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Lower Aire Flood Risk Management Strategy

Strategic Environmental Assessment: Scoping Consultation Document

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Published by:

Environment Agency
Phoenix House
Global Avenue, Beeston,
Leeds, LS11 8PGTel: 0870 8506506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

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Summary

We are preparing the Lower Aire Flood Risk Management Strategy (LAFRMS) to set out how we manage flood risk from the River Aire between Oulton and Goole. Our Study Area covers the floodplain of the River Aire and its tributary rivers from Lemonroyd Weir, to the south and east of Leeds, to its confluence with the River Ouse close to Goole. The Study Area is approximately 340km², and includes Selby to the north and the M62 motorway to the south.

The LAFRMS will consider the detail of flood risk in the local area, and will give a clear presentation of the present and future flood-risks – expressed as a frequency of flooding and consequences of flooding for the public and stakeholders. It will identify what flood risk management activities are required for the short (0-20 years), medium (20-50 years) and long (50-100 years) term, including identification of what needs to be done and who can contribute. The strategy will include a costed action plan identifying how FRM is going to be delivered. We are preparing to consult on the draft LAFRMS in summer 2010.

As part of the FRM Strategy development, we are undertaking a Strategic Environmental Assessment (SEA). This will ensure that we make decisions regarding the management of flood risk in a way that prioritises environmental concerns.

SEA has two main stages:

Scoping – establishes the existing key environmental conditions issues in the Study Area and how the assessment will be undertaken

Assessment – identifies the likely significant effects of the LAFRMS and alternative options. The assessment also makes recommendations for changing the Strategy to avoid or reduce adverse effects

This SEA Scoping Report outlines what we have found during the scoping stage so far. It presents the information we have compiled to date for the LAFRMS and provides details about how we intend to assess the effects of the flood risk management options on the environment.

Statutory consultees and other organisations have already provided us with valuable feedback on the strategic environmental baseline/context from our consultation on the draft Catchment Flood Management Plans (CFMPs) in 2008. We will be consulting on amendments to the draft CFMPs at the same time as consulting on this document. This document focuses on environmental issues and influences relevant to the local area of the LAFRMS. We have started scoping the SEA and - from the information gathered so far - we have identified the key environmental issues we think it needs to focus on; these are outlined in the table overleaf.

We will use the feedback from consultees on the draft CFMPs (and their associated SEAs) in the development of the LAFRMS. However, we would like consultees to tell us whether there are more local issues/opportunities – or available environmental information - relevant to the Study Area that they did not consider significant or relevant for consideration across the whole catchment.

Please share with us your views on our identified key environmental issues and opportunities by 12th March 2010. A simple response form is included for you to comment on the scope of the SEA. We would be grateful if you would return this to:

Lower Aire Strategy Scoping Consultation, Environment Agency, Phoenix House, Global Avenue, Beeston, Leeds, LS11 8PG.

lowerairestrategy@environment-agency.gov.uk

| Environmental Receptor | Key Issues and Opportunities |
|---|--|
| Human Beings | <p>Managing the risk to urban and rural communities at flood risk.</p> <p>Critical transport and power infrastructure associated with coal fired power stations and national road and rail networks.</p> <p>Public access and green space opportunities in relation to flood risk management options.</p> |
| Flora and Fauna | <p>Conserving and enhancing the special interest features of the freshwater Sites of Special Scientific Interest (SSSIs).</p> <p>Opportunities for Biodiversity Habitat Action Plan habitat creation on river floodplains, river restoration and enhancement and improving fish passage.</p> <p>Control of invasive plant species on the rivers and floodplain</p> |
| Air and Climate | Planning for climate change impacts. |
| Water | Point source and diffuse pollution affecting water quality. Heavy modification of water bodies throughout the study area, particularly in urban areas. |
| Landscape | <p>Protection and enhancement of areas of high landscape quality in diverse urban and rural landscapes.</p> <p>Opportunity to develop multi-functional urban and rural open spaces which contribute to the green infrastructure of the study area</p> |
| Historic Environment | <p>Roman and medieval site of national archaeological importance found within the rural floodplain.</p> <p>High concentrations of listed buildings associated with historic centres of Snaith, Selby, Knottingley and Goole.</p> |
| Soils, Geology, Land Quality and Land Use | <p>Large areas of high quality and versatile agricultural land at flood risk.</p> <p>Significant concentrations of contaminated land upstream of Ferrybridge associated with historic industrial land use.</p> |
| Natural Resources | Potential for future exploitation of coal measures and extraction of aggregates. |

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1 Introduction

1.1 The Lower Aire Flood Risk Management Strategy

We are the Environment Agency and we responsible for managing the risk of flooding from rivers and the sea. We are preparing the Lower Aire Flood Risk Management Strategy (LAFRMS) to deal with flooding issues, and it will set out what will be done to manage flood risk in the floodplain of the River Aire between Oulton and Goole.

We take a three-staged approach to flood risk management. Table 1.1 describes these three stages, highlighting the hierarchy and relationship between each stage and where the LAFRMS sits within this. Each stage requires an understanding of flood risk in the area concerned, along side an appreciation of the associated environmental issues and planning framework that needs to be worked within. Each stage must do this at a level of detail that is appropriate to the stage and the scale of the area being considered.

Table 1.1 The Flood Risk Management Framework

| Policy/Project | Purpose | Level of detail | Current Status | Timetable |
|---|---|--|--|--|
| Catchment Flood Management Plans (CFMP). | To provide a high level understanding of flooding across the whole River catchment and to develop policies for the FRM strategies | An understanding of catchment process and an overview assessment of current and future flood risks, environmental constraints and objectives | Due for further consultation January 29 th 2010 | To be adopted following consultation in 2010 |
| Lower Aire Flood Risk Management Strategy | To implement the policies drawn from the CFMP by defining FRM options specific to the Study Area | Detailed understanding of flood processes, appraisal of alternatives and selection of preferred management measures | Strategy currently in development | Draft Strategy due in Summer 2010 |
| Flood Risk Management Projects | Projects to implement the results of the FRM strategy | Detailed appraisal of specific measures, design, selection and implementation | No current timetable – This will be determined by the outcomes of the LAFRMS | |

In 2008, we consulted on the draft Catchment Flood Management Plans (CFMP) for a number of river catchments throughout the UK. These large-scale plans identify strategic flood risk issues on a catchment wide basis. The CFMPs identify broad policies to manage these risks through a high level assessment of opportunities and constraints. The plans separate catchments into a number of policy units based on a range of criteria including hydraulic characteristics, topography, geology and drainage characteristics, land use, links to other plans and opportunities for future flood risk management. The LAFRMS Study Area [the Study Area] (see Section 1.2) covers an area of land which falls within the boundaries of the Aire, Ouse, Don and Calder CFMPs and their policy units (See Figure 1, Appendix A).

Through our work to date in developing the LAFRMS and other strategies, we have further developed our understanding of both the flooding mechanisms and the likely extent of flooding within the Study Area. Based on this more detailed assessment, we propose to amend the policies contained within the CFMPs. We will be consulting on the policy amendments simultaneously with this Scoping Consultation Document. Consultation on the CFMP policy amendments will run until April 2010.

The LAFRMS will add greater local detail to the CFMP, including a clear presentation of the present and future flood risk, expressed as a frequency of flooding and the subsequent consequences for the public and stakeholders. It will identify the required FRM activities for the short (0-20 years), medium (20-50 years) and long (50-100 years) term, including identification of what needs to be done and who will contribute.

1.2 The Study Area

In setting the Study Area we have identified the area at risk from an extreme flood event from our knowledge of historic flood events and through the use of computer modelling. We have then widened this area to readily identifiable features and boundaries. The area at risk from flooding is defined as the area that would be inundated by the 1 in 100 year flood event, or a flood with a 1% annual chance of occurrence if the present flood defences no longer functioned. We have also considered how climate change might affect water levels during such an event, and have increased the flood flows by 20% and increased the tide level at the confluence of the Rivers Aire and Ouse by 1.039m to take account of this. The Study Area and the area at flood risk are highlighted in Figure 2 (Appendix A).

This area covers the floodplain of the River Aire from Lemonroyd Weir, to the south and east of Leeds, to its confluence with the River Ouse close to Goole. The Study Area is approximately 340km², and includes Selby to the north and the M62 motorway to the south. The Study Area is characterised by contrasting land use, being predominantly rural to the east of Ferrybridge; whilst upstream of this point the landscape is dominated by the settlements of Knottingley and Castleford and the eastern outskirts of Leeds.

The majority of the area within the floodplain is protected to some extent by a combination of linear flood embankments or walls and by a series of washlands. The washlands are generally areas of unpopulated land encircled by earth embankments, which act like a series of temporary reservoirs. They are allowed to flood when river levels rise to a certain level and are used to store floodwaters until river levels drop and any risk to populated areas has receded. The river channels are also maintained to manage flood risk.

1.3 Flood Cells

By considering the different types of land use and how different areas might be affected by flooding, we have split the Study Area into smaller units for analysis. We have called these areas “flood cells”. Each flood cell could potentially be affected by flooding independently from other flood cells, due to lay of the land or because of obstructions, such as roads or embankments that might affect how water would move across the floodplain.

We have split the flood cells into smaller areas, called Flood Risk Management Units (FRMUs), which we have categorised based on the main type of land use, these are shown in Figure 2, Appendix A. The FRMU categories are:

- **Urban** flood cells, which contain large concentrations of properties and infrastructure.
- **Semi-rural** flood cells, which contain villages set within the rural landscape.
- **Rural** flood cells, which contain no properties or a few scattered isolated properties.
- **Managed washlands**, flood cells which are allowed to flood in a controlled way to manage flooding elsewhere in the floodplain. Washlands usually contain no properties, but in some cases there may be isolated properties found on the edges of the flood risk area.

1.4 Developing a FRM Strategy

In undertaking our flood risk management responsibilities we are able to carry out capital works or maintenance to address issues of priority flood risk to people, property and the environment. To do this we must make best use of limited public funds and are therefore required to prioritise those funds to achieve the maximum public benefit.

In order to achieve this we have set national public service targets referred to as Outcome Measures, listed in Table 1.2.

We are also developing further Outcome Measures to:

- Improve the take up of our flood warning service.
- Improve contingency planning by emergency responders.
- Avoid inappropriate development in flood risk areas.
- Introduce long term flood risk management policies and action plans.

Table 1.2 National Flood and Coastal Erosion Risk Management public service targets to 2011

| Outcome Measures | Details |
|---|---|
| 1. Economic Benefit | We have set targets that ensure the cost of providing flood risk management does not outweigh the benefits. Flood risk management measures that provide the greatest economic benefit for the least cost will be prioritized. |
| 2. Households at risk | We have set a target to improve the standard of protection against flooding for 145,000 households, with particular focus on improving protection for 45,000 households significantly at risk. |
| 3. Deprived households at risk | We have set a target to improve the standard of protection for those households in the most deprived 20% of areas significantly at risk from flooding. |
| 4. Nationally important wildlife sites | We have set targets to improve the condition of 24,000ha of the Sites of Special Scientific Interest, where they are dependent on flood risk or water level or drainage management. |
| 5. UK Biodiversity Action Plan habitats | We have set targets to create 800ha of BAP habitats by March 2011. |

To develop a FRM strategy we are required to follow government guidance (MAFF, 2001) by carrying out technical, economic and environmental assessments of a range of potential options. With this guidance in mind we have set the following objectives for the LAFRMS:

- Define a 100 year sustainable strategy for a flood risk management.
- Undertake a Strategic Environmental Assessment (SEA) to include the identification of opportunities for environmental enhancements.
- Engage and develop solutions following effective engagement with key stakeholders and the general public.

Our strategy will be developed by considering how flood risk might be managed in each of the flood cells and FRMU's using a range of different options. We will also consider how such management might affect flooding in other cells. This approach will allow us to take a strategic view of flood risk, ensuring that work to manage flooding in one flood cell does not increase the risk of flooding to people and property in other parts of Study Area.

