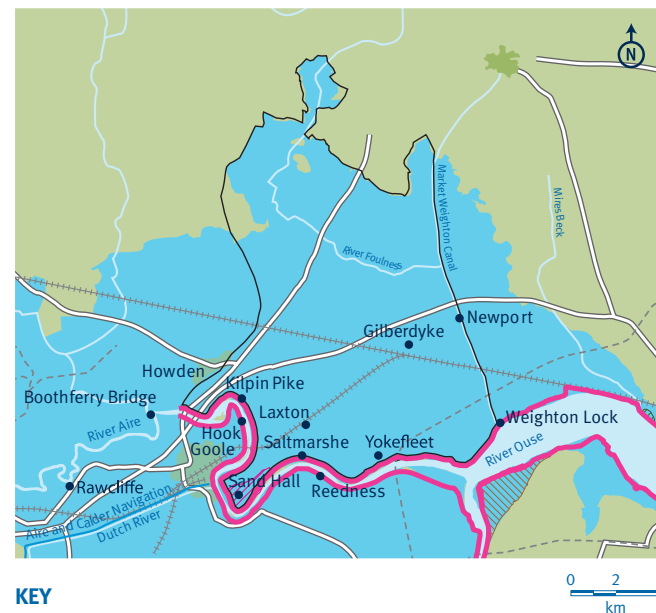
Key information	
Size of flood area	14,143 ha
Number of properties in floodplain	2821
Area of agricultural land	14,074 ha
Length of defences	24.4 km
Current standard of protection	Varies, generally 5% (1 in 20) or better but locally 20% (1 in 5)
Remaining life of defence	Varies, generally 10 to 20 years
Defences managed by	Environment Agency, Associated British Ports Ltd and others

This area contains several villages together with many scattered residential properties and farmsteads. It also contains a large area of high-grade agricultural land together with key infrastructure including road and rail links to Hull and high-voltage power lines. The land is drained by ditches that flow either to the River Ouse by gravity or to the Market Weighton Canal (directly or through the River Foulness), which itself flows to the estuary by gravity through Weighton Lock.

### Existing flood defences

The defences are generally in reasonable condition and provide an appropriate standard of protection. The banks of the River Ouse are being eroded in a number of places and there is concern about the stability of the defences at some points. Two lengths have been identified as needing to be improved within the next 15 years; between Blacktoft and Yokefleet; and at Sand Hall. The latter has also been identified as a possible flood storage scheme, although this needs further study.

The area is also at risk of flooding from high flows in the River Derwent and the River Ouse. We are preparing separate strategies or management plans for these rivers.



### Proposed management approach

We will continue to inspect all the defences and to maintain and improve the ones for which we are responsible as necessary. We will also keep in touch with those responsible for the other defences, telling them about any maintenance or repairs needed.

We are considering the possibility of keeping some lengths of the defences lower than others, so that we will know which areas will be flooded during a major event and can take steps to minimise the damage. We will look carefully at all the implications of this approach, taking into account the benefits of the lower river levels that will result from any overtopping that occurs or from the flood storage schemes that have been identified in the Humber and Ouse strategies. Before deciding whether or not to adopt the approach we will discuss the issues it raises with all those who might be affected.

## Flood area 12 – Goole

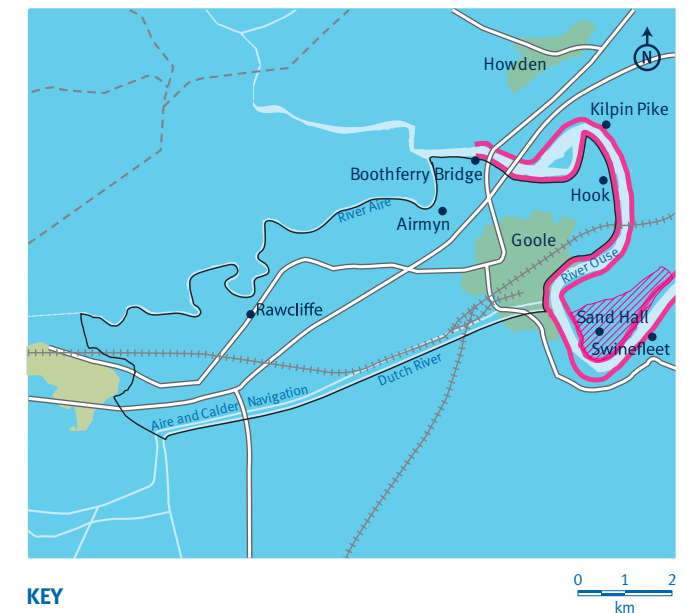
Key information	
Size of flood area	3380 ha
Number of properties in floodplain	9960
Area of agricultural land	2855 ha
Length of defences	8.6 km
Current standard of protection	0.5% (1 in 200) or better
Remaining life of defence	20 years or more
Defences managed by	Environment Agency

All the properties in Goole, which is very low-lying, are at risk of flooding. There is also a significant number of properties in smaller communities nearby including Hook, Airmyn and Rawcliffe. The area contains important industrial, commercial and port-related facilities together with key infrastructure (including major road and rail links) and high-grade agricultural land.

### Existing flood defences

The defences are generally in good condition and provide a good standard of protection. However, in places the banks of the River Ouse are being eroded by the river and showing signs of instability, for example at Hook Road.

Parts of the area are also at risk of flooding from high flows in the rivers Ouse, Aire and Don. We are preparing separate strategies for these rivers.

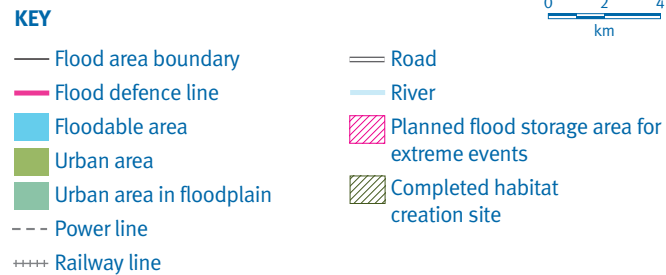
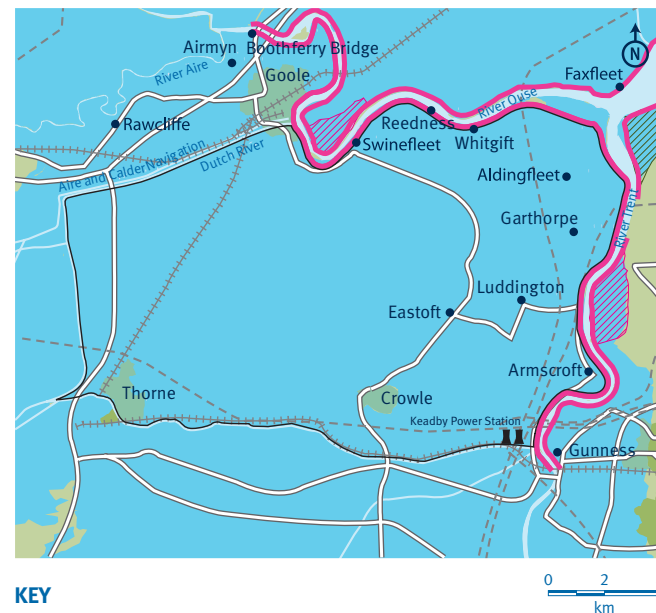


### Proposed management approach

We will continue to maintain and improve this area's existing defences, carrying out further investigations as necessary. We will also work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. The defences will need to be improved as sea levels rise. This will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

## Flood area 13 – Goole Fields and Crowle

Key information	
Size of flood area	19,626 ha
Number of properties in floodplain	10,654
Area of agricultural land	19,787 ha
Length of defences	28.7 km
Current standard of protection	Varies, 3.3% (1 in 30) to 0.5% (1 in 200) or better
Remaining life of defence	Generally 10 to 20 years, 5 years locally
Defences managed by	Environment Agency, Associated British Ports Ltd and others



Many of the properties at risk, such as those in Thorne and Crowle, are some distance from the flood defences. There are also significant numbers of properties in small communities close to them including Swinefleet, Reedness, Garthorpe, Amcotts and Keadby. The area is largely used for agriculture and contains scattered farms as well as a rail link, power station, high-voltage power lines and the internationally important Humberhead Peatlands. The land is drained by several systems of ditches and pumping stations flowing either to the River Ouse or the Trent. The future management of the system leading to Keadby Pumping Station (draining a part of this area as well as an extensive area further south) is being reviewed.

