Bedford Borough Council Local Flood Risk Management Strategy

Strategic Environmental Assessment

Environmental Report
May 2014

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Contract

This report describes work commissioned by Bedford Borough Council. Jonathan Harrison, David Revill and Laura Thomas of JBA Consulting carried out this work.

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Purpose

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Non-Technical Summary

Bedford Borough Council is currently preparing a Local Flood Risk Management Strategy (LFRMS). As part of this process, the Council is also carrying out a Strategic Environmental Assessment (SEA), which considers the likely significant environmental impacts associated with the implementation of the LFRMS. This Environmental Report sets out findings of the SEA. A proportionate approach was adopted towards establishing the scope of the SEA, reflecting the high-level nature of the LFRMS. It has been produced in conjunction with the SEA Regulations and follows the guidance contained within *A Practical Guide to the Strategic Environmental Assessment Directive* (ODPM, 2005).

The full range of environmental receptors has been considered through the SEA. This meets the requirements of the SEA Directive, which requires that an assessment identifies the potentially significant environmental impacts on *'biodiversity, population, human health, fauna, flora, soil, water, air, climatic, material assets including architectural and archaeological heritage, landscape and the interrelationship between the above factors'*.

An SEA Scoping Report for the LFRMS was previously prepared and issued to the statutory consultation bodies in January 2014. A number of comments were received on the scope of the assessment and assessment framework, which were incorporated into the preparation of this Environmental Report.

Assessment of the SEA objectives against three management options ('do nothing', 'maintain current flood risk management regime' and 'manage and reduce local flood risk') was undertaken. This identified the potential impacts on the environment associated with these different management actions.

The 'do nothing' option is likely to result in a number of significant adverse impacts, particularly in relation to people and property, and other environmental assets including historic sites and biodiversity, where increased flooding may create new pathways for the spread of invasive non-native species. Surface water and groundwater quality could also be adversely affected, with increased flooding of contaminated sites leading to greater impacts on water resources. Conversely, increased flood risk may result in greater connectivity between watercourse and their floodplains, offering opportunities for habitat creation of benefit to a range of protected and notable species.

The option to 'maintain current flood risk management regime' is likely to result in little or no change in the environmental baseline in the short to medium term as the existing flood risk management actions continue to maintain existing levels of flood protection. However, in the future, as a result of climate change, flood risk will increase, resulting in many of the impacts identified under the do nothing option, although potentially to a lesser extent and significance.

The option to 'manage and reduce local flood risk' has the potential to provide a range of environmental benefits. Flood risk management initiatives, if designed and implemented in an appropriate manner, could have multiple benefits including reducing flood risk to people and property, contributing to the protection of heritage assets and improvements in water quality, and providing new opportunities for habitat creation and the provision of recreation and amenity assets.

Therefore, it is evident that by doing nothing or maintaining current levels of flood risk management, there are likely to be significant adverse effects on the environment, which are likely to be prevented by carrying out active flood risk management as proposed by the LFRMS.

Assessment of the LFRMS objectives and underpinning measures against the SEA objectives has also been undertaken. No negative environmental impacts have been identified; although a range of unknown effects have been highlighted.

Many of the proposed LFRMS measures have the potential for both direct and indirect environmental benefits. Strategy objective 5 in particular has potential to provide a positive contribution to all of the SEA objectives and make a significant positive contribution to many of them. In addition, measures to promote the use of SuDS (objectives 2 and 5) and encourage better design and more effective maintenance have the potential to achieve a range of potential

benefits. In particular, the LFRMS could achieve a range of biodiversity benefits, including new habitat creation, enhancement of existing habitats and greater habitat connectivity.

In addition, as expected of a strategy for managing flood risk, the majority of measures within the strategy will contribute to achievement of the SEA objectives that seek to reduce flood risk to people, property and infrastructure. As a result, the strategy is likely to have a significant positive effect on reducing flood risk to local communities.

Each of the strategy objectives is also likely to assist with climate change adaptation. In particular, measures that reduce flood risk, promote better use of water resources, seek to deliver new habitat creation and better connection between existing habitats (such as de-culverting), could make a significant positive contribution to achievement of this SEA objective.

The LFRMS should seek to maximise the potential environmental benefits associated with delivery of these objectives/measures. This can be best achieved through the integration of LFRMS objectives and through close partnership working, so that appropriate resources and funding are effectively allocated.