1.5 Flood Risk Management Options

We are currently developing several strategic options for managing flood risk within the Study Area. The government Foresight Future Flooding Report (Office of Science & Technology, 2004) has developed an exhaustive list of flood risk management measures (see Appendix B) which can be split into the following themes:

- Managing the rural landscape;
- Managing the urban fabric;
- Managing flood events;
- Managing flood losses; and
- Engineering interventions.

We have reviewed these measures (see section 5.4) to produce a number of potential options which may be applied to each flood cell, these options are set out in Table 1.3. In accordance with Defra guidance, we will consider the benefits, costs and environmental impacts of each option by comparing the options with what would happen if nothing further was done to manage flood risk. We call this the Do Nothing scenario, this is a theoretical “option” which assumes that nothing would be built, no maintenance would be carried out on existing flood defences or structures and no flood warnings system would be put in place.

Table 1.3 Options that will be considered in the development of the LAFRMS

| Option | Description |
|------------------------------------|---|
| Do minimum | This option provides for the continued maintenance and operation of existing flood defences and structures until the end of their useful life. Other existing measures such as flood warnings would continue. No new flood risk management measures would be implemented. |
| Flood proofing | This option would provide for the fitting out of individual properties with flooding proofing items or devices such as door guards, air brick covers, and portable flood barriers. |
| Linear defences | This option would involve constructing new linear defences or improving existing flood walls or embankments to reduce the level of flood risk. The height and scale of new or improved defences would depend on what standard of protection is required. |
| Channel restoration | This option would involve restoring the river channel to a more natural state to reduce the velocity of the river flow, and removing or replacing constrictions to flow such as weirs and bridges. |
| Bypass or flood diversion channels | This option would involve the creation of artificial river channels to divert flood water from a specific area or to provide extra channel capacity along a certain stretch of river. |
| Specialist structures | This option would involve constructing or installing specialist structures to block flow routes, such as floodgates or short sections of road raising. |
| Floodplain / wetland storage | This option would involve using areas of floodplain adjacent the river to store water in suitable locations during high flows. |
| Floodplain restoration | This option would involve allowing the river to flood its natural floodplain once again by removing river defences. |
| Ring dykes around vulnerable areas | This option would involve the construction of circular defences surrounding small concentrated areas of flood risk set away from the river. |
| Managed realignment | This option would involve setting back a current line of flood defence; or, where it will not increase flood risk to people or properties, completely removing a length of flood defence. |
| Relocation of exposed structures | This option would involve relocating at risk structures (such as specific properties, substations etc) out of the floodplain so that they are no longer at risk. |
| Withdrawal of Maintenance | This option is extremely unlikely as an overall policy for the whole Study Area but it may be appropriate in localised circumstances. Under this option, after an appropriate period of consultation, unviable flood risk management assets would cease to be maintained. |

Some of the options outlined above may not be applicable to all of the flood cells we are considering, for instance where there are no properties within a flood cell there would be no requirement to provide ring dykes, or where a river wall backs on to urban properties managed realignment would be difficult. Some of these options might also be used in combination with each other to provide the most effective way of managing flood risk.

2 Strategic Environmental Assessment

2.1 Overview

As part of the development of the LAFRMS, we will be undertaking a Strategic Environmental Assessment (SEA).

SEA is a process that ensures that the environmental problems and opportunities relevant to the Study Area are considered as we develop the options for managing flood risk. The SEA will be undertaken in parallel with the development of the LAFRMS, allowing for the environmental effects of options to be considered from an early stage.

The SEA process will enable us to understand the environmental effects and identify opportunities where we can improve the existing environment. We know that flood risk management options can have adverse environmental effects and we want to avoid or reduce these potential impacts. We also want the SEA to identify opportunities where flood risk management options can lead to additional environmental enhancements. By doing this we can ensure the protection of the environment and promote sustainable development.

The stages of the SEA process and how it integrates with the development of the LAFRMS is highlighted in Table 2.1.

The UK SEA Regulations¹ do not require us to undertake SEA for the LAFRMS. However, it is our policy to undertake SEA for flood risk management strategies as best practice, and we intend to meet the requirements of the regulations throughout. Consultation will also be conducted with all interested parties, including the statutory consultees.

The outputs of the SEA process are:

- This Scoping Report.
- An Environmental Report – published with consultation on the draft LAFRMS. The Environmental Report documents the assessment of the draft strategy and the reasonable alternatives considered.
- An SEA Statement – published on adoption of the final LAFRMS and which documents how it has been influenced by the findings of the SEA.

¹ The Environmental Assessment of Plans and Programmes Regulations 2004 (Statutory Instrument 2004 No 1633)

Table 2.1: Stages of the SEA Process

| FRM Strategy Stage | SEA Stage | Objective | Purpose |
|--|---------------------------------|--|--|
| Data collection and analysis | Scoping | To gather information to identify the key environmental issues relevant to the area and FRMS | The information is used to identify opportunities for flood risk management options that can also improve the environment. Environments that are sensitive to change or adversely affected by the strategy are identified. |
| | Scoping Consultation | To consult on the scope and level of details required for the SEA. | The feedback is used to refine the understanding of key environmental issues affecting the area and how the FRMS may influence these. |
| Develop strategic options | Assessment | The strategy will identify a number of potential FRM options which will be assessed for their environmental effects. Mitigation and enhancement measures will be developed to avoid or reduce the negative impacts or maximise the positive impacts. The selection of the preferred strategy options is informed by the results of the assessment. | To identify whether any FRM options are likely to have adverse environmental effects, with the aim of developing alternative options or measures to mitigate the effects. This information influences the strategy and how it can be improved to better protect and enhance the environment. Assessment of the possible flood risk options in detail to fully understand their environmental effects before selecting the preferred options. |
| Produce draft Strategy & public consultation | SEA Environmental Report | To consult with the relevant bodies and the public on the draft strategy and the results of the SEA. | The feedback is taken into account whilst producing the final strategy. |
| Strategy adoption | SEA Statement | To adopt the strategy and show how the environmental issues and consultation feedback has been taken into account. | The results of the assessment help to implement the preferred options. |
| Project planning and implementation | SEA informs project development | To develop and implement the flood risk management schemes and operations identified in the strategy. | Information in the SEA forms the basis for more detailed environmental assessment of flood risk management schemes or operations. |
| Strategy progress and review | Monitoring | To monitor the environmental effects of the strategy and its implementation. | Monitoring is used to confirm the environmental effects of the strategy, how any mitigation measures are working and provide a better understanding of the environment. |

2.2 SEA Scoping and Consultation

We are now at the scoping consultation stage for the SEA. The purpose of this report is to compile and present information on the Study Area at an early stage and to explain how we intend to carry out the environmental assessment. We will consult on the draft LAFRMS at a later stage of the programme.

The aims of the scoping stage of the LAFRMS SEA are to:

- Set out the aims of the LAFRMS.
- Identify the area that the LAFRMS has the potential to affect (the Study Area).
- Understand the relationship between the LAFRMS and other plans and strategies which influence the environment in the Study Area.
- Describe what we think the environment is like now and how it is likely to develop in the future.
- Consult statutory authorities and other relevant organisations to identify any additional information which will be useful in developing the strategy and discuss the scope and the level of detail of our SEA.

Question Box 1

Sections 1 and 2 set out the objectives of the LAFRMS and the environmental assessment and provides an overview of the FRM options that will be considered

Do you have any comments on these objectives?

Do you have any comments on the options being considered?

Question Box 2

Section 2 describes the SEA process and how it will be applied to the development of the LAFRMS.

Do you have any comments on the process or how the consultation applies to the LAFRMS?

3 Legislation, Policy and Guidance

3.1 Introduction

The LAFRMS is not the only strategy relevant to the area. We have already described in Section 1 how the strategy fits with other strategic flood risk management planning. However, we also want to understand how it interacts with other policies, plans and strategies relevant to the area.

These documents include:

- European Directives;
- UK legislation and policy;
- English legislation and policy;
- Defra policy and guidance;
- Environment Agency policy and guidance;
- Regional and local authority policy and documents; and,
- Local studies and reports.

3.2 Statutory Responsibilities

We are responsible for managing the flood risk arising from rivers and the sea. However, the legislation covering management of flood risk and coastal erosion is permissive in nature i.e. it permits us to carry out works but there is no obligation on us to do so. Flood defences remain the responsibility of the relevant landowner unless they are adopted by an operating authority, such as us. A large number of flood defences are therefore privately owned and maintained.

Under the relevant sections of the Environment Act 1995 and the Land Drainage Act 1994, we are required to contribute to the conservation and enhancement of flora and fauna, natural beauty, geological and physiographical features, heritage and recreation when carrying out flood risk management functions under the relevant Acts (MAFF, 2001). Consequently, the LAFRMS must meet these requirements.

The LAFRMS may have the potential to affect Natura 2000 sites - areas designated by the UK Government as being of European importance for their biodiversity. Where there are potential effects we are required to assess them in way set out in the Habitats Regulations. If required, we will undertake this process separately but in parallel with the SEA. This Habitats Regulations Assessment (HRA) will be reported on separately but will be referred to and summarised in the SEA Environmental Report.

3.3 National and Regional Policies and Plans

We have very recently consulted on the draft Aire CFMP, which is due for a further period of consultation in early 2010 before it is adopted. As described in Section 1, the Aire CFMP informs the development of this strategy and has also been subject to SEA. The Aire CFMP and SEA have already considered the strategic policy context of other UK and regional plans and strategies in developing its draft policies. We have therefore concentrated on the local policy issues and influences relevant to the Study Area.

Appendix C details all of the policies and plans that have been reviewed during the production of the draft Aire CFMP and highlights those plans that will need to be considered for this strategy.

3.4 Relevant Local Policies and Plans

The following sections provide an overview of the plans and policies which are relevant to the LAFRMS at the local level. The key issues associated with local level plans and policies that will require detailed consideration at the next stage of the LAFRMS are described in summary below.

3.4.1 Local Planning & Policy

The LAFRMS covers the Regional Administrative boundary of the Government Office for Yorkshire and Humberside. The Study Area also covers areas within the boundaries of a number of County and Local District Councils and Unitary Authorities responsible for planning and development within their specific areas. Table 3.1 provides a summary of the key planning actions relevant to the Study Area.

Table 3.1 Regional and Local Planning Items in the Study Area

| |
|---|
| <p>Yorkshire and the Humber Regional Spatial Strategy (2008) highlights the following Items</p> <ul style="list-style-type: none"> Coalfield Regeneration Area in Wakefield – focus housing renewal and development and employment opportunities on the Principal Towns of Castleford and Pontefract, and in Featherstone, Knottingley and Normanton, at an appropriate scale for individual communities with a particular emphasis on transforming the town centres. Support the roles of Selby and Goole in line with their roles as Principal Towns. |
| <p>Leeds Unitary Development Plan (2006) highlights the following Items</p> <ul style="list-style-type: none"> Large housing developments and new schools proposed in Allerton Bywater. The area to the North of Castleford is identified as an urban fringe development priority area – no further defined proposals thus far. Proposed housing development in Mickletown. Leeds City Council is currently developing the Local Development Framework and Core Strategy, alongside a number of Area Action Plans. These strategies will supersede Leeds UDP |
| <p>Wakefield Metropolitan District Council Draft Local Development Framework (LDF) (2008) highlights the following Items</p> <ul style="list-style-type: none"> The Aire river corridor throughout Castleford has been designated a Wildlife Habitat Network – nature conservation in this area is a priority and it is intended that environmental enhancements will be put in place. Two large housing developments planned in Wheldale and multiple housing developments proposed throughout Castleford Ings. Knottingley Riverside – large residential/business/leisure district proposed along the riverside as part of the Five Towns Regeneration. Castleford Riverside – large regeneration project as part of Five Towns Regeneration. Will include provision of public open space, local leisure facilities, residential and industrial development. |
| <p>Selby District Local Plan (2005) highlights the following Items:</p> <ul style="list-style-type: none"> Large residential developments proposed in central Selby including housing and schools. The Waterfront Project – five year programme aims to improve and enhance the canal corridor within Selby. Three Special Policy Areas highlighted within Selby centre for development however specific developments not stated. |
| <p>East Riding of Yorkshire Council Local Plan (1999) highlights the following Items:</p> <ul style="list-style-type: none"> The Plan indicates that tourism will be an essential tool in diversifying the local economy. The Plan aims to encourage the growth within the tourism sector, particularly to develop the tourism infrastructure outside of the traditional coastal resorts, with particular emphasis placed upon historic and environmental locations. |
| <p>Boothferry Borough Local Plan (1999) highlights the following Items:</p> <ul style="list-style-type: none"> Large housing developments and a Country Park proposed in Goole. New school proposed in Rawcliffe. |

Under the new planning framework Local Plans are being replaced by a Local Development Frameworks (LDF), which consist of a number of documents rather than one large document. Until the adoption of the LDFs is finalised the current Local Plans still apply, however, certain policies have already been disregarded in the development of the LDFs. Continued monitoring of the LDF development will occur throughout the SEA process to ensure that all new and continued planning proposals are considered.