### Existing flood defences

The defences are generally in reasonable condition and their height provides an adequate standard of protection. However, the riverbanks are being worn away in places and there are concerns about the stability of the defences at some points. We have recently improved the defences near Amcotts and are planning to do so at Swinefleet within the next five years and at Reedness within the next 15.

The area is also at risk of flooding from high flows in the rivers Ouse, Don and Trent. We are preparing separate strategies for these rivers that will link with this strategy.

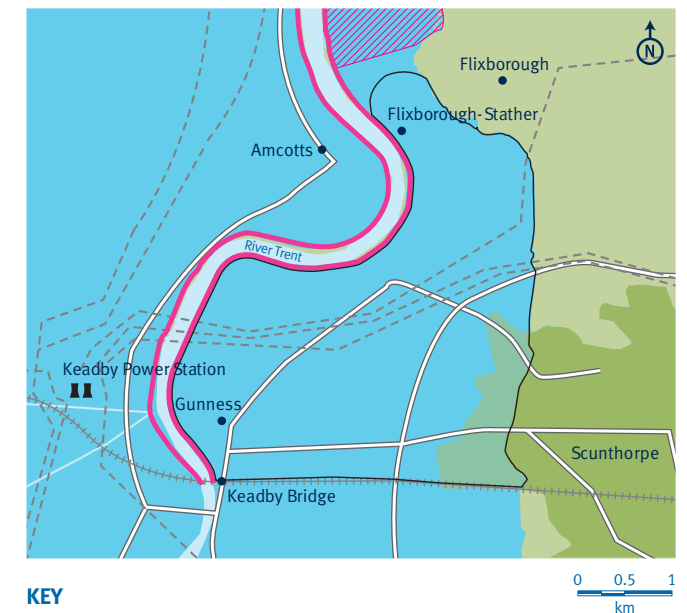
### Proposed management approach

We will continue to inspect all the defences and to maintain and improve the ones for which we are responsible as necessary. We will also keep in touch with those responsible for the other defences, telling them about any maintenance or repairs needed.

We are considering the possibility of keeping some lengths of the defences lower than others, so that we will know which areas will be flooded during a major event and can take steps to minimise the damage. We will look carefully at all the implications of this approach, taking into account the benefits of the lower river levels that will result from any overtopping that occurs or from the flood storage schemes that have been identified in the Humber and Ouse strategies. Before deciding whether or not to adopt the approach we will discuss the issues it raises with all those who might be affected.

## Flood area 14 – Guinness to Flixborough

Key information	
Size of flood area	1070 ha
Number of properties in floodplain	2649
Area of agricultural land	934 ha
Length of defences	59 km
Current standard of protection	Varies, 1% (1 in 100) to 0.5% (1 in 200)
Remaining life of defence	Varies, generally more than 20 years but locally 10 to 20 years
Defences managed by	Environment Agency and others



Most of the residential properties at risk are in Scunthorpe or Guinness but there are industrial and commercial developments at Flixborough Stather and Grove Wharf. The remainder of the area is largely used for agriculture but includes road and rail links and high-voltage power lines. The land is drained by a system of ditches that flow into the River Trent. North Lincolnshire Council is examining development opportunities in the area through its Lincolnshire Lakes project.

### Existing flood defences

In places the defences are formed by quays, elsewhere they are earth banks. They are generally in good condition and provide a good standard of protection, although in places there is some concern about erosion and stability. We will look into the stability of the defences between Grove Wharf and Neap House within the next five years, carrying out any improvements necessary. Defences between Neap House and Flixborough will be improved within the next 15 years.

The area is also at risk of flooding from high flows in the River Trent. We have produced a separate strategy for the tidal reaches of this river that will link with this strategy.

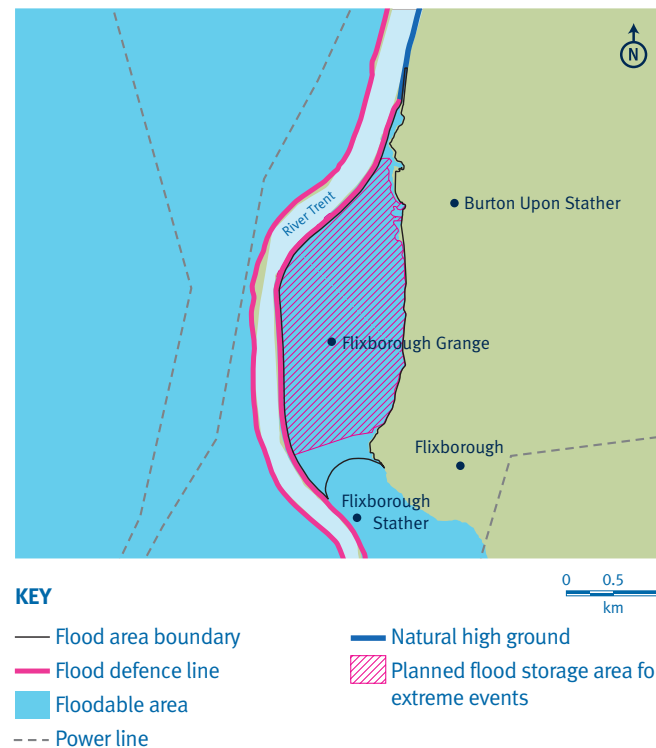
### Proposed management approach

We will continue to maintain and improve our defences in this area as necessary and will keep in touch with those responsible for the other defences about any work needed. We will also work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process.

The defences will need to be improved as sea levels rise. This will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new work needed to protect their development.

## Flood area 15 – Flixborough Grange

Key information	
Size of flood area	365 ha
Number of properties in floodplain	7
Area of agricultural land	355 ha
Length of defences	6.3 km
Current standard of protection	0.5% (1 in 200) or more
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



All but one of the properties at risk are in Burton upon Stather, where there is also a wharf. The other one is set in high-grade agricultural land that drains to the River Trent by gravity.

### Existing flood defences

The defences are in good condition and provide a good standard of protection. They are not expected to need major improvement for at least 20 years. The area has been identified as a possible flood storage scheme, although this needs further study.