At present, the potential effects associated with several of the LFRMS measures are unknown. Several measures (associated with objectives 4, 6 and 7) may result in physical interventions that could affect achievement of several other SEA objectives, depending upon how they are implemented. The uncertainty of the impacts in this assessment associated with such measures arises from a lack of specific information relating to their delivery. However, these measures could conceivably cause a range of negative and positive environmental effects depending upon how they are implemented. In order to ensure that the LFRMS does not result in adverse effects, all strategy objectives should be integrated so that delivery of individual measures does not conflict with achievement of the wider strategy objectives. In addition, development and implementation of these measures should be effectively managed by ensuring that, where necessary, proposals are assessed to determine their potential environmental effects (positive and negative) in advance of their implementation and that appropriate mitigation measures are built into their delivery as required.

The SEA Regulations require Bedford Borough Council to monitor the significant environmental effects (positive and negative) upon the implementation of the LFRMS. Key potential environmental effects that require monitoring have been identified together with the monitoring indicators that can be applied to track whether such effects occur. Possible partners for monitoring responsibility are also highlighted.

This Environmental Report will be subject to public consultation for 8 weeks alongside the Bedford Borough Council Flood Risk Management Strategy. All consultation responses received will be reviewed and taken into consideration for the next stage of appraisal process. This will involve the preparation of a Statement of Environmental Particulars (SoEP), which will set out how the findings of the Environmental Report and the views expressed during the consultation period have been taken into account as the LFRMS has been finalised and formally approved. The SoEP will also set out any additional monitoring requirements needed to track the significant environmental effects of the strategy

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Abbreviations

ALC ..... Agricultural Land Classification
AQMA ..... Air Quality Management Area
AQO ..... Air Quality Objectives
AONB ..... Area of Outstanding Natural Beauty
BAP ..... Biodiversity Action Plan
CAMS ..... Catchment Abstraction Management Strategy
CWS ..... County Wildlife Site
GI ..... Green Infrastructure
FRM ..... Flood Risk Management
HAP ..... Habitat Action Plan
IDB ..... Internal Drainage Board
JBA ..... Jeremy Benn Associates
LBAP ..... Local Biodiversity Action Plan
LFRMS ..... Local Flood Risk Management Strategy
LGA ..... Local Government Association
LLFA ..... Lead Local Flood Authority
LNR ..... Local Nature Reserve
ODPM ..... Office of the Deputy Prime Minister
OS ..... Ordnance Survey
RBMP ..... River Basin Management Plan
NCA ..... National Character Area
NNR ..... National Nature Reserve
PFRA ..... Preliminary Flood Risk Assessment
SA ..... Sustainability Appraisal
SAB ..... SuDS Approval Body
SAC ..... Special Area of Conservation
SAP ..... Species Action Plan
SEA ..... Strategic Environmental Assessment
SoEP ..... Statement of Environmental Particulars
SPA ..... Special Protection Area
SPZ ..... Source Protection Zone
SSSI ..... Site of Special Scientific Interest
SuDS ..... Sustainable Drainage Systems
UWWTD ..... Urban Waste Water Treatment Directive
WCS ..... Water Cycle Strategy
WFD ..... Water Framework Directive

1 Introduction

1.1 Background

Bedford Borough Council is currently preparing a Local Flood Risk Management Strategy (LFRMS). As part of this process, the Council is also carrying out a Strategic Environmental Assessment (SEA), which considers the potential environmental impacts of the LFRMS. This Environmental Report sets out findings of the SEA. It has been produced in conjunction with *The Environmental Assessment of Plans and Programmes Regulations 2004* (hereafter referred to as the 'SEA Regulations') and follows the guidance contained within *A Practical Guide to the Strategic Environmental Assessment Directive* (ODPM, 2005).

The ODPM guidance sets out a five stage process (A to E) to be followed (see Table 1-1). This report addresses stages B and C of the SEA process wherein LFRMS options and alternatives are identified and the predicted environmental effects of the LFRMS are assessed.

Consultation (Stage D) on this Environmental Report, which will be conducted as outlined in Section 7.1 of this document, whilst monitoring of the significant effects of the LFRMS (Stage E) will be undertaken in accordance with the outline monitoring programme included in Section 6.3.

Table 1-1: Stages in the SEA process

SEA Stage	Purpose
Stage A	Setting the context and objectives, establishing the baseline and deciding on the scope
Stage B	Developing and refining alternatives and assessing effects
Stage C	Preparing the Environmental Report
Stage D	Consulting on the draft plan or programme and the Environmental Report
Stage E	Monitoring the significant effects of implementing the plan or programme on the environment.