3.4.2 Water Management Planning

In addition to flood risk management plans there are a number of other water management plans relevant to the Study Area.

The European Water Framework Directive (Directive 2000/60/EC) (WFD) sets out a number of principles and targets for how Member States (including the UK) should aim to protect and enhance the water environment to ensure the sustainable use and development of water resources for economic and social development.

Under our commitment to the WFD, the UK must aim to reach good chemical and ecological status in inland and coastal waters by 2015. Furthermore, the WFD seeks to:

- Enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands;
- Promote the sustainable use of water;
- Reduce pollution of water, and;
- Ensure progressive reduction of groundwater pollution.

These principles have been set out for the Study Area in the following plans:

- Humber River Basin Management Plan (RBMP) 2009.
- Aire and Calder Catchment Abstraction Management Strategy (CAMS).

These have developed policies seeking to preserve and improve water quality and water environments within their catchments. It will therefore be necessary for the LAFRMS to maintain the water quality status of water bodies within the Study Area. There are opportunities for contributing positive measures to help achieve WFD targets; improving water quality will have positive impacts on flow, erosion and sedimentation, and water body capacity.

Under the Water Resource Management Plan Regulations 2007, water companies in England and Wales are required to set out how they plan to manage water supplies over the next 25 years. Yorkshire Water's draft Water Resource Management Plan (2008) sets out a programme of measures to use and improve its existing water supply network and services and reduce leakage to meet present and future demand. It will be necessary for the LAFRMS to ensure that any potential effects on the water supply network are fully considered and addressed.

3.4.3 Biodiversity Plans

There are numerous environmental and biodiversity plans relevant to the Study Area both at a national and a local level. Due to the level of detail of the FRM Strategy, we think that the local plans - which incorporate requirements of higher level strategic plans are of most relevance to the LAFRMS. Such local plans and strategies include:

- Local Biodiversity Action Plans (LBAP); and,
- Water Level Management Plans (WLMPs).

Relevant LBAPs for our strategy are those for Leeds, Wakefield, Selby and East Riding of Yorkshire and these identify the species and habitats for which action plans have been prepared.

WLMPs are required for all areas which have a conservation interest, with priority given to Sites of Special Scientific Interest (SSSIs), where the control of water is important for biodiversity. WLMPs are a means of balancing water level management for a range of land uses and activities within an area, including agriculture, angling, flood risk and conservation. WLMPs are presently being developed for a number of sites within the Study Area, notably at Fairburn and Newton Ings and Mickletown Ings.

A number of other initiatives promoting the enhancement of biodiversity and creation of wetland sites are currently being promoted in the Study Area. These include:

- Living Landscapes - an initiative led by Yorkshire Wildlife Trust to enhance biodiversity through the Yorkshire and Humber Region.
- Lower Aire Valley Vision – an initiative led by RSPB to restore and create 900 ha of important wildlife habitat within the Lower Aire Valley.
- North East Regional Habitat Creation Programme – our programme for delivery of BAP habitat creation in the Yorkshire and Humber area. This programme will take on the delivery of any potential BAP creation opportunities identified by the LAFRMS.

Some habitats/species are susceptible to changes in flood frequency, floodwater chemistry, groundwater levels and drainage system maintenance. It will therefore be important to maintain and enhance priority species and habitats, promoting new areas of habitat and improving quality through appropriate flood risk management activities. The LAFRMS will therefore need to consider the specific water level, water quality and habitat requirements during the development of options.

3.4.4 Landscape Plans and Strategies

There are several landscape plans and strategies within the Lower Aire Study Area, which may influence the FRM strategy. The most relevant of these strategies to the LAFRMS are listed below:

- Local Authority Green Space Strategies;
- The White Rose Forest Strategy; and,
- Leeds Green Infrastructure Strategy.

The Local Authorities within the study area are presently conducting open space audits, for development of Green Infrastructure Strategies. These strategies will advise whether landscape enhancements within the study area will be beneficial.

Question Box 3

Appendix C identifies the policies, plans and strategies that we will take into account as we develop the LAFRMS. It also includes those that we have scoped out of consideration. Are there any other plans or strategies that you think we should include?

4 Environmental Baseline

In this chapter we have provided a broad overview of the environment in the Study Area, that is a description of the existing environment (our baseline) and how that environment might change in future. It is important for us to understand what the baseline conditions are so that we can predict how the different options considered in the development of LAFRMS might change that environment.

In order to provide structure to our assessment, we have split the different features of the environment into different “receptor” categories. This will enable us to consider the potential constraints and opportunities associated with the different environmental receptors. We have undertaken a review of existing data, reports and local plans to inform this exercise.

A summary of the existing environmental baseline is provided for each receptor along with information on likely future trends, where the information exists.

4.1 Human Beings

This receptor category includes consideration of:

- Populations and communities at flood risk;
- Human Health; and,
- Material assets and critical infrastructure.

Flooding events can have significant effects on communities through damage to homes and businesses and in extreme cases may result in significant injury and/or death. In addition they are known to lead to health impacts (both physical and mental), including stress and trauma, sometimes months or years after the flood event, or whenever flooding appears likely to occur (Tapsell et al, 2002).

4.1.1 Populations and flood risk

There are an estimated 14,500 residential and 2,000 commercial and industrial properties within the flood risk area. The main population centres contained within the Study Area (see Figure 2, Appendix A) are Castleford and Knottingley, upstream of Ferrybridge, Selby to the north, and Goole, close to where the River Aire flows into the River Ouse in the east.

Castleford and Knottingley form part of the Five Towns conurbation (with Pontefract, Featherstone and Normanton). This section of the Study Area also encompasses the villages of Allerton Bywater, Methley, Brotherton and Ferrybridge. The remainder of the Study Area, between Ferrybridge and Goole, is predominantly rural containing smaller scattered communities. The villages of Kellington, Eggborough, Gowdall, Hensall and the town of Snaith are found within the floodplain of the right bank of the River Aire, whilst villages such as Birkin, West and Chapel Haddlesey, Temple Hirst, Hirst Courteney and Carlton lie within the floodplain of the left bank of the river. The exception to this rural character is Selby, situated in the north of the Study Area, on the southern bank of the River Ouse..

Several areas within the Study Area have experienced historical flooding; these are presented in Table 4.1.

Table 4.1 Flooding frequency in population centres over recent history:

| Location | Significant Flood Events | | | | |
|---------------------------------------|--------------------------|------|------|------|------|
| | 1978 | 1982 | 1995 | 2000 | 2007 |
| Castleford Loop | x | x | x | x | x |
| Allerton Bywater | | | | | x |
| Whitwood Mere & Castleford Ings | x | | x | x | x |
| Brotherton | | | | x | x |
| Low Street, Brotherton | | x | | x | x |
| Burn* | | | | | x |
| Ferrybridge (Upstream) | | | | x | x |
| Ferrybridge (Downstream) | | | | x | x |
| East Knottingley | | | | x | x |
| Lime Heck, Hensall | | | | x | |
| Butt Fields & Gowdall Fields, Gowdall | | | | x | x |

*Burn flooded >0.1ha.

4.1.2 Human Health

Table 4.2 highlights the health status of the population within the LAFRMS Study Area. The health status of the Yorkshire & Humber region as a whole is relatively similar to the national average; however, within the region the health status varies. The percentage of the population within Castleford and Knottingley classified as having 'Not Good Health' and 'Fairly Good Health' is above the national and regional average. Castleford Whitwood has close to double the percentage of residents with 'Not Good Health' when compared with the average for England.

Table 4.2 Indicative Health Status within the LAFRMS Study Area

| Health Status | Percentage of Population | | | | | |
|--------------------|--------------------------|-------------|-------|--------|--------------------|---------|
| | Castleford Whitwood | Knottingley | Goole | Snaith | Yorkshire & Humber | England |
| Good Health | 59 | 61 | 67 | 68 | 67 | 69 |
| Fairly Good Health | 25 | 25 | 23 | 23 | 23 | 22 |
| Not Good Health | 16 | 14 | 10 | 9 | 10 | 9 |

Source: ONS, 2001 Census

Available data on deprivation within the Study Area indicates that a number of locations fall within the lowest 20% of the Index of Multiple Deprivation². Figure 3 (Appendix A) identifies Whitwood Mere in Castleford, East Knottingley, and areas within Selby and Goole as deprived locations where there are properties at flood risk. However, unpopulated parts of the deprived areas of Fryston Basin, New Fryston and Ferrybridge also lie within the flood risk area.

Several recreational footpaths and public rights of way have been opened in recent years. The Transpennine trail runs through the Study Area. "The Links" footpath joins the

² A ward-level index made up from six indicators (income; employment; health deprivation and disability; education; skills and training; housing) used to measure relative levels of deprivation in the UK.

Transpennine trail from the left bank of River Aire and runs between St. Aidans nature reserve and Allerton Bywater on an old railway line. According to the Aire CFMP (2008), the tow canal path between Kildwick and Mickletown has recently been developed as a cycle-path. The majority of the footpaths and cycle route lay outside of the flood risk area, but several locations along the length may be vulnerable to flooding and subsequent disruption caused to users.

4.1.3 Material assets and critical infrastructure

The Aire and Calder Navigation system incorporates a network of rivers and artificial cuts which connect Leeds, Wakefield, Castleford and Selby with the docks at Goole on the River Ouse. However, the Aire and Calder Navigation and 12 mile long Selby Canal carry little commercial traffic and are now mainly used for recreation purposes. Holiday-makers and day trip visitors all use the canal network within the area.

The development of the Aire and Calder Navigation helped fuel the industrial revolution, contributing to the development of Castleford, Knottingley and Pontefract. These areas have historically been linked with mining, mineral extraction and heavy industries such as chemical production. Many of these sites are now being redeveloped for commercial or residential use. A significant proportion of this development is focussed around Junction 32 of the M62 at Castleford, with retail and leisure units providing employment to the local population. There are also expanding industrial estates and warehousing connected with the motorway, rail and canal transport links (Aire CFMP, 2008).

The Study Area is intersected by several major motorways and large 'A' roads, details of which are presented in Table 4.3.