### Proposed management approach

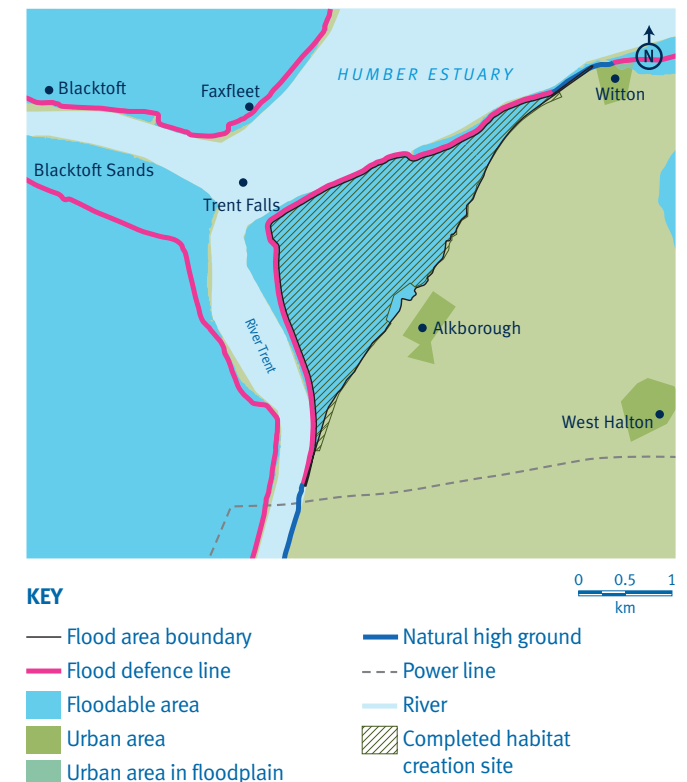
At present we are continuing to maintain the defences but the relatively small number of properties at risk means that in future we could find it difficult to justify spending public money doing this. The area could be used for flood storage, which would lower water levels, if further study shows this to be worthwhile. If not, we may withdraw. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say exactly when this might happen, but currently we expect it to be in more than 20 year's time. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

Although we may not be able to carry on maintaining the existing defences, others may wish to. Provided they comply with the Habitats Regulations and can obtain the approvals needed, we will provide all the

advice and information we can to help them. If not, we will look at building secondary banks to protect properties in Burton upon Stather. Without further study we cannot confirm this will be possible or say exactly where the banks might be located. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. Again, we will provide all the advice and information we can.

## Flood area 16 – Alkborough

Key information	
Size of flood area	427 ha
Number of properties in floodplain	0
Area of agricultural land	408 ha
Length of defences	6.4 km
Current standard of protection	Varies (partly inter-tidal)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



The recently completed scheme at Alkborough covers the whole 427 ha of the flood cell. The land is now managed for nature conservation and provides about 170 ha of inter-tidal habitat to replace the losses caused by our flood defence works and sea level rise. The remainder of the area will provide grazing marsh and reedbed habitats.

### Existing flood defences

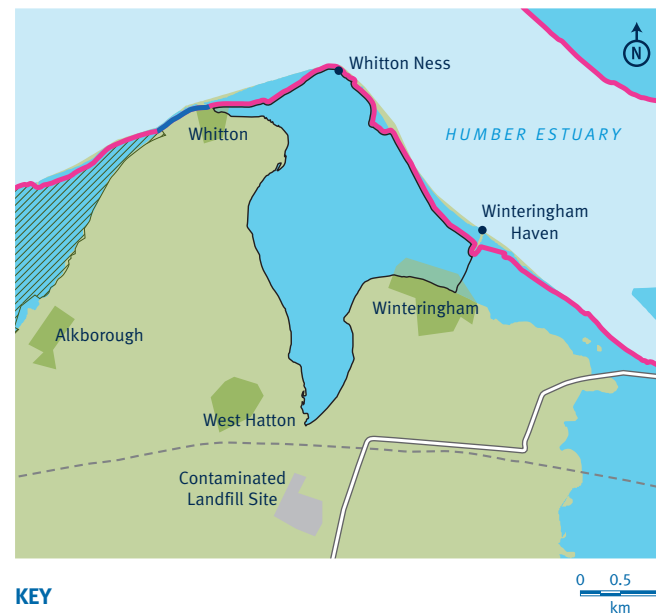
The defences have been modified and new structures built so that just under half the area will flood on most high tides while the remainder will be available to store water during extreme events. As a result water levels in the Trent and the Ouse during these events are likely to be up to 150 mm lower than they would be without the changes. The defences are in good condition and are expected to last for at least 30 years before any major improvements are needed.

### Proposed management approach

We will maintain the existing defences and the new structures so the scheme continues to provide flood defence benefits by lowering water levels during extreme events. We will also work with our partners, Natural England, North Lincolnshire Council and Associated British Ports, to make sure our joint objectives for the area are achieved.

## Flood area 17 – Whitton to Winteringham

Key information	
Size of flood area	636 ha
Number of properties in floodplain	59
Area of agricultural land	635 ha
Length of defences	4.6 km
Current standard of protection	1% (1 in 100 years on average)
Remaining life of defence	Varies, generally more than 25 years, except at Whitton Ness
Defences managed by	Environment Agency



Most of the properties at risk are in Whitton and Winteringham, at the edge of the floodplain. The rest of the area is high-grade agricultural land containing scattered farms and a high-voltage power line. The land is drained through a system of channels to an outfall at Winteringham Haven.

### Existing flood defences

The defences are generally in good condition except at Whitton Ness where there is a risk that they could be eroded. If this is prevented from happening and regular maintenance continues the defences are expected to last for more than 25 years.

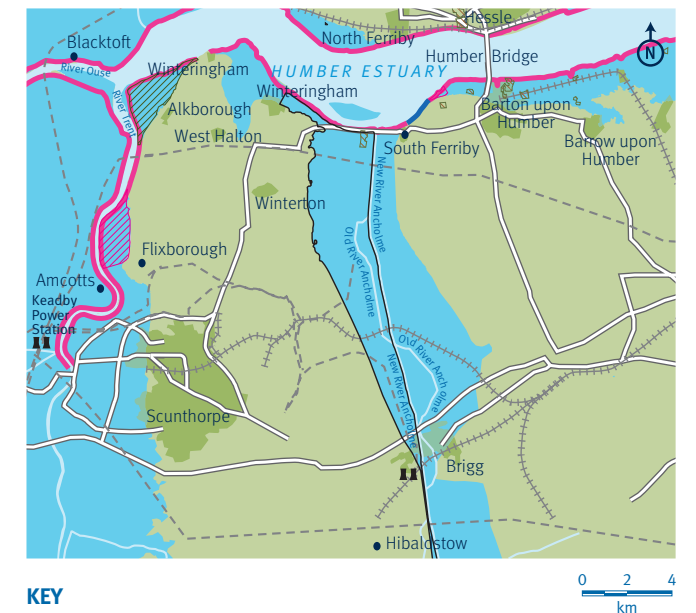
### Proposed management approach

At present we are continuing to maintain the defences. In the future, however, the relatively small number of properties at risk means that we could find it difficult to justify spending public money on the defences and so may have to withdraw. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say exactly when this might happen but currently expect it to be in between 10 and 20 years, possibly more. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

Although we may not be able to carry on maintaining the existing defences, others may wish to. Provided they comply with the Habitats Regulations and can obtain the approvals needed, we will provide all the advice and information we can to help them. If not, we will look at building short secondary banks to protect properties in Whitton and Winteringham. Without further study we cannot confirm this will be possible or say exactly where the bank might be located. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. Again we will provide all the advice and information we can.

## Flood area 18 – Winteringham Ings

Key information	
Size of flood area	4,760 ha
Number of properties in floodplain	536
Area of agricultural land	4,745 ha
Length of defences	4.5 km
Current standard of protection	Varies, 20% (1 in 5) to 1% (1 in 100)
Remaining life of defence	10 years or less
Defences managed by	Environment Agency



The area extends along the Ancholme Valley past Brigg, which contains a significant number of the properties at risk. The remainder are scattered along the valley, which is largely devoted to agriculture but also contains a cement works together with key infrastructure including major road and rail links and high-voltage power lines. Although this and the neighbouring area of South Ferriby (Flood Area 19) are separated by the River Ancholme, flooding in one can affect the other. Therefore the two areas should be considered together.