1.2 Strategic Environmental Assessment (SEA)

SEA is a statutory assessment process required under European Directive 2001/42/EC *on the assessment of the effects of certain plans and programmes on the environment* (the 'SEA Directive')[1]. The Directive requires formal assessment of plans and programmes that are likely to have significant effects (either positive or negative) on the environment. It applies to all plans and programmes which are *'subject to preparation and/or adoption by an authority at national, regional or local level'* or are *'required by legislative, regulatory or administrative provisions'*[2]. The requirements of the Directive are transposed into UK law through the SEA Regulations.

Local Government Association (LGA) guidance[3] on the production of the LFRMS identifies the likely requirement for an SEA, stating that *'the Local* [Flood Risk Management] *FRM Strategy is likely to require statutory SEA, but this requirement is something the* [Lead Local Flood Authority] *LLFA must consider'*. A SEA screening process was therefore undertaken and the Council has confirmed the requirement for its LFRMS to undergo SEA.

SEA involves the systematic identification and evaluation of the potential environmental impacts of the LFRMS. This information is then used to aid the selection of a preferred option(s) for the strategy, which are those that best meet its economic, environmental and social objectives, and legal requirements.

The full range of environmental receptors has been considered through the SEA. This meets the requirements of the SEA Directive, which requires that an assessment identifies the potentially significant environmental impacts on *'biodiversity, population, human health, fauna, flora, soil, water, air, climatic, material assets including architectural and archaeological heritage, landscape and the interrelationship between the above factors'*[1].

[1] Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment

[2] Office of the Deputy Prime Minister (2004), Environmental Assessment of Plans and Programmes Regulations 2004 (No. 1633)

[3] Local Government Association (2011), Framework to Assist the Development of the Local Strategy for Flood Risk Management.

Annex I of the SEA Directive sets out the scope of information to be provided by the SEA. This is described in Table 1-2 below, which also identifies where in the SEA process for the LFRMS that the relevant requirement will be met.

Table 1-2: Stages in the SEA process as identified within Annex I of the SEA Directive

SEA Directive requirements	Where covered in the SEA
(a) an outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes;	Section 1.3
(b) the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme;	Section 2
(c) the environmental characteristics of areas likely to be significantly affected;	Section 2
(d) any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC;	Section 2
(e) the environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation;	Section 2
(f) the likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors;	Sections 4 and 5
(g) the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme;	Section 5
(h) an outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;	Section 4
(i) a description of the measures envisaged concerning monitoring in accordance with Article 10;	Section 6.3
(j) a non-technical summary of the information provided under the above headings.	Executive summary

The first output from the SEA process is the production of a Scoping Report[4], which outlines the scope and methodology of the assessment. A proportionate approach was adopted towards establishing the scope of the SEA, reflecting the high-level nature of the LFRMS. Consultation with the statutory consultees (English Heritage, Natural England and the Environment Agency) was undertaken in January 2014 to confirm the baseline environment of the study area and the assessment framework (see Section 1.5 for further information).

This Environmental Report has now been prepared to set out the likely significant impacts on the environment of implementing the LFRMS.

1.3 The Local Flood Risk Management Strategy (LFRMS)

The Flood and Water Management Act (FWMA) was passed in April 2010. It aims to improve both flood risk management and the way we manage our water resources. The FWMA creates clearer roles and responsibilities and instils a more risk-based approach to flood risk management. This includes a new lead role for the Council as a Lead Local Flood Authority (LLFA) in managing and leading on local flood risk management from surface water, groundwater and ordinary watercourses.

Under the requirements of the FWMA, the Council must develop, maintain, apply and monitor a LFRMS for local flood risk management in its area. The LFRMS provides a delivery vehicle for improved flood risk management and supports the development of partnership funding and a strategic investment programme.

[4] JBA Consulting (2013), Bedford Borough Council Local Flood Risk Management Strategy. Strategic Environmental Assessment (SEA) Scoping Report (12 December 2013)

The LFRMS will set out:

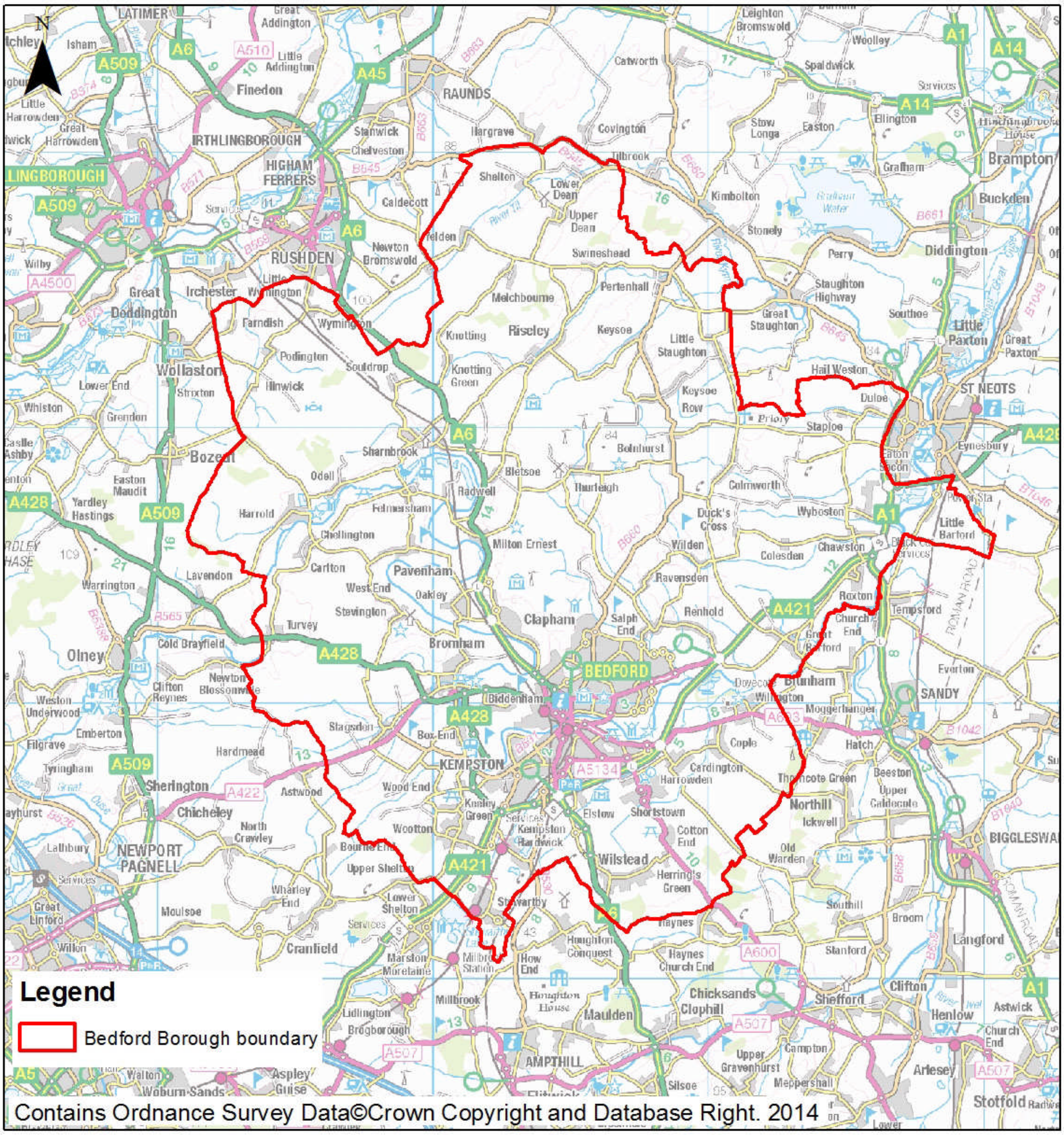
- The roles and responsibilities for each Risk Management Authority (RMA) and their flood risk management functions; and
- Opportunities, objectives and measures for flood risk reduction of existing communities, including ways to minimise the risk from future growth.

Development of the LFRMS provides considerable opportunities to improve and integrate land use planning and flood risk management. It is an important tool to protect vulnerable communities and deliver sustainable regeneration and growth.

1.4 The study area

Bedford Borough is a unitary authority located in the county of Bedfordshire in the east of England (See Figure 1-1). It takes its name from its largest settlement, Bedford, which forms the principal urban area in an otherwise largely rural borough. The Borough covers an area of approximately 475 km^2 (183 square miles) and has a population of approximately 160,000 people. It is bounded to the north by the districts of Wellingborough and East Northamptonshire, with Central Bedfordshire to the south, Huntingdonshire to the east and Milton Keynes to the west.

Figure 1-1: Extent of the study area



1.5 SEA scoping

The SEA Scoping Report for the LFRMS was issued to the statutory consultation bodies in January 2014. A number of comments were received on the scope of the assessment and assessment framework. Table 1-3 below summarises the comments received and how they have been addressed within this Environmental Report.