Table 4.3 Major road network in the Study Area

| Road | Provides links to: |
|--------------|--|
| M18 | South to Doncaster and M1 |
| M62 | West to Leeds, Liverpool and Manchester and links with the M1 East to Hull |
| A1(M) and A1 | North to Ripon and Newcastle South to Pontefract, Nottingham, East Midlands and the South |
| A19 | North to York South to Doncaster |
| A63 | West to east: A1M, Selby and M62 |
| A614 | South to North: M62 Rawcliffe, Goole, Airmyn |
| A645 | West to east: Knottingley, Eggborough and Snaith to Howden and Driffild |
| A1041 | South to north: Snaith to Selby |

Major rail infrastructure, including major national rail networks and a number of smaller regional and commuter rail services, stations and tracks, are found within the Study Area. The main East Coast Mainline, linking London and Hull to Newcastle and Edinburgh, dissects the Study Area north to south. Rail lines link Hull and Goole, in the east, with Leeds, in the west, running parallel with the M62 motorway through the Study Area. A number of railway stations are found within the flood risk area at Whitley Bridge, Snaith, Rawcliffe, Selby and Goole.

Major rail freight routes link the ports of Immingham, Hull and Goole to industry in the Aire Valley, providing raw materials and delivering fuel to the power stations at Drax, Ferrybridge and Eggborough. These power stations contribute in the region of 14% of the national electricity demand and dominate the landscape locally. The power stations lie outside of the flood risk area, however, they rely on the wider rail network for the delivery of coal and the transport of waste ash. The power stations also abstract significant quantities of water for the power generation process.

Infrastructure connected with the power plants is scattered throughout the flood risk area, including pylons, substations and transport networks. A network of other services including gas pipelines, water infrastructure and telecommunications also criss-cross the river valley. This infrastructure is important to the local, regional and national economies.

A number of wastewater treatment plants, dealing with wastewaters from residential and industrial sources, are located in the flood risk area, (see Figure 4, Appendix A). Floodwater inundation to any of these sites would cause severe disruption to their operation, and potential contamination of the surrounding areas with wastewater.

There are three Internal Drainage Boards (IDB's) within the flood risk area that manage drainage networks with the use of pumping stations. These are:

- Knottingley to Gowdall IDB;
- Selby IDB;
- Went IDB;
- Cowick IDB;
- Snaith IDB;
- Rawcliffe IDB; and,
- Goole & Airmyn IDB.

4.2 Flora & Fauna

This receptor category considers biodiversity within the Study Area.

4.2.1 International and National Nature Conservation Designations

There are a number of areas within the Study Area designated for their international and national importance for nature conservation (Figure 5, Appendix A).

Humber Estuary

The Humber Estuary is designated as a Special Area of Conservation (SAC), Special Protection Area (SPA), a wetland of international importance under the Ramsar Convention and a Site of Special Scientific Interest (SSSI). The Humber Estuary is the second-largest coastal plain estuary in the UK and supports important estuarine and coastal habitats, and internationally significant populations of invertebrates, birds, mammals and fish. The designated site covers an extensive area; however, the boundary of this designated site lies immediately downstream of the Study Area. We are uncertain at this stage whether any of the strategic options may lead to downstream effects on the designated site. Any effects will be identified and documented during the assessment of the options. Consideration will be given to the requirements of the Habitats Regulations should any potential effects be identified.

Fairburn and Newton Ings SSSI and Mickletown Ings SSSI

These SSSI's comprise a mix of lowland grassland, and waterbodies formed by mining subsidence. The sites support diverse populations of aquatic flora, invertebrates and wildfowl. These sites are presently considered to be in unfavourable condition due to problems with water level management and excessive build up of silt which has caused problems with water quality in both sites. We are working with Natural England and RSPB to resolve these problems. The SEA will ensure that the development of the LAFRMS fully considers the impacts and opportunities potential flood risk management options may have on the condition of these sites.

Other SSSIs

There are a further three SSSIs on the margins of the Study Area. These are Madbanks and Ledsham Banks SSSI; Townclose Hills SSSI; and Roach Lime Hills SSSI. At this stage we believe it is unlikely that these sites will be at risk of adverse impacts from flooding or from the effects of any of the potential flood risk management options.

More detailed information for each designated site can be found in Appendix D.

4.2.2 Local Nature Conservation Designations

There are a number of sites within the Study Area that are recognised for their regional or local importance for nature conservation. These consist of five Local Nature Reserves (LNRs), 29 Sites of Importance for Nature Conservation (SINCs) and 24 local Nature Areas (NAs) see Figure 5, Appendix A. Of these sites the most notable local nature conservation sites include:

- St Aidans – an operational washland and former open cast coal mine which has been converted to approximately 300ha of reedbeds, open water and wet grasslands.
- Letchmire Pastures – a mix of wetland, grassland, scrub and bare earth habitats developing on a former coal-stocking area.

4.2.3 Biodiversity Action Plan (BAP) Habitats and Species

Throughout the UK there are a number of BAP priority habitats. The Study Area, supports several of these BAP habitats, which are often connected with designated areas within the region.

The key LBAP habitats relevant to the Study Area include:

- Unimproved grassland
- Grazing marsh
- Reedbeds
- Purple moor grass and rush
- Lowland meadow
- Canal
- Lowland calcareous grassland
- Fens
- Rivers, streams and ditches
- Lakes and ponds
- Wet woodland
- Ancient woodlands

LBAP species relevant to the Study Area include:

- Pasqueflower (*Pulsatilla vulgaris*)
- Thistle broomrape (*Orobanche reticulata*)
- Harvest mouse (*Micromys minutus*)
- Pipistrelle bat (*Pipistrellus spp.*)
- Depressed River Mussel (*Pseudanodonta complanata*)
- White-clawed crayfish (*Austropotamobius pallipes*)
- Great crested newt (*Triturus cristatus*)
- Water vole (*Arvicola amphibius*)
- Brown hare (*Lepus europeus*)
- Otter (*Lutra lutra*)

The main threats to biodiversity within the Study Area are identified in Habitat Action Plans (HAPs), which have been written for the habitats identified within the LBAP. We consider that the main factors affecting these habitats are:

- Nutrient run-off from agricultural practices;
- Developmental pressures, including agricultural development;
- Lack of appropriate management; and,
- Spread of invasive non-native species.

4.2.4 Invasive Species

There are records of alien (non-native invasive) plant species including Japanese knotweed (*Fallopia japonica*), Himalayan balsam (*Impatiens glandulifera*), and giant hogweed (*Heracleum mantegazzianum*) throughout the Study Area. These species can be difficult and costly to control.

4.2.5 Protected Species

Within the Study Area, there are known to be populations of otter, badger (*Meles meles*) and water vole. The locations are highlighted in Figure 6, Appendix A. Other protected species are likely to be found within the Study Area. However, based on the present level of information we have not been able to identify their presence.

4.2.6 Fisheries

Historically, the River Aire was a salmon (*Salmo salar*) river with catches recorded into the early part of the nineteenth century, until the effects of pollution brought a halt to their presence. In recent years salmon have returned to the river and the first recorded rod-caught salmon was at Eggborough in 2001. Salmon are migratory and the main obstacle to their re-colonisation is the large number of weirs within the River Aire system. However, recent anecdotal information indicates that spawning salmon are able to migrate as far as Chapel Haddlesey. Other migratory species of note include sea trout (*Salmo trutta* morpha *trutta*), smelt (*Osmerus eperlanus*) and eel (*Anguilla anguilla*). The Humber Eel Management Plan identifies the weirs at Chapel Haddlesey and Beal as major constraints to the movement of eel in the River Aire. The installation of fish passes helps salmon and other migratory fish in their journey upstream to spawning grounds.

The River Aire is a thriving coarse fishery, and is very popular for angling for species such as roach, bream, perch, chub, dace and gudgeon. There are also a number of angling lakes found within the Ings and operational washlands of the Lower Aire floodplain. Many of these are found on waterbodies formed either through mining subsidence or through mineral or aggregate extraction. A number of fish farms are also found within the Study Area.

4.3 Air and Climate

4.3.1 Air Quality

Air Quality Management Areas (AQMAs) are declared by Local Authorities to help identify areas where the air quality needs to be improved. The Study Area contains sections of two AQMAs in Castleford and Knottingley, both designated by Wakefield Council. Monitoring data from 2000 – 2007 indicates that since 2004 Knottingley and Castleford AQMAs have not exceeded national air quality objectives.

Increasing road traffic and population growth together with associated expansion of major roads and urban areas may lead to local reductions in air quality in the Study Area.

4.3.2 Climate

Met Office data indicates that from 1971 – 2000 the annual average rainfall over the Study Area is up to 1000mm making it one of the relatively drier areas of the UK. Annual mean temperature from 1971 – 2000 was 9 – 10°C, with mean summer temperatures ranging from 14 – 16°C and mean winter temperatures from 3 – 5°C.

The United Kingdom Climate Impacts Programme (UKCIP) has recently released a range of data and predictions for climate scenarios. Climate change projections vary dependent on the emissions scenario used to make the prediction of climate change. However, the main changes, regardless of the emissions scenario, are likely to include warmer temperatures, wetter winters, drier summers and rising sea levels. We will review the climate scenarios for Yorkshire and Humber and use them in the development of LAFRMS and our environmental assessment.

Whilst the options will have the potential to release varying levels of greenhouse gases, these will not be at levels significant, in isolation, to influence local climate conditions. However, we still need to consider the strategy’s contribution to emissions, particularly the relative emissions from construction and maintenance of strategy options.

The LAFRMS explicitly considers the implications of climate change on flood risk and follows Defra guidance on the level and nature of increasing flood risk over the 100 year life time of the strategy. Our policies are therefore aiming to help society to adapt to climate change. Relevant effects of climate change e.g. changes in the range of the plant/animal species, will be considered under each appropriate receptor.

4.4 Water

4.4.1 Surface Water

The floodplain of the Lower Aire Catchment is drained by the River Aire and its tributaries and the cuts and links of the Aire & Calder Navigation and its connecting canals. Details of the river and canal network are provided in Table 4.5.

Table 4.5 Watercourses within the LAFRMS Study Area

| Watercourse | Course within the LAFRMS Area |
|--|--|
| River Aire | Flowing West to East via Lemonroyd Weir – Castleford – Knottingley – Ferrybridge – Snaith – Airmyn – Discharging to the River Ouse at Airmyn/Goole |
| Oulton Beck | West to East through Oulton – Discharging to the River Aire (d/s Lemonroyd Weir) |
| River Calder | West to East via M62 Bridge – Whitwood Mere - Discharging to the River Aire at Castleford |
| Aire and Calder Navigation (North Arm) | West to East: Combined with River Aire - Splits from Aire at Knottingley – Discharging to the River Ouse d/s of Goole |
| Aire and Calder Navigation (South Arm) | South Arm combined with River Calder Knottingley to Goole Cut – Discharging to the North Arm at Castleford |
| Sheffield Beck/Lin Dyke | Flowing South East, to the north of Allerton Bywater - Ledton and Fairburn Ings – Discharging to the River Aire (d/s of Bulholme Lock) |
| Fryston Beck | Flowing West to East via Townville – Ferrybridge power station – Discharging to the River Aire (u/s of Ferrybridge) |
| Wash Dyke | North through Knottingley discharging to the Aire & Calder Navigation at Ferrybridge / Knottingley |
| Selby Canal | Flowing South West via Selby - Brayton – West Haddlesey – Discharging to the River Aire (d/s of West Haddlesey) |

An extensive network of agricultural drainage channels and pumping stations also feeds into the river and canal systems, particularly downstream of Ferrybridge. The floodplain

upstream of Ferrybridge also hosts a large number of shallow, often interconnected waterbodies formed by mining subsidence and mineral or aggregate extraction.

The final 26km of the river downstream of Chapel Haddlesey is tidal. In addition, the River Aire, River Don and the Aire and Calder/ Dutch River Cut all discharge to the River Ouse around Goole. The interaction of these separate river flows during period of heavy rainfall and or tidal surge events has the potential to lead to increased flood risk in this area.