### Existing flood defences

Very strong tidal currents flow along the channel between the shore and Read's Island and there is a serious threat they will wash away the existing defences and the A1077 behind them. We've strengthened and repaired the defences at various times over the last 10 years and more repairs are likely to be needed within the next 10, both to manage the erosion threat and improve the standard of protection.

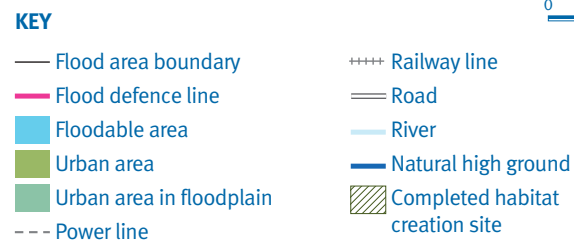
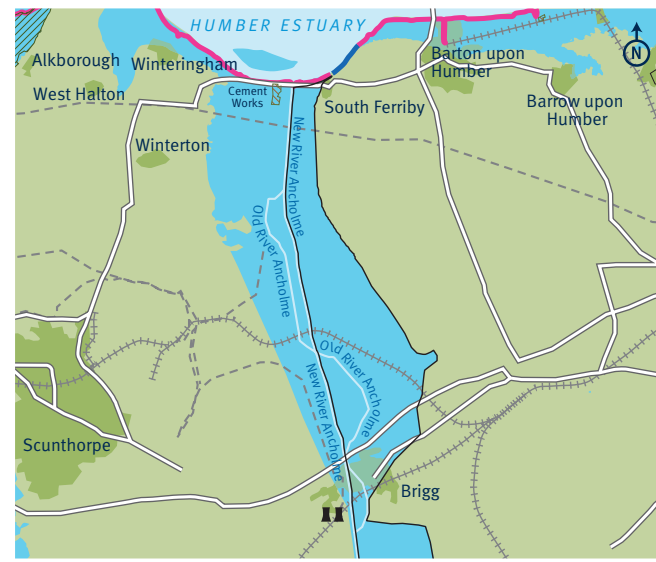
The area is also at risk of flooding from high flows in the River Ancholme, for which a separate strategy was initiated some years ago, but which is currently stalled. We are keen to progress that plan alongside the Humber Strategy if the opportunity arises.

### Proposed management approach

We will continue to maintain and improve the estuary defences protecting this area. This may involve moving them back from the shore in places and we will work with North Lincolnshire Council to make sure the effects on the A1077 are taken into account. The work will be expensive so we will seek to supplement public funds with contributions from major beneficiaries.

## Flood area 19 – South Ferriby

Key information	
Size of flood area	6,170 ha
Number of properties in floodplain	1,107
Area of agricultural land	6,075 ha
Length of defences	3.2 km
Current standard of protection	Varies, 10% (1 in 10) to 0.5% (1 in 200)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



The area extends along the Ancholme Valley past Brigg, which contains a significant number of the properties. The remainder are scattered along the valley, which is largely devoted to agriculture but also contains key infrastructure including major road and rail links and high-voltage power lines. Although this and the neighbouring area Winterringham Ings (Flood Area 18) are separated by the River Ancholme, flooding in one can affect the other. Therefore the two areas should be considered together.

### Existing flood defences

The existing defences are in good condition but are expected to need major improvement in about 20 years time.

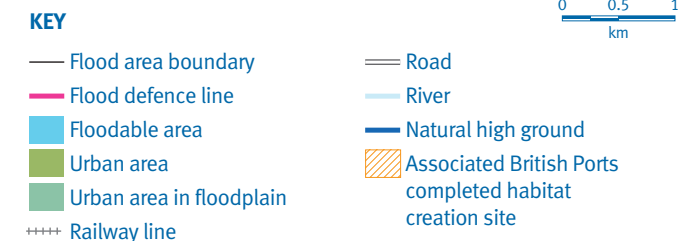
The area is also at risk of flooding from high flows in the River Ancholme, for which a separate strategy was initiated some years ago, but which is currently stalled. We are keen to progress that plan alongside the Humber Strategy if the opportunity arises.

### Proposed management approach

We will continue to maintain and improve the estuary defences protecting this area as necessary.

## Flood area 20 – Barton Cliff to Barton Haven

Key information	
Size of flood area	206 ha
Number of properties in floodplain	439
Area of agricultural land	196 ha
Length of defences	2.9 km
Current standard of protection	Varies, 5% (1 in 20) to 2% (1 in 50)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency, Associated British Ports



Most of the properties at risk are in Barton-upon-Humber. The rest of the area contains several disused clay pits, which are internationally important for their fresh-water habitats. There are also some scattered properties and farmland. The area is drained to the estuary by gravity.

Associated British Ports has created new inter-tidal habitat at a site near Chowder Ness to compensate for losses due to port development at Immingham.

### Existing flood defences

The estuary defences are in good condition and are not expected to need major improvement for more than 20 years. The defences along Barton Haven have been improved within the last five years.

### Proposed management approach

At present we are continuing to maintain all the existing defences. There are very few properties at the western end of the area. This means that in the future we could find it difficult to justify spending public money on maintaining the defences protecting them, rather than building a secondary shorter defence near the Humber Bridge that only protects Barton-upon-Humber. Without further study we cannot confirm this would be the best option or say exactly where the new defence might be located. If a new defence is built, we would withdraw from the defences further west. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say exactly when this might happen, although currently, we expect it will not

be for 20 years or more. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

Although we may be unable to carry on maintaining the existing defences, others may wish to. Provided they comply with the Habitats Regulations and can obtain the approvals needed, we will provide all the advice and information we can to help them. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. Again we will provide all the advice and information we can.

## Flood area 21 – Barton Haven to Barrow Haven

Key information	
Size of flood area	442 ha
Number of properties in floodplain	958
Area of agricultural land	362 ha
Length of defences	3.3 km
Current standard of protection	Varies, 5% (1 in 20) to 1% (1 in 100)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



Most of the properties at risk are in Barton-upon-Humber with a few near Barrow Haven. The rest of the area contains several disused clay pits (important for their fresh-water habitats), a rail link and farmland.

### Existing flood defences

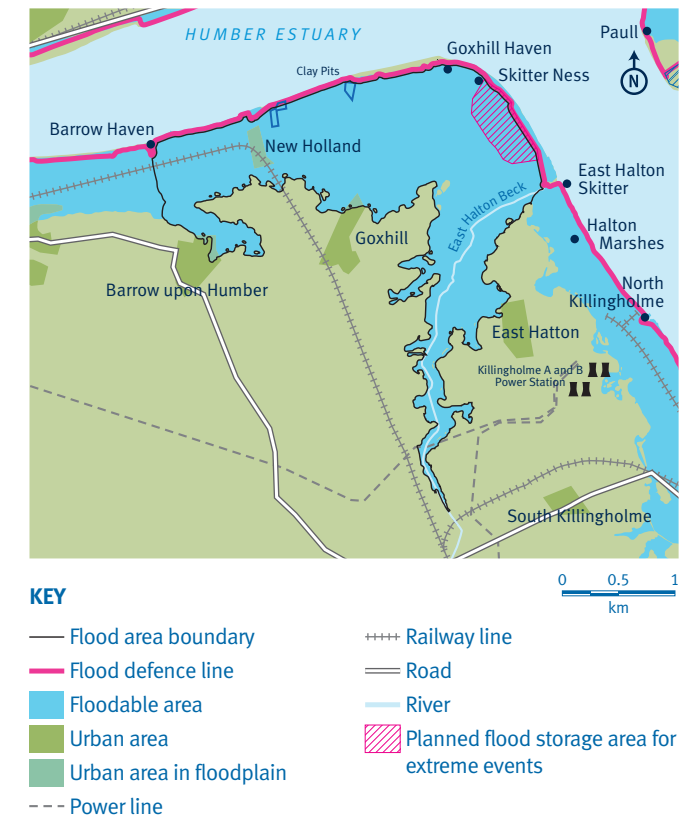
The existing defences are in good condition but are expected to need major improvement in about 20 years. The defences along Barton Haven have been improved within the last five years.