Table 1-3: SEA scoping consultation responses

Consultee	Comment received	Action taken
Natural England	Natural England is satisfied with the baseline description with regard to landscape, biodiversity and geology and soils and with the decision to scope these themes in to the SEA.	No action required.
	With regard to objective 2 we would recommend that the indicator makes a distinction according to the status of the habitat affected, e.g. impacts to a Site of Special Scientific Interest (SSSI) should be considered to be of greater significance than to a County Wildlife Site.	The indicators for SEA objective 2 have been amended to distinguish between statutory and non-statutory designated sites.
	The indicator for objective 7 could be improved by distinguishing impacts to areas of higher and lower land quality under the Agricultural Land Classification (ALC).	The indicators for SEA objective 7 have been amended to distinguish between higher (ALC Grade 1-3) and lower (ALC Grade 4-5) quality land.
	With regards to Habitats Regulations Assessment (HRA) screening Natural England is satisfied with the assessment at this time. We agree that the LFRMS is not likely to have a significant effect to Eversden and Wimpole Woods Special Area of Conservation (SAC) and that, providing the flow regime and water quality of the River Ouse is unaffected, that there would be no likely significant effect to Portholme SAC. Given the lack of detail on the strategy we would agree that a likely significant effect to the Upper Nene Valley Gravel Pits Special Protected Area (SPA) and Ramsar cannot currently be ruled out. However this issue should be reviewed when more information is available.	The HRA has been reviewed and amended to assess the strategy objectives and measures.
Environment Agency	Various minor additions and clarifications required to environmental baseline information.	Amendments to the baseline environmental information have been made to address Environment Agency comments.
English Heritage	English Heritage recommends that our updated guidance (2013) on Strategic Environmental Assessment (SEA) / Sustainability Appraisal (SA) and the Historic Environment is used to inform the environmental assessment.	Comment noted.
	Makes recommendations for the review of several national and local level plans and programmes within the SEA.	These plans have already been assessed within the Scoping Report.
	We are concerned that the section on the Historic Environment at paragraph 4.6 on page 18 of the report only lists the numbers of designated heritage assets and makes no reference to non-designated heritage assets, particularly undesignated archaeology, which includes preserved organic and palaeo- environmental remains; some of this undesignated archaeology may be nationally important.	This aspect has been addressed in this Environmental Report with specific information now included to highlight the importance of non-designated heritage assets.
	The data on Heritage at Risk is out of date. The 2013 register has 11 entries for Bedford Borough, consisting of 1 building or structure; 1 Place of Worship; 8 archaeological sites and 1 conservation area.	Comment noted and information amended.

Consultee	Comment received	Action taken
	We note that there is no reference to any historic landscape characterisation studies, such as the Bedfordshire Historic Landscape Characterisation; a greater understanding of the historic character of the landscape needs to be reflected in the report.	Comment noted and reference to and summary of study included.
	We recommend that this is amended as follows to reflect current terminology and the possible impact on setting of flood alleviation works: *'Preserve and, where possible, enhance ~~important historic and cultural sites~~ heritage assets in the Borough and ensure that their settings are protected and enhanced.'*	Comment noted and SEA objective amended.
	With respect to specific indicators for the strategy additional, topic specific indicators might include: • Number of heritage assets at risk of flooding. • Proportion of conservation areas at risk from flooding, which could be expressed either as the number of conservation areas at risk from flooding as a proportion of the total number of conservation areas or the area of conservation areas at risk as a proportion of the total area of conservation areas designated in the county. • Number of flood risk management measures implemented that conserve and enhance heritage assets. • Number of designated and non-designated heritage assets harmed by flood risk management measures, including impacts on their settings.	Comments noted and additional SEA indicators included in SEA framework.

1.6 Habitats Regulations Assessment

The European Council Directive on *the Conservation of Natural Habitats and of Wild Fauna and Flora* (92/43/EEC, 'the Habitats Directive') as implemented through the Conservation of Habitats and Species Regulation 2010 (as amended) ('the Habitats Regulations') requires a competent authority to carry out a Habitats Regulations Assessment (HRA) of a plan or project to establish whether it will have a 'likely significant effect' on sites designated for their nature conservation interest at an international level (known as European sites, which include Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and by UK Government policy, Ramsar sites). The LFRMS for Bedford Borough, as a statutory plan, is subject to the requirements of the Habitats Directive.

Assessing the impacts of a plan under the Habitats Regulations is a separate process to SEA. However, there is overlap between these two types of assessment. A Test of Likely Significant Effect (Screening Assessment) was undertaken in accordance with the requirements of the Habitats Regulations to determine whether the LFRMS would be likely to adversely affect the integrity of a European site (alone or in combination with other plans, policies and projects). The outcomes of this screening assessment were documented in the SEA Scoping Report[4] and consultation on the assessment was undertaken as part of the SEA scoping consultation process.

All European sites lying partially or wholly within 15km of the Borough boundary were included in the assessment in order to address the fact that measures in the Bedford LFRMS may affect European sites which are located outside the administrative boundary of the strategy.