4.4.2 Water Quality

Under the Water Framework Directive, a draft River Basin Management Plan for the Humber (including the Aire and Calder catchment) is currently awaiting approval from Ministers. The plan describes the current status of waters within the Humber Basin and proposes methods to increase the quality of the water environment over the next two decades. There are several significant water management issues within the Aire which are relevant to the LAFRMS:

- Urbanisation – large sections of the River Aire run through industrialised areas, such as Castleford, which may account for high levels of specific pollutants including Copper and Zinc. Numerous channel modifications have also occurred due to its proximity to large settlements.
- Point source pollution – the river is used heavily for storm discharges and sewage treatment works outflows both of which contribute to reducing the water quality within the catchment.
- Diffuse pollution – agricultural run off and acidification affect sections of the River Aire within the rural landscape.

The River Aire and its tributaries are identified as being “Heavily Modified” as a result of flood protection measures, urbanisation and navigation. The assessments for the tributaries within the Study Area are shown in Table 4.4 and are highlighted within the RBMP for the Humber region.

Table 4.4 Water quality assessments for the River Aire and its tributaries

| Watercourse | Current Ecological Quality | Predicted 2015 Ecological Quality | Current Chemical Quality | Predicted 2015 Chemical Quality |
|----------------------------|----------------------------|-----------------------------------|--------------------------|---------------------------------|
| Oulton Beck | Bad | Not yet assessed | High | Fail |
| River Calder | Poor | Moderate | Moderate | Fail |
| Aire and Calder Navigation | Not yet assessed | Fail | Not yet assessed | Fail |
| Sheffield Beck/Lin Dyke | Not yet assessed | Fail | Not yet assessed | Fail |
| Fryston Beck | Not yet assessed | Fail | Not yet assessed | Fail |
| Wash Dyke | Not yet assessed | Fail | Not yet assessed | Fail |
| Selby Canal | Not yet assessed | Not yet assessed | Not yet assessed | Not yet assessed |

Groundwater

The Study Area is underlain by a number of different water-bearing rock strata. The headwaters of the River Aire are underlain by minor aquifers of Carboniferous Limestone. Downstream of Ferrybridge the Study Area is underlain by two major aquifers; an area of Magnesium Limestone present along the line of the A1, and Sherwood Sandstone.

Groundwater can be extremely vulnerable to pollution and is protected by legislation. The majority of the Study Area is designated as a Groundwater Nitrate Vulnerability Zone (NVZ). The NVZ runs almost parallel to the River Aire, just to the south of the watercourse

from Fairburn to Snaith. There is also a second, smaller NVZ located to the south west of Selby covering areas such as Brayton and Thorpe Willoughby.

Source Protection Zones (SPZ) are designated to protect sources of drinking water. There are two total catchment SPZs located within the Study Area with nine inner zones protecting a number of individual boreholes, close to Carlton and Snaith, which abstract potable water from the Sherwood Sandstone aquifer.

The majority of the groundwater quality is classified as “Good” throughout the Study Area, however, this is at risk due to the increasing chemical content. The north of the Study Area, within the Wharfe and Lower Ouse Sherwood Sandstone aquifer however has poor groundwater quality possibly as a result of the mining heritage within the area.

4.4.3 Water Resources

Water Supply

There are over 50 licensed abstraction points (Figure 8 in Appendix A), the majority of which are groundwater sourced and used for agricultural purposes. Agriculture is also the most intensive user of water from the watercourses within the Study Area, whilst a number of key surface water abstractions supply the power stations at Ferrybridge and Eggborough.

The Study Area lies within the Yorkshire Water jurisdiction, with the majority of potable water supplied to the area provided through extensive water grid which distributes water from upland reservoirs and river transfers to the north and west of the Study Area.

Water Availability

The water resources within the Study Area are covered by the Aire and Calder Catchment Abstraction Management Strategy (CAMS). The CAMS has identified two water resource management units (WRMU) within the Study Area:

- The Lower Aire and Lower Calder Water WRMU; and,
- The Sherwood Sandstone Aquifer Groundwater Management Unit GWMU.

The 2007 status of the Lower Aire and Lower Calder WMU was one of “water available”. However, the strategy for this WMU was to move to a status of “no water available”. The 2007 status of the GWMU was one of “over-licensed”; therefore the strategy adopted is to revoke licences unused for four years and reduce time limited licences where the need for water cannot be proved.

Wastewater Discharges

There are numerous combined sewer overflows and discharge points from industrial and wastewater treatment works, as well as pumping stations for pumping flood water from the washlands into the channel. Unprotected sections of the river bank and bed at these localised discharge points may respond to increased shear stresses by eroding. Potentially, eroded sediment will collect downstream, increasing the risk of flooding.

Predicted increases in agricultural output, population and tourism within the area will lead to increased pressure on water resources, meaning that efficiency measures are vital to secure adequate water supplies without affecting the environment.

4.5 Landscape

There are no statutory landscape designations within the Study Area.

4.5.1 Landscape character

Natural England has produced a map of England which categorises areas with similar landscape character and wildlife as National Character Areas (NCAs) The Study Area is made up three NCAs (Figure 7, Appendix A):

- The Nottinghamshire, Derbyshire and Yorkshire Coalfield - a mix of industrial, derelict land and built-up areas with significant evidence of industrial activity as well as hills, escarpments and broad valleys creating a diverse landscape.
- The Southern Magnesian Limestone – elevated ridges cut through by rivers and dry valleys with panoramic views of the surrounding lowland. Contains large amounts of farmland as well as country houses and estates with extensive areas of parkland.
- The Humberhead Levels - large expanse of flat, low lying land characterised by large river plains, parts of which are now below sea level. Contains significant areas of heath and peat bog as well as vast areas of artificially drained farmland.

In addition, to the general characterisation of the Study Area's landscape, a number of local authorities have undertaken more detailed landscape character assessments of their respective areas. These cover Leeds, Wakefield, Selby and East Riding of Yorkshire. We will review these assessments and consider them in the assessment of how flood risk and potential flood risk management options might affect landscape issues and features, constraints and opportunities.

4.6 Historic Environment

Although there are no World Heritage Sites or historic battlefields, there are a number of sites recognised for the historic and archaeological importance within the Study Area. These sites range from the remains of a roman fort and medieval settlements and bridges; historic market towns, and a wide variety listed buildings, representing a range of historic architectural styles from pre and post industrial periods to more contemporary 20th century structures.

There are nine Scheduled Monuments within the Study Area (Figure 7, Appendix A), these include:

- The Ferrybridge (SM WY75)
- Barlow Hall (SM 30130)
- Scurff Hall Moated Site (SM 30117)
- Castle Hill Moated Site (SM 30108)
- Roman fort 600m West of Roall Hall (SM 30128)
- Newton Abbey Moat, Fairburn Ings (SM 13285)
- Thorpe Hall Moated Monastic Grange (SM 30113)
- Drax Augustinian Priory (SM 32628)
- Hall Garths Moated Site (SM 30129)

Further details regarding these sites can be can be found in Appendix E:

There are a number of Conservation Areas present, scattered through the Study Area, notably in the historic centres of the towns of Knottingley and Selby, the market town of Snaith and a number of the outlying villages including Ledston, Hillam and Methley.

There are high concentrations of listed buildings within the Study Area aggregated around many of the historic settlement located within the Lower Aire Valley (Figure 7, Appendix A). The highest concentrations are seen around Selby, Snaith and Goole, each of which are set within Locally Important Landscape Areas.

The nature of the data available on the historic environment generally does not allow for the appraisal of the impacts of flooding; assessment of these impacts can normally only be done at the point where individual schemes of work are being prepared.

Rivers, lakes, wetlands and alluvium-covered areas can be important in terms of archaeology because of the types of site preserves and the possibility of anaerobic conditions permitting the preservation of organic materials. Water levels may be critical to preserving remains, as an increase may result in erosion and a decrease may lead to the deterioration of previously waterlogged deposits.

Non-designated historic environment assets

Not all nationally important sites are designated. Other features may be known and recorded on the County Historic Environment Records (HERs). Additionally, there may be unknown features of significant interest, especially buried archaeological and palaeoenvironmental remains. Data from the HERs has not been considered in this study as they are too detailed for this study. However, these data will be considered and the views of English Heritage and the local authority archaeological officers sought at more detailed design (Scheme) stages of flood risk management planning.

4.7 Soils, Geology, Land Quality and Land Use

4.7.1 Soil and geology

The soil types within the Lower Aire valley differ greatly, however, the Study Area can be broadly split in two at Ferrybridge.

Upstream of Ferrybridge the soil type can be characterised by freely draining floodplain soils that are loamy in texture and classed as moderate to high fertility. Further soil types include slowly permeable, seasonally wet, acid loam and clays, with low fertility.

Downstream of Ferrybridge the soil type is characterised by loamy and clay soils typical of coastal flats. The groundwater table within this area is high; the fertility of these soils is described as lime-rich to moderate.

The surface geology that underlies the soil in the Study Area is mainly derived from historic river processes. The river banks and much of the areas beyond the River Aire are almost entirely covered by a layer of alluvium. River terrace deposits of gravel are found adjacent to the alluvium in some areas especially around Rothwell and Mickletown, on low-lying ground. Outside of the floodplain, the wider area contains patchy and localised deposits of glacial sand and gravel.

The underlying solid geology of the Study Area is made up a number of stratigraphic layers, including (from the surface layer downwards):

- Carboniferous Coal Measures
- Permian Limestone
- Sands and marls
- Permo-Triassic sandstones of the Sherwood Sandstone Group

The strata which outcrop (or sub-crop beneath the superficial deposits) in the Study Area become progressively younger with distance to the east.

4.7.2 Contaminated Land

The Study Area upstream of Ferrybridge contains a significant concentration of contaminated land (Royal Haskoning 2009). Mostly due to the number of potential contaminative land uses within the area, including areas of industrial land use, active and historical landfill sites, a disused tip, railway land, works and land subject to mining and

quarrying activities. The areas of contaminated land are highlighted on Figure 9, Appendix A.

4.7.3 Land Use

The LAFRMS Study Area is easily split into two distinct land use categories. Upstream of Ferrybridge land use is characterised by predominantly urban settlements, particularly those of Castleford, Knottingley and Ferrybridge itself. These urban and suburban areas are made up of mixed residential, commercial and industrial use.

The arable landscape downstream of Ferrybridge is dominated by agricultural land use, with much of the area classified as grades 1, 2 and 3 and considered to be the "best and most versatile" types of agricultural land (as shown in Figure 9 Appendix A). This rural floodplain is given over to the intensive production of arable and root crops and market gardening. Large commercial farm units and greenhouses are in evidence throughout the floodplain. Much of the agricultural land is heavily drained and relies on this drainage to maintain high productivity.

4.8 Natural Resources

4.8.1 Coal Mining, Minerals and Aggregates

The upstream section of the LAFRMS Study Area is historically linked with coal mining and processing. Kellingley Colliery, situated approximately 1.5 miles east of Knottingley, is the only remaining operational coal mine within the Study Area and one of the few remaining deep-shaft mines still in operation in the United Kingdom. Anecdotal evidence suggests that approximately 2 million tonnes of coal is extracted from the colliery each year.

It is anticipated that there will be future development of the Selby Coalfield would involve either mining new seams within the existing geographical area of the current coalfield or extending works laterally beyond current boundaries. Further coal seams, including the Barnsley seam, could be worked at greater depths in East Yorkshire but would be subject to the necessary planning permissions and would also be limited by technical and economic constraints. Any extensions to Kellingley Colliery would require planning permission to be granted by the local authority and would be highly dependent on the competitiveness and market position of the colliery.

Sand and gravel, crushed rock aggregate and magnesium limestone are extracted from various workings within the Study Area. In general, due to the relatively low level of mineral and aggregate extraction within the Study Area, the relevant local plans indicate the responsible authorities are often net importers of minerals and aggregates.