### Proposed management approach

We will continue to maintain existing defences protecting this area and improve them as sea levels rise. This will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

## Flood area 22 – Barrow Haven to East Halton Skitter

Key information	
Size of flood area	2551 ha
Number of properties in floodplain	634
Area of agricultural land	2542 ha
Length of defences	10.5 km
Current standard of protection	Varies, 10% (1 in 10) to 0.5% (1 in 200)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



Most of the properties at risk are in Barrow upon Humber and New Holland, at the western end of the site, or near the edge of the floodplain at Goxhill. There is a wharf with industrial and commercial developments and a rail line at New Holland. The rest of the area contains high-grade agricultural land with scattered farms. The land is drained to the estuary by gravity.

We have identified a suitable site for creating new intertidal habitat north of East Halton Skitter at Goxhill. This habitat is needed to replace the losses caused by flood defence improvements and sea level rise. However, the site's development depends on whether the defences continue to be maintained and is unlikely to be until after 2040.

### Existing flood defences

The existing defences are good condition and are expected to need major improvement in 20 to 30 years.

### Proposed management approach

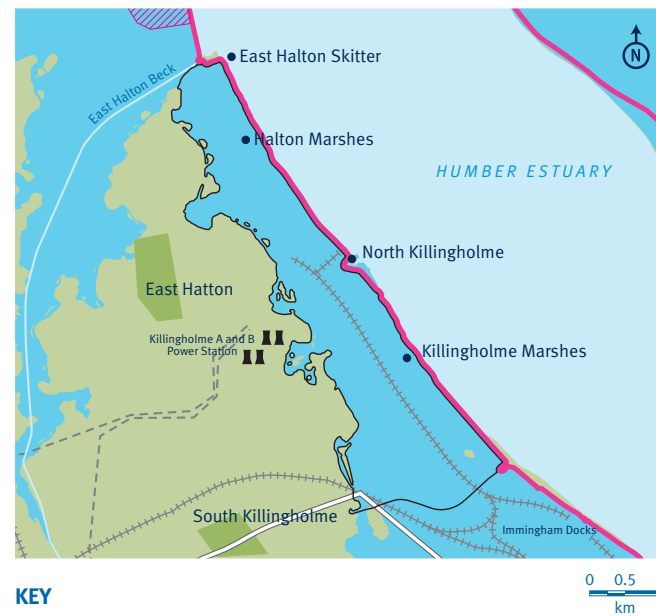
At present we are continuing to maintain the defences. There is a possibility, however, that we could protect most of the properties at risk in Goxhill, Barrow upon Humber and New Holland by building a secondary line of new defences. If so, we will find it difficult to justify spending public money on maintaining the existing defences to protect the rest of the area. Without further study we cannot confirm secondary defences would be the best option or say exactly where they would be located. Uncertainty about the rate at which sea levels

will rise and the defences deteriorate means we cannot say exactly when this might happen, although currently we expect it will not be for 20 years or more. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

Although we may not be able to carry on maintaining the existing defences, others may wish to. Provided they comply with the Habitats Regulations and can obtain the approvals needed, we will provide all the advice and information we can to help them. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. Again we will provide all the advice and information we can.

## Flood area 23 – Halton and Killingholme Marshes

Key information	
Size of flood area	876 ha
Number of properties in floodplain	26
Area of agricultural land	871 ha
Length of defences	7.3 km
Current standard of protection	Varies, 2% to 0.67% (1 in 50 to 1 in 150)
Remaining life of defence	Varies, 5 to 15 years
Defences managed by	Environment Agency, Associated British Ports



The areas of Halton and Killingholme Marshes lie within the proposed South Humber Bank development site which has been allocated for estuary related industry or commercial activities. Most of the properties at risk fall into this category, including wharf facilities and a major petro-chemical plant. There is also a significant area of high-grade agricultural land. The local authorities have prepared a Strategic Flood Risk Assessment to inform their planning decisions and the future development of the area. The land drainage is designed to cater for these developments and releases surface water into the estuary through a combination of pumped systems and gravity.

### Existing flood defences

The foreshore is being worn away, which is weakening the defences along the whole frontage, particularly at Halton Marshes. If they are not repaired these defences are likely to fail within the next five years.

We are currently planning to improve the standard of protection in 10 to 20 years, although the timing will depend on the rate of sea level rise.

### Proposed management approach

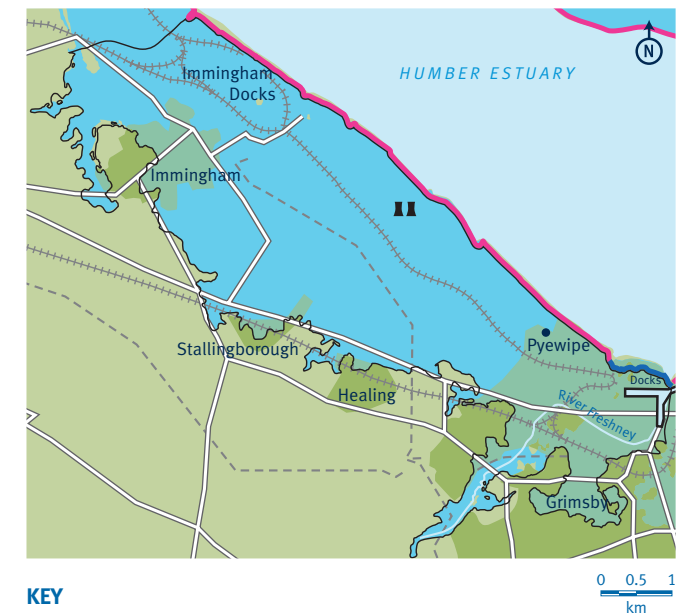
We will continue to protect most of this area and will work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. We will also work with the local planning authorities to

avoid any permanent buildings being located immediately behind the defences.

We will improve the defences that protect existing development but plan to stop maintaining those that protect currently undeveloped areas. The work will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

## Flood area 24 – Immingham to River Freshney

Key information	
Size of flood area	3613 ha
Number of properties in floodplain	11687
Area of agricultural land	2233 ha
Length of defences	12.6 km
Current standard of protection	Varies, 1% to 0.5% (1 in 100 to 1 in 200)
Remaining life of defence	Varies, 10 to 20 years generally, 5 years locally
Defences managed by	Environment Agency, Associated British Ports



Most of the residential properties at risk are in Immingham and West Grimsby, although there are some in Stallingborough and Healing. A large part of the area lies within the proposed South Humber Bank development site and has been allocated for estuary related activities. It already contains major industrial and commercial facilities, including wharves, storage areas, petro-chemical and power plants. The area also contains important road and rail links and high-voltage power lines, while most undeveloped land is used for agriculture. The local authorities have prepared a Strategic Flood Risk Assessment to inform their planning decisions and the future development of the area. The land drainage is designed to cater for the level of development and releases surface water into the estuary through a combination of pumped systems and gravity.

### Existing flood defences

The existing defences generally provide a good standard of protection. However, the foreshore is being eroded which is weakening the defences along much of the frontage. We are planning to improve a length of the defences near Immingham within the next five years and to carry out further improvements later.