Bedford Borough does not support any European sites (SACs, SPAs and Ramsar sites). However, there are four European sites within 15km of the Borough boundary:

- Upper Nene Valley Gravel Pits SPA
- Upper Nene Valley Gravel Pits Ramsar
- Portholme SAC
- Eversden and Wimpole Woods SAC

The screening assessment concluded that the LFRMS is not likely to have a significant effect on Portholme SAC and Eversden and Wimpole Woods SAC. In relation to the Upper Nene Valley Gravel Pits SPA and Ramsar site, whilst located outside the Borough area, the sites are hydrologically linked to the Borough by Knuston Brook, which flows northwards from Hinwick and Podington, before passing through the SPA and Ramsar and joining the River Nene to the west of Rushden. Ordnance Survey (OS) mapping indicates that other small streams in the north of the Borough may also connect into the River Nene and be linked to the designated sites.

At the scoping consultation stage, the objectives and measures to be implemented by the LFRMS were yet to be determined and so it was not known whether the strategy could result in changes to surface water drainage and river flow in the north of the Borough, which could in turn affect the Upper Nene Gravel Pits SPA and Ramsar sites. The precautionary principle was therefore applied and the screening assessment concluded that it was not possible to identify that the LFRMS would not be likely to have a significant effect on these sites. It was recommended that an Appropriate Assessment be undertaken in relation to these two sites once the strategy measures were identified.

Following development of the draft strategy objectives and measures, the screening assessment was reviewed to determine whether the LFRMS would be likely to have a significant effect on the Upper Nene Gravel Pits SPA and Ramsar site.

The outcome of this revised screening assessment is documented in Appendix 0 of this report and a summary of its outcomes is provided in Section 6.4. Consultation with Natural England on the outcomes of this assessment will be undertaken as part of the consultation process outlined in Section 7.

2 Environmental baseline

2.1 Introduction

The following section presents the findings of the SEA Scoping Report[4], which identified the context and objectives of the LFRMS and identified and the scope of the assessment.

2.2 Other relevant plans, programmes and environmental protection objectives

As part of the SEA process, an assessment of the integration of existing policies, plans and programmes on the proposed LFRMS is required. This is to address the requirement within the SEA Directive to determine the *'relationship [of the plan or programme] with other relevant plans and programmes'* (Annex I (a)), including, *'environmental protection objectives, established at international, [European] community or [national] level'* (Annex I (e)).

Identifying these relationships enables potential synergies to be determined, strengthening the benefits that can be gained from implementation of the LFRMS. This information is also used to inform the development of the environmental baseline and the identification of key issues and problems. In addition, any inconsistencies or constraints can be identified, which could hinder the achievement of the environmental protection objectives or those of the LFRMS, and therefore providing a broad appraisal of the strategy's compliance with international, national and local considerations.

The ODPM SEA guidance recognises that no list of plans or programmes can be definitive and as a result this report describes only the key documents that may influence the LFRMS. These are shown in Table 2-1.

Table 2-1: Policies, plans and programmes reviewed through this SEA process

Plan, Policy or Programme
International
EU Sustainable Development Strategy (revised 2006)
European Biodiversity Strategy to 2020
EC Birds Directive – Council Directive 2009/147/EEC on the conservation of wild birds
EU Floods Directive – Directive 2007/60/EC on the assessment and management of flood risks
EU Groundwater Directive – Directive 2006/118/EC on the protection of groundwater against pollution and deterioration
EC Habitats Directive – Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora
Urban Wastewater Treatment Directive – Directive 91/271/EEC concerning urban waste water treatment
EU Water Framework Directive – Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy
National
Securing the Future – the UK Government Sustainable Development Strategy (2005)
Flood and Water Management Act (2010)
Flood Risk Regulations (2009)
Water for People and the Environment, Water Resources Strategy for England and Wales (2009)
Future Water, The Government's water strategy for England (2008)
Making Space for Water – taking forward a new Government strategy for flood and coastal erosion risk management in England (2005)
The National Flood and Coastal Erosion Risk Management Strategy for England (2011)
Water Act (2003)
Draft Water Bill (2012)
The National Flood Emergency Framework for England (2011)
The Carbon Plan (2011)
Building a Low Carbon Economy – the UK's Contribution to Tackling Climate Change (2008)
Climate Change Act (2008)
Biodiversity 2020: A Strategy for England's Wildlife and Ecosystems (2011)