4.8.2 Waste Management

The Study Area contains current landfill locations close to Castleford, Knottingley, Selby Ferrybridge, Eggborough and Drax. In addition, there are 36 locations that are categorised as historic landfill locations throughout the Study Area. These are highlighted on Figure 9. These areas can also present issues with contaminated land in the vicinity of the landfill location.

4.9 Interactions between the above receptors

SEA provides opportunities to identify cumulative effects which are not often available at the project level. The LAFRMS will give consideration to how the impacts of options might affect more than one type of receptor though direct, indirect, and or combined effects resulting from the options, either alone or in combinations with other plans and strategies.

Following our review of available information we have considered the potential for links between the different receptors within the Study Area to allow us to start to consider how cumulative effects might occur. Table 4.5 provides a summary of the potential receptor interactions within the Study Area.

Table 4.5 Receptor interaction table

| | Castleford | Knottingley | Aire & Calder Navigation | Left Bank Villages | Right Bank Villages | St Aidans | Methley (Incl SSSI) | Fairburn (Incl SSSI) | Allerton Bywater | LNRs / SINC | Power Stations | Road Network | Rail network | Water Abstractions | WTW's | Contaminated Land | Deprived Communities | BAP Habitats & Species | Historical Features | Operational Washland | Agriculture | D-O-A Confluence | Landscape CA | Health & Social |
|--------------------------|------------|-------------|--------------------------|--------------------|---------------------|-----------|---------------------|----------------------|------------------|-------------|----------------|--------------|--------------|--------------------|-------|-------------------|----------------------|------------------------|---------------------|----------------------|-------------|------------------|--------------|-----------------|
| Castleford | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Knottingley | ~ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Aire & Calder Navigation | ✓ | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Left Bank Villages | ~ | ~ | ~ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Right Bank Villages | ~ | ~ | ~ | ~ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| St Aidans | ~ | ~ | ~ | ~ | ~ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Methley* | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Fairburn** | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Allerton Bywater | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| LNRs / SINC | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Power Stations | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Road Network | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Rail network | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Water Abstractions | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| WTW's*** | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Contaminated Land | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Deprived Communities | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| BAP Habitats & Species | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Historical Features | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Operational Washland | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Agriculture | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| D-O-A Confluence**** | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Landscape CA***** | ~ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Health & Social***** | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |

Note: Read across and down to determine the likely interaction between receptors.

* Including Mickletown Ings SSSI; ** Including Fairburn Ings SSSI ; *** Wastewater Treatment Works; **** Don – Ouse – Aire Confluence; ***** Landscape Character Areas, ***** Includes hospitals, schools and care homes

Question Box 4

Section 4 outlines the baseline environmental information and the key issues and opportunities for the FRM Strategy.

Are there further key issues or baseline information that we should be considering?

5 SEA Methodology

5.1 Introduction

This chapter outlines the method we will use to identify, predict and compare the potential environmental impacts of the flood risk management options considered in the development of the LAFRMS.

5.2 Stages of Assessment

We will adopt a two-stage approach to our environmental assessment of the options.

- A high level assessment of the full range of options; and,
- A more detailed assessment of the practicable options (our shortlisted options)

Our high level assessment will allow us to develop a short list of reasonable alternatives from which we can identify our preferred flood risk management strategy. By undertaking a high level assessment we will be able to rule out environmentally unacceptable options at an early stage and focus our attention on the detailed assessment of more reasonable alternatives.

Our more detailed assessment will focus on identification and consideration of the significant effects that each of the shortlisted flood risk management options might lead to. This will allow us to consider how we can avoid, reduce or offset any adverse effects and allow us to make the most of any potential opportunities to enhance the environment as part of the option.

5.3 Focussing the Assessment

Both levels of assessment will consider the potential impact the LAFRMS may have on the receptors identified in Section 4. These influences, their nature and the potential exposure to changes in the environment brought about by the LAFRMS options on the receptors are summarised in Table 5.1, which provides our initial views on the scope of the environmental assessment. By considering these influences we will be able to focus on the receptors which are mostly likely to be affected by the LAFRMS - identifying those receptors to be included in the assessment and excluding those which will not.

Table 5.1 Assessment topics to be included within the LAFRMS SEA.

| Receptor | LAFRMS influence | Scoped in |
|---|--|------------------|
| Human Beings | | |
| Population and Flood Risk | The LAFRMS and the options considered in it is development will seek to manage flood risk for the benefit of the population within the Study Area. | Yes |
| Human Health, Well Being | The LAFRMS options considered may affect public access to recreational features, goods and public services that can make a material difference to their Quality of Life. The perceived level of flood risk that communities are exposed to may also affect levels of stress and impact on Quality of Life. | Yes |
| Material Assets and critical infrastructure | The LAFRMS options will seek to manage flood risk to critical infrastructure and materials assets within the Study Area. The implementation of options has the potential to disrupt critical transport infrastructure (such as road or rail networks), utilities (such as clean water) or access to community care facilities (hospitals or health centres). The location of such infrastructure may influence the range of available options. | Yes |
| Flora and Fauna | | |
| Biodiversity, Designated Nature Conservation Sites & BAP Habitats and Species | LAFRMS options may include construction, land use change, changes in flood risk, frequency or changes in water levels that have the potential to adversely affect nature conservation and biodiversity features. Alternatively, such changes may present opportunities to improve the condition of existing habitats or create new biodiversity features. | Yes |
| Air and Climate | | |
| Air Quality | The LAFRMS options are unlikely to significantly change air quality within the Study Area. Although emissions associated with construction activities can lead to localised and temporary effects on air quality, these are better assessed and managed at the project level. | No |
| Climate | The LAFRMS options have the potential to lead to an increase in greenhouse gas emissions through construction or intensive maintenance. Alternatively, options may provide an opportunity to reduce emissions by adopting more sustainable approaches to flood management. The flood risk options may provide the opportunity to address any potential increase in flood risk due to climate change. | Yes |
| Water | | |
| Water Quality | Construction, changes in flood risk to areas of potentially contaminated land and changes in flood frequency associated with the LAFRMS options could lead to changes in the waterbodies within the Study Area. Such changes may affect a waterbody's ability to achieve and / or maintain good ecological status. | Yes |
| Water Resources | The LAFRMS options are unlikely to affect water supply within the Study Area, however, the LAFRMS options may affect that way in which major groundwater reserves are exploited within the Study Area. | Yes |

| Receptor | LAFRMS influence | Scoped in |
|--|--|-----------|
| Landscape | | |
| Landscape | The LAFRMS options have the potential to lead to construction activities and land use change which may alter the character and quality of the existing landscape. The options may also provide opportunities to improve landscape quality through the creation or enhancement of landscape features. | Yes |
| Historic Environment | | |
| Cultural Heritage & Archaeology | The LAFRMS options may involve the construction activities, land use changes or alterations to flooding regimes that can adversely affect historic environment sites and their settings. The options may also manage the flood risk to heritage features or lead to improved access to historic environment sites. | Yes |
| Soils, Geology, Land Quality and Land Use | | |
| Soils, Geology & Land Quality | The LAFRMS options may have the potential to degrade or compromise soil quality and/or function and, as a result, what that land can be used for, e.g. by construction activities or increasing the seasonal period during which soil is waterlogged. | Yes |
| Land Use | The options may change the frequency and extent of flooding leading to consequent changes in the use of land affecting its versatility and or productivity. | Yes |
| Natural Resources | | |
| Natural Resources | The LAFRMS options have the potential to lead to changes in flood risk, which may adversely affect the management or ability to exploit natural resources within the Study Area. The construction of new flood management structures may disrupt activities that make use of natural resources, such as coal mining or aggregate extraction. | Yes |

5.4 High level Assessment

We will assess how each of the broad range of flood risk management options might impact on the environment and social receptors in the Study Area. At this stage we will focus our attention on whether the options might create environmental effects in specific locations within the Study Area that we consider at an early stage to be unacceptable. Where we are not able to rule an option out, but we are able to highlight the potential for significant impacts on the environment, we will start to consider how we might avoid or lessen such effects.

Based on the information currently available, we will consider whether options will potentially lead to environmental change through either:

- Increasing or reducing flood risk;
- Changing the ability of the areas of land to be used in a certain way; and,
- Damage or change caused by the need to construct new flood defences or alter existing flood defence or river structures.

By considering the potential for such changes, we will assess whether options have the potential to affect the following types of receptor:

- People, properties and local communities;
- Nationally or internationally protected sites, including SSSIs, SPAs, SACs, Scheduled Monuments;
- Recreational features and facilities;

- Exposure of contaminated land;
- Water quality and river environment; and,
- Land use.

The high level environmental assessment of options will contribute to the development of a practicable shortlist of options that will then be subject to the more detailed environmental assessment. In developing this shortlist we will consider other factors alongside environmental and social issues. These factors include:

- The technical feasibility of potential options;
- The cost required to implement potential options;
- Aspects associated with Health and Safety; and,
- Consideration of how the option fits in with CFMP policy.

5.5 Detailed Assessment

The detailed environmental assessment of the short list of options will consider the environmental effects of each option in relation to each receptor, and whether the likely effect may be significant. We will then use this assessment to evaluate and compare each of the options using 'assessment criteria'.

We have developed draft assessment criteria by considering what we believe to be the key environmental issues that may be influenced by the LAFRMS and how the LAFRMS may affect the environmental objectives of other relevant plans.

5.5.1 Assessment of significance

Our assessment of significance will take into account the value and vulnerability of the receptors in the LAFRMS Study Area and consider their sensitivity to the changes in the environment the options are likely to expose them to. By considering the scale or magnitude of this change we will be able make a judgement on the significance of the effect on the receptor.

When considering the magnitude of change we will be looking at:

- The area or extent of the receptor affected over that area;
- Whether the effect is temporary or permanent and if it is short, medium or long term (include range of years where possible);
- Whether the effect directly or indirectly impacts on the receptor; and,
- Whether there will be cumulative effects.

Cumulative effects can occur when a number of small effects, which may not be significant on their own, accumulate to create a much greater effect on one or more receptor. In understanding how our options might affect receptors in this way we will consider how different elements of an option might combine to create such effects. We will also consider how other plans or policies might cause changes in environment which could combine with the effects of the options in the Study Area.

Table 5.2 sets provides an outline of how the sensitivity of a receptor and magnitude of change define the significance of the effect as major, moderate, minor or not significant. The effect is described as either positive or negative. For example, using the approach shown in Table 5.2, an option which leads to a major reduction in flood risk to a large proportion of a vulnerable urban community would be considered to have lead to a high magnitude of change for a highly sensitive receptor. Under such a scenario we would conclude that the significance of the option's environmental effect would be would be major and positive for the community in question.

Table 5.2 Determining significance of effect

| | | Magnitude of environmental change | | | |
|-------------------------|--------|-----------------------------------|----------------------------|----------------------------|-------------------------|
| | | High | Medium | Low | Very Low |
| Sensitivity of Receptor | High | Major positive/negative | Major positive/negative | Moderate positive/negative | Minor positive/negative |
| | Medium | Major positive/negative | Moderate positive/negative | Minor positive/negative | Not significant |
| | Low | Moderate positive/negative | Minor positive/negative | Not significant | Not significant |

In our assessment we will consider how we might lessen the negative impacts of each option through mitigation. Mitigation can take a number of forms and is very dependent on the nature of the adverse environmental change we are trying to lessen the effect of. Mitigation will therefore include consideration of:

- Alternative ways we might implement an option which might avoid or reduce its negative effects;
- How sensitive design of an option might avoid or reduce its negative effects; and,
- How we might offset the effect of an option by replacing what may be lost or damaged elsewhere.

We will also consider how we might work with others to address flood risk in areas where we cannot justify capital works or continuing maintenance of existing flood defences. In all cases we will make a judgment on how effective we think mitigation can be.