### Proposed management approach

We will continue to protect this area and will work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. We will

also work with the local planning authorities to avoid any permanent buildings being located immediately behind the defences. We will have to work on the defences to deal with erosion and maintain a good standard as sea levels rise. This will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.



## Flood area 25 – East Grimsby

Key information	
Size of flood area	802 ha
Number of properties in floodplain	18909
Area of agricultural land	0 ha
Length of defences	3.9km
Current standard of protection	Varies, 20% to 0.5% (1 in 5 to 1 in 200) or better
Remaining life of defence	Varies, 10 to 20 years generally, less than 5 years locally
Defences managed by	Associated British Ports, North East Lincolnshire Council, Environment Agency

The area at risk covers the docks at Grimsby as well as a large part of the town. In addition to residential properties it contains important industrial and commercial developments, including cold storage and associated facilities, together with key road and rail links. The local authorities have prepared a Strategic Flood Risk Assessment to inform their planning decisions and the future development of the area. Surface water is drained by a combination of sewers (mostly managed by Anglian Water) and open channels, all of which flow or are pumped to the estuary.

### Existing flood defences

North East Lincolnshire Council manage the defences at the eastern end of the flood area, which are in good condition and provide a good standard of protection. Most of the remaining defences are along the dock frontage and are managed by Associated British Ports. Their condition varies, with a significant proportion being in poor condition. The standard of protection they provide also varies. If flooding does occur it is likely to be initially in the dock area rather than in the town. Nevertheless, major improvements are needed within the next 10 years.



### Proposed management approach

We will work with those who manage the defences, particularly Associated British Ports, to make sure properties in Grimsby receive an appropriate standard of protection, with defences being maintained and improved as necessary. We will also work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. Maintaining and improving the defences will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

## Flood area 26 – Cleethorpes and Humberston

Key information	
Size of flood area	1669 ha
Number of properties in floodplain	2243
Area of agricultural land	1234 ha
Length of defences	9.2 km
Current standard of protection	Varies, Cleethorpes 0.5% (1 in 200) or better, Humberston Fitties 20% (1 in 5)
Remaining life of defence	More than 20 years
Defences managed by	North East Lincolnshire Council, Environment Agency

Most of the properties at risk are in Cleethorpes and Humberston with some at Tetney. Humberston Fitties contains a considerable number of seasonally occupied chalets and a large caravan site. Between Humberston and Tetney there is a large area of high-grade agricultural land. Surface water is drained by a combination of sewers (mostly managed by Anglian Water) in the built-up areas and open channels elsewhere, all of which flow or are pumped into the estuary.

### Existing flood defences

North East Lincolnshire Council manage most of the defences protecting Cleethorpes and Humberston. These are generally in good condition and provide a good standard of protection, except at Humberston Fitties, where they consist of reinforced sand dunes with significant low spots. We manage a second line of defences behind them, which protects the caravan site. Most of the chalets are in front of these defences, and so, are at serious risk of being flooded if waves wash over the sand dunes. Our defences continue along the shoreline to protect the agricultural land beyond them.



### Proposed management approach

We will continue to inspect all the defences and to maintain and improve the ones for which we are responsible as necessary. We will also work with North East Lincolnshire Council to make sure the flood risk in Cleethorpes and Humberston remains acceptable, paying particular attention to the situation at Humberston Fitties.

## Flood area 27 – Tetney to Saltfleet Haven

Key information	
Size of flood area	13,138 ha
Number of properties in floodplain	2,928
Area of agricultural land	11,540 ha
Length of defences	17.4 km
Current standard of protection	Varies, 10% (1 in 10) to 0.5% (1 in 200) or better
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency

The properties at risk are scattered across the area, many in villages such as North Cotes, Marsh Chapel, Grainthorp, Conisholme, North Somercotes and Saltfleet. There is also a large number of isolated residential properties and farms. Most of the land is used for agriculture and is drained through a system of channels and ditches, some of which are pumped and some flow by gravity.

We have identified a site near Donna Nook as suitable for creating new inter-tidal habitat. This will replace the losses due to flood defence improvements and sea level rise. We are planning to develop it within the next five years.

### Existing flood defences

The defences consist of a combination of earth banks and sand dunes. They are generally in good condition but some of the dunes appear to be deteriorating as the beaches in front of them change. At present we do not expect major improvements will be needed for the next 20 years but this will be reviewed.

The area is also at risk of flooding from high flows in the Louth Canal. We are preparing a separate management plan for this watercourse.



### Proposed management approach

At present we expect to continue maintaining the existing defences and improving them as necessary, though this will depend on the availability of government funding and on whether the sand dunes continue to deteriorate and the rate at which this happens. We will keep this under review.

## Studies undertaken

### Producing the HESMP (1997-2000)

**Land use:** identifying the assets lying within the floodplain and so benefiting from the protection provided by the defences.

**Flood defences:** consolidating and reviewing data about the defences to determine their condition and the standard of protection they provide.

**Historic and current estuary behaviour:** examining the estuary's geology and historic development as well as the processes taking place there now.

**Environmental baseline:** collecting environmental data (natural and historic) about the estuary and floodplain and identifying the constraints on managing the defences.

### Producing the strategy consultation draft (2001-2005)

#### (a) Studies covering the whole estuary

**Future estuary behaviour:** examining the effect of sea level rise on the sediment balance and inter-tidal habitat in the estuary (and on the adjacent coast-line) and assessing the impact of possible management options, including managed realignment.

**Coastal Habitat Management Plan (CHaMP):** drawing up a CHaMP to determine how the integrity of the SPA/SAC can be maintained while continuing to manage the estuary's defences.

**Potential managed realignment sites:** identifying sites where the defences could be re-aligned, costing the work needed and starting to discuss the implications with landowners and tenants.

**Standard of protection:** identifying and costing the work needed over the next 50 years to provide a high or low standard of protection to each of the 12 management units (subsequently subdivided into flood areas) around the estuary.

**Strategic Environmental Assessment (SEA):** undertaking an SEA to assess the impact of the work and determine which option is to be preferred in each unit on environmental grounds.

**Economic appraisal:** comparing the costs and benefits of each option to determine which is to be preferred in each unit on economic grounds.

**Long-term programme of work:** selecting the preferred option for each unit taking all issues into account and drawing up a prioritised programme of the work needed over the next 50 years (including managed realignment as necessary).

**Sustainability Appraisal:** assessing the sustainability of the overall strategy using a methodology developed by the Yorkshire and Humber Regional Assembly.

**Strategic Environmental Assessment (SEA):** undertaking an SEA to assess the impact of the strategy as a whole to complement the earlier study of the individual options.

#### (b) Studies covering work at individual sites or in specific parts of the estuary

**Work in first 15 years:** reviewing the work in the first 15 years of the programme to identify key issues (including the possibility of realigning the defences), re-assessing their priority and so confirming the work to be included in a package covering the first five years.

**Approval process:** establishing the approach to be followed when applying for outline approval of a package of flood defence work affected by the Habitats Regulations.

**Work in first five years:** developing the designs and assessing the impacts (technical, environmental, economic and social) of the work in the first five-year package sufficiently to allow outline approval to be obtained.

**Monitoring and maintenance:** reviewing the monitoring and maintenance work needed to manage the defences in the future (including erosion protection to prevent them being undermined).

**Benefits of flood storage:** determining the reduction in risk and saving in cost that will result from the provision of flood storage upstream of the Humber Bridge in the future.

**'Shadow' Appropriate Assessment:** assessing the impact of the work included in the package as required by the Habitats Regulations and drawing the individual assessments together to provide a 'shadow' assessment of the whole package.