Plan, Policy or Programme
England Biodiversity Framework (2008)
UK Biodiversity Action Plan (1994)
National Wetland Vision (2008)
Wildlife and Countryside Act (as amended) (1981)
Natural Environment and Rural Communities (NERC) Act (2006)
Salmon and Freshwater Fisheries Act (1975)
Contaminated Land (England) Regulations (2006)
Heritage Protection for the 21st Century, White Paper (2007)
National Planning Policy Framework (2012)
Regional / Local
River Basin Management Plan Anglian River Basin District (2009)
The Upper Ouse and Bedford Ouse Catchment Abstraction Management Strategy (2013)
Preliminary Flood Risk Assessment for Bedford Borough Council, Central Bedfordshire Council and Milton Keynes Council (2011)
River Great Ouse Catchment Flood Management Plan (2011)
Bedford Borough Council Development Plan Document: Core Strategy and Rural Issues Plan (2008)
Bedford Borough Local Plan (2002)
Bedfordshire & Luton Biodiversity Action Plan (2013)
Bedford Borough Health and Well Being Strategy (2012)
Bedford Borough Council Local Transport Plan (2011)
Bedford Green Infrastructure Plan (2009)
Bedford Waterspaces: Economic Impact & Opportunities Study (2011)

2.3 Environmental characteristics and key issues

A search of baseline environmental information was undertaken to identify the key environmental characteristics of the Borough. This included details of the environmental status and condition of notable environmental features; current and future predicted trends in the evolution of the environment; and issues and problems currently affecting the environment. The baseline information is used as the basis for predicting and monitoring the effects of the LFRMS implementation.

The information obtained through this desk study is broadly strategic in nature and reflects the high-level objectives of the LFRMS. It has been obtained from a broad range of sources and no new investigations or surveys were undertaken as part of the scoping process. The baseline may require updating throughout the duration of the SEA process as the LFRMS is developed further and new information becomes available.

2.4 Landscape and visual amenity

The Borough of Bedford is the largest in Bedfordshire, stretching across the north of the county. Bedford is the main settlement within the Borough and is surrounded by a number of villages and hamlets. The Borough is dominated by an elevated clay plateau to the north of Bedford, which forms an almost entirely rural landscape. To the west is a distinctive limestone landscape created by the erosive force of the River Great Ouse, which meanders from the north-west before flowing eastwards from Bedford[5].

A large area to the north-west of the Borough is identified as an Area of Great Landscape Value (AGLV)[6]. Grassland remains the most prominent feature in the AGLV, although agricultural policies have encouraged the ploughing of pasture land in recent years. Important open spaces within built up areas in both the urban and rural parts of the Borough are also recognised through the designation of Urban Open Space and Village Open Space in Bedford Borough Council strategic

[5] Land Use Consultants (2007), Bedford Borough Landscape Character Assessment (Final Report), prepared for Bedfordshire County Council and Bedford Borough Council.

[6] Bedford Borough Council (2013), Local Plan 2002, Chapter 3: Natural Environment, http://www.planvu.co.uk/bbc/written/cpt3.htm#ne14

planning policy. Significant areas of Bedford town are identified as Urban Open Space[7]. Bedford Borough Council also recognise the importance of the open character of the countryside and have formally designated significant areas of the Borough, particularly in the north, as 'countryside', where development will only be permitted if it would be consistent with national planning policy.

The Forest of Marston Vale covers a large area of former brick working in the south of the Borough and is one of only 12 Community Forests in England. The area has been designated by the UK Government as a national priority area for the environmentally led regeneration of degraded and industrially scarred landscapes[8].

No Areas of Outstanding Natural Beauty (AONB) or National Parks are present within the Borough. The closest is the Chilterns AONB to the south, which encompasses part of the distinctive chalk landscape system within the southern part of Central Bedfordshire. The Borough is characterised by three National Character Areas (NCAs): Bedfordshire and Cambridgeshire Claylands; Bedfordshire Greensand Ridge; and Yardley-Whittlewood Ridge[9]. The following landscape types have been identified in the Borough:

- Clay farmland;
- Wooded Wolds;
- Limestone Valleys;
- Clay Valleys;
- Wooded Greensand Ridge; and
- Clay Vales.

Bedford Borough has an important and diverse historic environment ranging from prehistoric sites, medieval buildings and historic brickworks to recent military remains. Designated listed buildings, conservation areas, and other undesignated buildings, structures and areas of local importance are located throughout the Borough and make a significant and valuable contribution to the local landscape character[10]. Historic landscape characterisation studies identify a range of historic landscape types across the Borough, including ancient woodland, historic field patterns and parkland. The River Great Ouse supports a series of historic meadows and parkland areas, which provide important areas of open land and a valuable resource for recreation, amenity and local wildlife.