5.5.2 Options Comparison

Once the significance of the effects on receptors has been evaluated and documented for each option, we will use the results of our assessment to test and compare the options using our assessment criteria. The assessment criteria will be used to demonstrate and record the comparative effects each of the options will have on different types of receptor. The assessment criteria also allow us to test how each of the option might contribute to achieving the environmental objectives of other plans or policies, such as BAP or WFD objectives, which are not directly associated with flood risk management.

Table 5.3 presents the draft assessment criteria we have developed following our review of the key issues associated with flood risk management and the receptors within the Study Area.

Consultation on this scoping report will allow for feedback from consultees on the SEA assessment criteria and the potential indicators we will use to test them. Thus the assessment criteria may be subject to change before we carry out our more detailed stage of the environmental assessment.

5.5.3 Enhancements

As part of the development of the LAFRMS we will seek to build on the work we and our partners have undertaken in the past to identify and deliver opportunities for environmental enhancement. Such work includes consideration of potential opportunities identified in our Ridings Area Enhancement Project in the Aire Catchment (Environment Agency 2005).

Potential opportunities noted within the LAFRMS Study Area include:-

- Bankside habitat improvement;

- Wetland or backwater refuge creation;
- Backwater refuge creation only;
- Reconnection of adjacent water features, for example oxbow lakes and borrow pits;
- Weir removal or fishpass creation; and,
- Access, leisure and angling development opportunities.

When we develop our shortlist of options we will identify where these or other potential enhancements might be incorporated in to the way an option might be implemented. Where potential enhancements become part of the option we will ensure that we identify the effects on the environment these may bring.

Table 5.3 SEA Assessment Criteria and Potential Indicators

| LAFRMS Receptors | Assessment Criteria | Potential Indicators |
|---|--|---|
| Receptor: Human Beings | | |
| Properties in: Castleford Knottingley Allerton Bywater Ferrybridge Methley Selby, etc.... | Will the option manage flood risk to people and property? | Properties at flood risk moved into lower flood risk category and number of properties maintained in the low flood risk category. |
| Populations and communities referred to above. Recreational interest including: Navigation – Aire and Calder, Selby Canal Nature conservation – bird watching Public rights of Way, Trans Pennine trail Angling | Will the option protect and improve access to recreational infrastructure, facilities and features that contribute to well being and human health? | Proportion of population benefitting from improved health and well being from the option from factors including reduced stress and greater access to public open space and recreational facilities. |
| Critical transport links, utilities and community infrastructure e.g. schools, hospitals, Water treatment facilities, major transport links. | Will the option protect and improve access to key critical infrastructure? | Proportion of critical infrastructure features adversely or beneficially affected by changes in flood risk or through direct impacts due to flood risk management structure or operations |
| Receptor: Flora and Fauna | | |
| Designated biodiversity sites: Natura 2000 Sites, SSSIs, regional & local sites BAP habitats and species | Will the options lead to improvements in the conservation status of designated and non designated biodiversity features? | Area and value of the Study Area subject to adverse or beneficial changes in flood risk |
| Receptor: Climate | | |
| Carbon footprint of flood risk management operations | Will the option lead to sustainable, carbon neutral approaches to flood risk management? | Balance of carbon sinks and sources resulting from the implementation of the option. |

| LAFRMS Receptors | Assessment Criteria | Potential Indicators |
|--|--|---|
| Receptor: Water | | |
| Watercourses: Aire, Calder, Aire and Calder Navigation, Lin Dyke, Fryston Beck, Wash Dyke, Selby Canal | Will the option increase or reduce the likelihood of watercourses within the Study Area achieving good ecological status by 2015 (in line with the WFD)? | Biological Quality Elements of the watercourses in the LAFRMS Study Area |
| Water resources: Source protection zones Vulnerable aquifers Surface water abstraction sources | Will the option lead to a change in the availability of water resources? | Water resource features adversely or beneficially affected. |
| Receptor: Landscape | | |
| Landscape Character, NCAs, Local Landscape Character Areas, landscape characteristics, elements and features | Will the options lead to the strengthening or degradation of landscape character within the Study Area? | Change in extent, type and condition of key landscape elements and features within the Study Area. |
| Receptor: Historic Environment | | |
| Historic Environment Features Scheduled monuments (Roman forts and medieval structures) Conservation Areas Listed buildings Historic setting | Will the options lead to changes that will affect the integrity and setting of key heritage features within the Study Area? | Number of heritage features with improved or maintained integrity and setting due to flood risk management structures and operations. |
| Receptor: Soils, Geology and Land Quality Land Use | | |
| Urban and Rural and Land Quality Classification and Use | Will the options lead to a change in the availability of the most versatile and productive use of land within the Study Area? | Area of land subject to improved or reduced versatility of land use due to flood risk management structures and operations. |
| Receptor: Natural Resources | | |
| Natural resource reservoirs Coal seams, mineral and aggregate deposits, waste management sites | Will the options lead to a change in the availability of natural resources within the Study Area? | Change in availability or access to reservoirs or natural resources within the Study Area due to flood risk management structures and operations. |

5.6 Monitoring

When we implement the strategy, it is possible that the following effects could occur:

- The predicted significance of an effect is inaccurate.
- Mitigation and enhancement prove to be ineffective.
- A change occurs in the circumstances that affect the assumptions made in the assessment.

To reduce the possibility of these effects occurring, a monitoring plan will be produced and implemented to allow the actual environmental impacts of strategic measures to be tested against the predicted impacts. We will do this by:

- Identifying assessment and monitoring measures that will need to be undertaken where we implement the strategy through individual flood risk management schemes and operations. These will be documented in the scheme level environmental reports and statements;
- Identifying existing or forthcoming monitoring or data collection programme which might be used to review the findings of the strategy; and,
- Setting out the mechanisms for monitoring and the responsibilities we and other third parties will take on.

The monitoring process also helps to ensure that mitigation and enhancement are effective, checks whether unforeseen impacts are occurring and that existing arrangements for monitoring are not duplicated. Monitoring can also be used to address gaps in the data or uncertainty highlighted by the assessment, to provide a more comprehensive baseline when the strategy is reviewed. The implementation and findings of the monitoring plan will be reviewed and reported as a component of the review of the strategy.

Question Box 5

Section 5 outlines how we propose to undertake our environment assessment of the developing LAFRMS and how we have scoped the key environmental issues in the Study Area. This section also highlights a number of potential environmental enhancements that we can consider as part of the LAFRMS.

We would welcome your views on the environmental issues we have scoped in and the assessment criteria we have set for them.

We would also welcome your views on our environmental assessment process.

Are there any additional environmental enhancement we should consider?

6 Consultation and Next Steps

Consultation and engagement are integral to developing the strategy and making sure the SEA is both comprehensive and effective. We would be grateful if you could share your views on our identified key environmental issues and opportunities. You can respond either by email or post to:

Lower Aire Strategy Scoping Consultation

Environment Agency,

Phoenix House,

Global Avenue,

Beeston,

Leeds,

LS11 8PG.

lowerairestrategy@environment-agency.gov.uk

Consultation responses for this study and those made on the draft CFMP will be shared between the two processes to ensure relevant information is used appropriately in both. This scoping consultation period ends on 12th March 2010.

Following this, we will collate the responses and incorporate them as appropriate into our assessment. There will be further opportunities for you to provide input into the actual strategy at a later date.

The results of the environmental assessment will be published in an Environment Report at the same time as the public consultation on the draft FRM Strategy.

Question Box 6

Do you want to be involved in the development of the LAFRMS and the SEA?

Do you want to remain on our list of consultees?

Are there any other consultees that you think we should be involving?

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8 Appendices

Appendix A – Figures

Appendix B – Foresight Future Flooding Flood Risk Management Responses

Appendix C - Relevant Legislation Policy and Guidance

Appendix D – Nature Conservation Site Detailed Information e.g. citations

Appendix E – Historic Environment data

Appendix A – Figures

Appendix B - Foresight Future Flooding Report: Flood Risk Management Responses

Table B.1 Foresight flood risk management responses

| Response Theme | Response Group |
|-------------------------------|---|
| Managing the Rural Landscape | 1. Rural Infiltration: water retention and management of infiltration into the catchment |
| | 2. Catchment-Wide Storage: water retention through storage schemes at all scales |
| | 3. Rural Conveyance: managing conveyance to alter the volume and timing of runoff |
| Managing the Urban Fabric | 4. Urban Storage: increase storage in urban areas |
| | 5. Urban Infiltration: increase infiltration in urban areas |
| | 6. Urban Conveyance: manage conveyance of flood waters through urban areas |
| Managing Flood Events | 7. Pre-Event Measures: to ensure that people and stakeholders are prepared, mitigate negative impacts, and facilitate efficient management of the event |
| | 8. Forecasting and Warning: to provide sufficient time for people and organisations to take effective mitigating actions prior flood water arriving |
| | 9. Flood Fighting: to manage floodwaters and defences during the event |
| | 10. Collective Damage Avoidance Actions: organised or spontaneous removal of people, assets or livestock to a safe location |
| | 11. Individual Damage Avoidance Actions: actions taken by individuals to reduce flood losses including preventing or delaying flood water from entering buildings, and moving people, assets or livestock to safety |
| Managing Flood Losses | 12. Land-Use Management: reduce current exposure to flood loss associated with existing developments |
| | 13. Flood-Proofing: reduce current exposure to flood loss through improved flood resilience |
| | 14. Land-Use Planning: limit increase in exposure to flood loss associated with new developments |
| | 15. Building Codes: limit increase in exposure to flood loss through changing building codes and/or construction practices |
| | 16. Insurance, Share Risk and Compensation: facilitate economic and financial recovery from flood loss |
| | 17. Health and Social Measures: lessen the health, social and practical impacts of flooding |
| | 18. River Conveyance: alter river channel to increase conveyance of flow passed downstream |
| River and Coastal Engineering | 19. Engineered Flood Storage: construct or expand reservoirs, bunds or other impounding structures to increase flood storage |
| | 20. Flood Water Transfer: construct pipes or channels to convey flood waters to an adjacent catchment or drainage system |
| | 21. River Defences: construct or raise linear embankments and build or enhance control structures to contain and manage flood waters |
| | 22. Coastal Defences: construct or raise physical barriers to flooding and coastal erosion |
| | 23. Realignment of Coastal Defences: relocation landwards |
| | 24. Abandonment (managed or unmanaged) of Flood Defences: unmanaged realignment |
| | 25. Reduce Coastal Energy: structures, features or devices to reduce the energy of nearshore waves and currents |
| | 26. Coastal Morphological Protection: allow or encourage changes in coastline to accommodate forcing processes |

Appendix C – Relevant Legislation, Policy and Guidance

Table C.1: Relevant Legislation, Policy and Guidance

| Plan | Strategic Level | Organisation | Considered by CFMP SEA | Review requirements from FRMP SEA | Notes |
|--|-----------------|--|------------------------|-----------------------------------|--|
| Land-Use Planning (Regional and Local Government) | | | | | |
| Yorkshire and Humber Regional Spatial Strategy | Regional | Government Office for Yorkshire and the Humber | Y | 3 | |
| Wakefield Local Development Framework | Wakefield | Wakefield Metropolitan District Council | Y | 2 | LDF yet to be fully adopted by consultation complete in August 2008 |
| Selby Local Development Plan | Selby | Selby District Council | Y | 2 | Formally adopted February 2008 |
| Leeds Unitary Development Plan | Leeds | Leeds City Council | Y | 2 | Adopted in 2006 but will eventually be replaced by a Local Development Framework |
| Boothferry Borough Local Plan | Local | East Riding of Yorkshire Council | N | 1 | Adopted in April 1999 |
| North Yorkshire Minerals and Waste Plan | Regional | North Yorkshire County Council | N | 1 | In use until replaced by the Local Development Framework |
| Flood Risk Management Planning | | | | | |
| Planning Policy Statement 25: Development and Flood Risk | National | Communities and Local Government | Y | 3 | High Level Strategic Guidance. Will have been incorporated into low level PPPs. |
| Other Water Management Planning | | | | | |
| Humber River Basin Management Plan | Regional | Environment Agency | Y | 1 | |
| Aire and Calder Navigation Act | Local | UK Government | N | 1 | |
| Yorkshire Water, Water Resource Management Plan | Regional | Yorkshire Water | N | 1 | |
| Making Space for Water | England | Defra | Y | 3 | Policy considered at CFMP level, no local policy |
| Water Level Management | Local | Defra | Y | 1 | |