# Technical reports

Producing the HESMP (1997 – 2000)	
Joint Probability Analysis of Large Waves and High Water Levels	Environmental Baseline Study
Geomorphological Studies	Historic Environment Baseline Study
Urgent Works Review	Humber Estuary Shoreline Management Plan (SMP)
Producing the strategy consultation draft (2001 – 2005)	
<b>(a) Studies covering the whole estuary</b>	<b>(b) Studies covering work at individual sites or in specific parts of the estuary</b>
HESMP Phase 2 Geomorphology Studies	Key Issues Assessments (of work in first 15 years)
Coastal Habitats Management Plan (CHaMP)	Detailed Appraisals (of work in first five years)
Engineering Studies Report	Water Level Modelling Report
Economic Assessment Report	Technical Report
Strategic Environmental Assessment (of the Long-Term Programme)	‘Shadow’ Appropriate Assessment
Sustainability Appraisal	Sustainability Appraisal
Strategic Environmental Assessment (of the strategy)	Strategic Environmental Assessment (of the strategy)
Getting the strategy approved (2005 – 2007)	
Project Appraisal Report for the Strategy	Project Appraisal Report for the Works in the First 5 Years

# Consultation and information documents

General consultation documents	
A Strategy for Flood Defence (April 1999)	Humber Flood Risk Management Strategy, Consultation Document (August 2005)
Options Consultation Document (November 1999)	
Information documents	
Managed Realignment: Information for Landowners and Tenants (June 2002)	Newsletters ‘TidesNews’ #1 (July 2001) to #6 (March 2005)
Update on Managed Realignment (July 2003)	Newsletters ‘Humber tides news’ #1 (August 2007) to #3 (January 2008)

# Advisory groups

Advisory groups	
<p><b>Humber Joint Committee:</b> consists of the Chairman and another representative from each of the three Regional Flood Defence Committees with responsibilities on the Humber. Meets about three times a year to agree programme and funding arrangements and act as a co-ordinating link to the three parent committees.</p> <p><b>Steering Group:</b> contains representatives from the key stakeholders listed on the next page. Meets about three times a year to review progress in all aspects of strategy and discuss issues raised.</p> <p><b>Liaison Panel:</b> small group of people chosen for knowledge of the area and understanding of local issues. Meets about three times a year to discuss strategy and provide advice.</p>	<p><b>Technical Group:</b> contains representatives from key organisations involved in estuary and estuary process studies. Will meet about once a year to review current behaviour (including effects of sea level rise) and to advise on technical developments and opportunities for co-operation with others.</p> <p><b>CHaMP Review Group:</b> drawn from organisations with conservation interests. Will meet about twice a year to review programme for creating new habitat and advise on managing sites where habitat has been created.</p>

# Organisations on the steering group

Organisations invited to Steering Group meetings	
<p><b>Environment Agency</b></p> <ul style="list-style-type: none"> <li>Anglian Region</li> <li>Midlands Region</li> <li>North East Region</li> </ul> <p><b>Local authorities</b></p> <ul style="list-style-type: none"> <li>East Lindsey District Council</li> <li>East Riding of Yorkshire Council</li> <li>Kingston upon Hull City Council</li> <li>Lincolnshire County Council</li> <li>North Lincolnshire Council</li> <li>North East Lincolnshire Council</li> </ul> <p><b>Government and regional bodies</b></p> <ul style="list-style-type: none"> <li>Department for Environment, Food and Rural Affairs</li> <li>English Heritage</li> <li>Government Office for Yorkshire and Humber (Rural Affairs)</li> <li>Natural England</li> <li>Yorkshire Forward</li> </ul>	<p><b>Non-government bodies</b></p> <ul style="list-style-type: none"> <li>Associated British Ports Ltd</li> <li>British Association for Shooting and Conservation</li> <li>Country Landowners and Business Association</li> <li>Humber Estuary Management Strategy</li> <li>Humber Industry Nature Conservation Association</li> <li>Humberside Internal Drainage Boards</li> <li>Lincolnshire Wildlife Trust</li> <li>National Farmers Union</li> <li>Royal Society for the Protection of Birds</li> <li>The Crown Estate</li> <li>Yorkshire Wildlife Trust</li> </ul>

# Glossary

## Affordability

The ability to pay for the repairs or improvements needed if a flood defence is to continue performing satisfactorily.

## Assessment process

The process of defining objectives, examining options and weighing up the costs, benefits, risks and uncertainties of an action before a decision is made to proceed or not.

## Asset

Any item in the floodplain with a value that can be assessed.

## Beneficiary

In this document, an individual or organisation that benefits from the presence of flood defences.

## Biodiversity

The variety of life; the different plants, animals and micro-organisms, their genes and the ecosystems of which they are a part.

## Birds Directive

An EC Directive that provides a framework for the conservation and management of wild birds in Europe. Covers the classification of Special Protection Areas (SPAs).

## Blight

Adverse impact on property and land value or the ability to use it to its full extent brought about as a consequence of future plans.

## Business case

A comparison of the costs, benefits, risks and uncertainties associated with a decision.

## Catchment Flood Management Plan (CFMP)

A plan prepared by the Environment Agency with other key decision-makers within a river catchment to identify and agree sustainable flood risk management policies.

## Climate change

Radiation passes through the Earth's atmosphere and warms its surface before being reflected back into space. Some gases, including carbon dioxide and methane, trap some of the heat from radiation in the atmosphere. Human activity has increased the concentration of these gases dramatically, trapping more heat, causing global temperatures to rise and the climate to change. Sea level rise (q.v.) is a particular consequence of these changes.

## Coastal Habitat Management Plan (CHaMP)

A plan for managing a length of coastline to conserve and promote the habitats and wildlife it supports and to ensure compliance with the Habitats and Birds Directives (q.v.).

## Coastal defence

A structure, such as a groyne, length of piling or rock armour, intended to stop the coast from being eroded (worn away) by the sea.

## Coastal squeeze

A process whereby the area between high and low tide decreases as sea levels rise because the low water line moves towards the land while the high water line is fixed by the presence of flood or coastal defences (or high ground).

## Competent authority

The organisation responsible for implementing policy.

## Contribution

A payment made by an organisation or individual benefiting from flood defences, covering all or part of the costs of providing, maintaining or improving them.

## Department for Environment, Food and Rural Affairs (Defra)

The UK government department responsible for flood defence policy, the environment and animal welfare and regulation of the food industry.

## EC Directive

Legislation issued by the European Union that is binding on Member States in terms of the results to be achieved, but that leaves choice as to methods.

## Economically worthwhile

Describing the result of an assessment process (q.v.) in which the benefits of the action assessed, in monetary terms, are greater than the costs.

## Environmental Stewardship

A scheme administered by Natural England which provides funding to farmers and other land managers who deliver effective environmental management on their land.

## Erosion

The wearing away of material, in this document it generally refers to the wearing away of land by waves and currents in a river, estuary or the sea.

## Estuary processes

The movement and interaction of water, sediment and other materials (chemical or biological) in an estuary due to the action of waves, freshwater flows, tides, wind and other disturbing forces.

## Financial compensation

Monetary payments to offset damages or losses.

## Flood area

An area bounded by high ground or raised structures that will contain any flooding that occurs there (i.e. prevent it from extending outside the area).

## Flood defence

A wall, embankment or similar structure intended to exclude floodwater from the land behind it. The term includes any other items integral to its function such as sluices, weirs, barriers, locks, outfall culverts or pumping stations.

## Flood defence standard (see also Standard of protection)

The protection provided by a flood defence, generally expressed in terms of the average return frequency (e.g. once in 50 years, or 2 per cent per year) of a flood event that would cause it to be overtopped.

## Flood proofing (see also Flood resistance measures)

Actions taken to prevent floodwater from entering an area or a building.

## Flood resilience measures

Measures to minimise the damage caused to a building if flooding occurs.