1 - Review required for LAFRMS

2 – Strategic context taken from CFMP SEA, LAFRMS review to establish local policy context only

3 – No review required

| Plan | Strategic Level | Organisation | Considered by CFMP SEA | Review requirements from FRMP SEA | Notes |
|--|-----------------|--|------------------------|-----------------------------------|---|
| Plans | | | | | |
| Future Water Strategy | National | Defra | Y | 3 | |
| Millennium Communities Programme | National | UK Government | N | 2 | |
| Foresight Future Flooding Report | National | Office of Science and Technology | Y | 1 | |
| Aire and Calder CAMS | Local | Environment Agency | Y | 1 | |
| Environment/Biodiversity Plans | | | | | |
| Local Biodiversity Action Plans | Local | Leeds City Council, Selby District Council, East Riding of Yorkshire Council and Wakefield Metropolitan District Council | Y | 2 | |
| North East Regional Habitat Creation Programme | Regional | Environment Agency | N | 1 | Incorporated through liaison with RHCP representative |
| Wetland Vision for Yorkshire and the Humber | Regional | RSPB, Natural England, Environment Agency and Countryside Agency | Y | 2 | |
| Other Plans | | | | | |
| Planning Policy Statement 23: Planning and Pollution Control | National | Office of the Deputy Prime Minister | N | 1 | |
| CLR 11 | National | Environment Agency | N | 1 | |
| 'Securing the Future' UK Government Sustainable Development Strategy | National | Defra | Y | 2 | |
| Sustainable Development Action Plan | National | Defra | Y | 2 | |

1 - Review required for LAFRMS

2 - Strategic context taken from CFMP SEA, LAFRMS review to establish local policy context only

3 - No review required

| Plan | Strategic Level | Organisation | Considered by CFMP SEA | Review requirements from FRMP SEA | Notes |
|-------------------------------------|-----------------|--------------------|------------------------|-----------------------------------|-------|
| Environment Agency Outcome Measures | National | Environment Agency | Y | 2 | |
| Habitats Regulations | National | UK Government | Y | 2 | |
| Humber Eel Management Plan | Regional | Defra | N | 2 | |

1 - Review required for LAFRMS

2 – Strategic context taken from CFMP SEA, LAFRMS review to establish local policy context only

3 – No review required

Appendix D - Nature Conservation Site Detailed Information

Table 6.2 – Nature Conservation Sites

| Figure Ref | Name | Description/Conservation feature/Condition |
|--|---|---|
| Natura 2000 Sites | | |
| 1 | Humber Estuary SAC, SPA and Ramsar Site | <p>The second-largest coastal plain estuary in the UK, and the largest coastal plain estuary on the east coast of Britain. It is a muddy, macro-tidal estuary, fed by the Rivers Ouse (of which the River Aire is a tributary), Trent and Hull, Ancholme and Graveney.</p> <p>Habitats within the Humber Estuary SAC include Atlantic salt meadows; a range of sand dune types in the outer estuary; subtidal sandbanks; extensive intertidal mudflats; glasswort beds and coastal lagoons.</p> <p>The upstream section of the estuary is situated within the LAFRMS study area. This section is characterized by reedbeds and brackish saltmarsh communities fringing the estuary. Significant fish species include river lamprey (<i>Lampetra fluviatilis</i>) and sea lamprey (<i>Petromyzon marinus</i>).</p> <p>The Humber Estuary SPA supports internationally important bird populations including breeding little tern (<i>Sterna albifrons</i>), marsh harrier (<i>Circus aeruginosus</i>); over wintering bar-tailed godwit (<i>Limosa lapponica</i>), Bittern (<i>Botaurus stellaris</i>), Golden Plover (<i>Pluvialis apricaria</i>), Hen Harrier (<i>Circus cyaneus</i>); and migratory Redshank (<i>Tringa tetanus</i>), Sanderling (<i>Calidris alba</i>), Dunlin (<i>Calidris alpina alpina</i>), Knot (<i>Calidris canutus</i>), and Shelduck (<i>Tadorna tadorna</i>)</p> <p>The Humber also supports an internationally important assemblage of over 180,000 birds.</p> <p>In addition to the SPA and SAC features noted above the Ramsar site also recognises the important habitats that support the second largest grey seal colony in England and the furthest south regular breeding site on the east coast the most north-easterly breeding site in Great Britain of the natterjack toad (<i>Bufo calamita</i>).</p> |
| Sites of Special Scientific Interest (SSSI) | | |
| 1 | Mickletown Ings | <p>Formed by the progressive inundation of subsiding former coal mining sites and low-lying fields. The site now supports the most diverse aquatic flora and invertebrate fauna found within West Yorkshire.</p> <p>Mickletown Ings is also of ornithological interest, due to the number of passage and overwintering fowl. Flocks of coot, tufted duck and whooper swans use the site. Breeding species include dabchick, pochard and a large population of reed warbler.</p> <p>The condition of the SSSI is considered to be in unfavourable and declining condition due to excessive drainage of the site associated with historic changes with land use and water level management in adjacent areas. The site is highly sensitive to nutrient and other potential pollutant inputs which might be carried by normal river inputs or flood water.</p> |

| Figure Ref | Name | Description/Conservation feature/Condition |
|------------|--------------------------|--|
| 2 | Fairburn & Newton Ings | <p>Consist of former ings along the river which have been permanently flooded in part as a result of mining subsidence, forming a series of interconnected permanent waterbodies. There are extensive areas of marsh and wet pasture providing a range of different habitats.</p> <p>The site attracts a large number of birds and is particularly noted for its wintering wildfowl and for the variety of migrants. The SSSI is considered to be in unfavourable and declining condition due to eutrophication, a result of floodwaters remaining on site for extended periods of time allowing excessive silt and nutrient load to settle out. Storm flow (via Lin Dyke) from an adjacent sewage works may also contribute to the site's poor condition. As a result the site is highly sensitive to additional deposition of silt and associated pollutants</p> |
| 3 | Madbanks & Ledsham Banks | <p>Consists of two separate areas of permanent pasture developed over steep banks of magnesian limestone at an altitude of around 40m above sea level. A rich flora has developed on the grasslands through a traditional management and grazing regimes. Few areas of unimproved magnesian limestone grassland remain in West Yorkshire and both Madbanks and Ledsham banks exhibit features poorly represented or absent elsewhere in the county.</p> |
| 4 | Townclose Hills | <p>Comprises a knoll of magnesian limestone, rising to about 78 metres above sea level, supporting permanent ungrazed grassland, with some colonisation of hawthorn and bramble. Only eight unimproved magnesian limestone grasslands of over 1ha are known in West Yorkshire, with Townclose Hills being the largest of them.</p> |
| 5 | Roach Lime Hills | <p>Comprises an area of permanent grassland on magnesian limestone. It is considered the best remaining example of magnesian limestone grassland in West Yorkshire.</p> |

LBAP Species

| LBAP Name | Species listed |
|-----------------|---|
| Leeds BAP | Pasqueflower (<i>Pulsatilla vulgaris</i>) |
| | Thistle broomrape (<i>Orobanche reticulata</i>) |
| | Harvest mouse (<i>Micromys minutus</i>) |
| | Pipistrelle bat (<i>Pipistrellus spp.</i>) |
| | Atlantic-stream or White-clawed crayfish (<i>Austropotamobius pallipes</i>) |
| | Great crested newt (<i>Triturus triturus</i>) |
| Wakefield BAP | Wolverine (<i>Arvicola amphibius</i>) |
| | Great crested newt (<i>Triturus triturus</i>) |
| Selby BAP | Great crested newt (<i>Triturus triturus</i>) |
| | Wolverine (<i>Arvicola amphibius</i>) |
| | Brown hare (<i>Lepus europeaus</i>) |
| | Otter (<i>Lutra lutra</i>) |
| | Depressed River Mussel (<i>Pseudanodonta complanata</i>) |
| East Riding BAP | Atlantic-stream or White-clawed crayfish (<i>Austropotamobius pallipes</i>) |
| | Otter (<i>Lutra lutra</i>) |
| | Water Vole (<i>Arvicola amphibius</i>) |

Protected species locations within the LAFRMS study area

| Common Name | Location | Flood Cell Ref |
|-------------|---|-------------------------------|
| Water vole | Lemonroyd Lock Methley Mires Selby Canal - confluence [Selby Canal] Willowgarth N. R | 1b, 3d, 4b, 4c & 5a 13a |
| Otter | River Ouse, West Huddersley, Selby Canal & Rawcliffe River Aire Acaster Malbis to Acaster Selby, York | 10j,10m,10n |

Birds

Data on the number of birds and their locations have been received from the two biological records centres. The following BAP species are present in differing numbers and locations throughout the study area:

- Bittern
- Bullfinch
- Common Scoter
- Corncrake
- Grey Partridge
- Linnet
- Nightjar
- Red-Backed Shrike
- Red-Necked Phalarope
- Reed Bunting
- Roseate Tern
- Skylark
- Song Thrush

- Spotted Flycatcher
- Tree Sparrow
- Turtle Dove
- Woodlark
- Wryneck

There are a number of RSPB reserves within the study area, notably at Fairburn Ings and the developing St Aidans site. Some of these BAP bird species are present at the reserves, but also across the study area, see Figure 5.

Appendix E – Historic Environment data

Table 6.3 Scheduled Monuments within the Study Area

| SM Name | Description | Grid Ref (SE) | SM # |
|------------------------------------|---|----------------------|-------------|
| Ferrybridge, near Ferrybridge | Site of a medieval bridge (1198) standing at the crossing point of the Great North Road over the River Aire. Rebuilt at the end of the 14 th Century with seven pillars and a chantry chapel at one end. | 483 246 | WY75 |
| Barlow Hall | Medieval settlement and early post-medieval garden earthworks dating from the 16 th century. The monument includes the buried and earthwork remains. The monument is divided into two areas of protection. | 643 290 645 289 | 30130 |
| Scurff Hall Moated Site | The monument includes the buried and earthwork remains of a medieval moated manor house set within a larger moated enclosure and the remains of ridge and furrow earthworks. | 687263 | 30117 |
| Castle Hill Moated Site | Remains of a typical nobleman's moated manor house of the 12 th to 13 th centuries, with a 55m square island raised above the level of the surrounding fields with material dug from a deep encircling moat ditch. | 676 260 | 30108 |
| Roman fort 600m West of Roall Hall | The monument includes the buried remains of a Roman fort and associated features located on a sandstone promontory on the south side of the River Aire flood plain. | 564 252 | 30128 |
| Fairburn Ings – Newton Abbey Moat | The moat at Fairburn Ings Nature Reserve is situated on low ground between the River Aire and the higher limestone area to the north. Although the moated site is now located within the area of an artificial lake, the site is not entirely submerged; hence details of its form are still visible. | 444 277 | 13285 |
| Drax Augustinian Priory | The buried and earthwork remains of an Augustinian priory sited on an island of high ground which is now partly occupied by Drax Abbey Farm, just south of the River Ouse. | 466 428 | 32628 |
| Hall Garths Moated Site | The buried and earthwork remains of a medieval moated manor house site located immediately to the south of the 14 th century St Mary's Church. | 476 425 | 30129 |
| Thorpe Hall Moated Monastic Grange | The remains of a medieval moated manor house site on the north bank of the medieval drainage channel Selby Dam, to the north of Thorpe Willoughby village. | 457 431 | 30113 |

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