## Flood resistance measures

Measures to limit the volume of floodwater entering an area or a building, or to keep water levels inside from rising too far.

## Flood risk

The risk of an area or building being flooded, generally expressed in terms of the average return frequency (e.g. once in 50 years, or 2 per cent per year) of an event that would cause this.

## Flood storage

Allowing floodwater to flow out of a river or estuary onto the adjacent floodplain and storing it there until river/estuary levels have fallen; a flood storage scheme is an area separated from the rest of the floodplain and designed to optimise the flow of floodwater into and out of it.

## Floodplain

Land next to a river, estuary or the coast over which water flows in times of flood, or would flow if there were no flood defences.

## Habitat

The natural home of an animal or plant.

## Habitat creation site

An area designed to allow new habitat to develop within its boundaries. In the context of the Humber Strategy it generally involves the conversion of farmland to inter-tidal habitats (q.v.).

## Habitats Directive

An EC Directive that provides for the maintenance of biodiversity in Europe by maintaining or restoring natural habitats and wild species. Covers the classification of Special Areas of Conservation (SACs).

## Habitats Regulations

The Conservation (Natural Habitats &c.) Regulations (1994), the legislation enacting the EC Habitats and Birds Directives in the United Kingdom.

### **Improvement (to a flood defence)**

A scheme to improve the condition of or the standard provided by a flood defence, often (but not always) increasing its height so it can withstand rising sea levels.

### **Inter-tidal habitat**

Habitats that occur naturally between the low and high tide lines on land that is open to the sea or estuary; including saltmarsh, sandflats and mudflats.

### **Managed realignment**

Moving flood defences back from their existing position, either to reduce the cost of maintaining them in the future, or to provide an area that can be used for flood storage, or to create new inter-tidal habitats.

### **Management unit**

An area of the floodplain considered as a unit while developing the Humber Strategy.

### **National flood and coastal defence budget**

The money allocated by the government each year for maintaining and improving the country's flood defences.

### **Overtop**

Water flowing over the top of a defence, either because the water level in the river or estuary has risen above it or because the water level is high enough for large waves to wash over it.

### **Routine maintenance**

Inspections and other activities (such as grass-cutting, vermin control and minor repairs) that are carried out regularly to limit the deterioration of a defence.

### **Sea level rise**

Sea levels have been rising since the end of the last Ice Age but the rate is predicted to increase rapidly due to climate change caused by man's activities. The main direct causes of the increase are the melting of glaciers and ice packs and the expansion of seawater as its temperature rises.

### **Secondary defence**

A relatively short defence, generally built behind an existing longer defence to provide extra protection to part of the floodplain.

### **Shoreline Management Plan (SMP)**

A document that brings together information about issues such as flooding, erosion, coastal processes and human and environmental needs for a particular stretch of coastline. The preparation of SMPs is a national initiative for the future planning of the coastline.

### **Special Area of Conservation (see also Habitats Directive)**

An internationally important site where conservation measures are applied for the maintenance or restoration of the habitats and/or species for which the site is designated.

### **Special Protection Area (see also Birds Directive)**

An internationally important area classified for rare and vulnerable birds (listed in Annex I to the Birds Directive) and for regularly occurring migratory species.

### **Stakeholder**

An organisation or individual affected by or interested in the Humber Strategy.

### **Standard of protection (see also Flood defence standard)**

The protection provided by a flood defence, generally expressed in terms of the average return frequency (e.g. once in 50 years, or 2 per cent per year).

### **Strategic Flood Risk Assessment (SFRA)**

A strategic analysis of flood risk prepared by a local planning authority or other decision-maker and providing information about areas that flood, sources of flooding, the influence of climate change and other relevant issues. Forms the basis for preparing policies for flood risk management in these areas.

### **Storm surge**

The temporary rise in sea level caused by the low pressure and strong winds associated with a severe storm. During an extreme surge sea levels near the Humber can be raised up to two metres above the expected tide level.

### **Sustainable**

'Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs' 1985 Brundtland Commission. Balances economic development, social development, and environmental protection.

### **Tidal flooding**

Flooding from the sea (and so influenced by tidal conditions) rather than from a river.

### **Uneconomic defence**

A defence for which the whole life cost of keeping it functioning satisfactorily over a given period will be greater than economic benefits that will result.

### **Water Framework Directive**

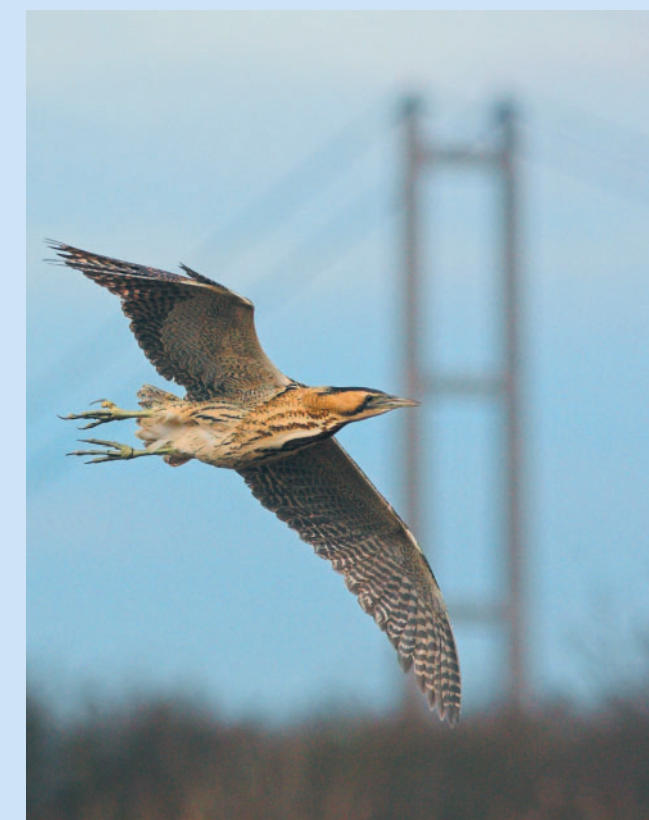
An EC Directive that aims to establish a framework for the protection of rivers and lakes, estuaries, coastal waters and groundwater.

### **Whole life cost**

The overall cost of keeping something functioning satisfactorily for a given period, including both routine maintenance and more significant periodic repairs and improvements.

### **Withdrawing maintenance**

The decision to stop carrying out any further work of any nature (including routine maintenance, repairs or improvements) to a defence.



*Bittern*

# Abbreviations



- ABP** – Associated British Ports
- BAe** – BAe Systems plc
- CFMP** – Catchment Flood Management Plan
- CHaMP** – Coastal Habitat Management Plan
- Defra** – Department for Environment, Food and Rural Affairs
- HECAG** – Humber Estuary Coastal Authorities Group
- HESMP** – Humber Estuary Shoreline Management Plan

- PPP/PFI** – Public-private partnership/private finance initiative
- PPS 25** – Planning Policy Statement 25: Development and Flood Risk
- SEA** – Strategic Environmental Assessment
- SFRA** – Strategic Flood Risk Assessment
- SMP** – Shoreline Management Plan
- UKCIP** – UK Climate Impacts Programme

# Contact details

This document summarises the Humber Flood Risk Management Strategy and is supported by the reports listed on page 54. If you would like any further information about the strategy or about the estuary's flood defences, please visit our website, [www.environment-agency.gov.uk/humberstrategy](http://www.environment-agency.gov.uk/humberstrategy), or contact the Humber Strategies Manager, Philip Winn, by post, telephone or e-mail to the address given below:

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# Planning for the rising tides

The Humber Flood Risk Management Strategy