Key environmental issues:

Pressure from new development and associated infrastructure is likely to present significant challenges as the area responds to an increasing population and the demands of economic development and climate change.

Flood risk management measures have the potential to affect the landscape characteristics in the Borough. This includes changes to the river corridors, impacts on existing open spaces, and impacts on the setting of local landmarks and landscape features. Many of these aspects are protected through regional and local policies and as such could restrict the implementation of LFRMS objectives if they are shown to present a risk to the quality of the landscape.

2.5 Biodiversity, flora and fauna

There are a wide variety of habitat types present within the Borough including agricultural land, meadows and grasslands, hedgerows, watercourses and other waterbodies, woodlands and urban gardens. Land is largely used for agriculture, particularly horticulture, arable and livestock farming. Bedfordshire is one of the least wooded counties in the country[11]. Most of the remaining woodland is found in the north-west of the Borough with the majority considered to be ancient semi-natural woodland. Bedford Borough Council has encouraged the creation of new woodland through the

[7] Bedford Borough Council (2013), Proposals Map, http://www.planvu.co.uk/bbc/help.htm

[8] England's Community Forests website, http://www.communityforest.org.uk/aboutenglandsforests.htm

[9] Natural England (2013) NCA Profile: 90 Bedfordshire Greensand Ridge, http://publications.naturalengland.org.uk/publication/

[10] Central Bedfordshire Council (2013), Landscape Character Assessment, http://www.centralbedfordshire.gov.uk/environment/natural-environment/natural-environment-landscape-character-assessment.aspx

[11] Bedford Borough Council (2013), Local Plan 2002, Chapter 3: Natural Environment, Policy NE5, http://www.planvu.co.uk/bbc/written/cpt3.htm#ne14

local plan process, with the inclusion of planning policies that aim to provide new mixed woodland subject to there being no conflict with local plan policies, the surrounding landscape or with other environmental features. The north and east of the Borough has a high proportion of good quality agricultural land (particularly Grade 2 as defined by the Agricultural Land Classification).

The River Great Ouse is the principal watercourse in the Borough. The river enters the Borough from the west and flows through the town of Bedford, before passing north-eastwards into Cambridgeshire. In addition, several main rivers including the River Til, Riseley Brook and Pertenhall Brook are located to the northern part of the Borough. The tributaries of the River Great Ouse have been modified in places for land drainage, flood defence and navigation, leading to a loss of habitat and ecological diversity and creating barriers to fish movement.

Wetland habitats in the Borough include ponds, lakes, and rivers. Priory Lake, to the east of Bedford town provides a recreational and watersports facility alongside the nearby marina. The adjacent Finger Lake is used for fishing and supports a variety of wildlife. To preserve the character of the riverine areas in the Borough, the Bedford Local Plan includes a River Protection Area where development will not normally be permitted unless it meets the criteria set out in policy NE15[12].

The following priority habitats are listed as part of the Bedfordshire and Luton Biodiversity Action Plan (BAP) and each habitat has an independent Habitat Action Plan (HAP):

- Arable field margins;
- Floodplain grazing marsh;
- Hedgerows;
- Lowland dry acid grassland;
- Lowland calcareous grassland;
- Lowland heathland;
- Lowland meadows;
- Ponds;
- Reedbed;
- Traditional orchards;
- Wet woodland;
- Wood-pasture and parkland; and
- Woodland.

Reedbeds in the Borough are found in ditches, along the margins of rivers and around ponds, lakes and the numerous flooded brick and gravel pits. Although most areas of reedbed are small, proportionally the Borough contains most of the reedbed habitat in the county, with some 20ha of habitat recently created at the Marston Vale Forest Centre in the south of the Borough[13].

The following priority species are listed as part of the Bedfordshire and Luton BAP and each species has an independent Species Action Plan (SAP)[13]:

- Adder;
- Arable plants;
- Depressed River Mussel;
- European Otter;
- Great Crested Newt;
- Hazel Dormouse; and
- Water Vole.

Flooding and flood risk management has the potential to significantly impact on these species. A number of these species such as Water Vole and Otter, are dependent upon aquatic and riparian habitats, and are sensitive to changes in habitat conditions, changes in water quality, flow,

[12] Bedford Borough Council (2013), Local Plan 2002, Chapter 3: Natural Environment, Policy NE15, http://www.planvu.co.uk/bbc/written/cpt3.htm#ne14

[13] Bedfordshire and Luton Biodiversity Partnership (2013) http://www.bedscape.org.uk

vegetation cover and bank profile. Great Crested Newts, a species protected under national and European law, are found in the Borough, which is thought to be a stronghold for the species[14].

2.5.1 Designated nature conservation sites

Bedford does not support any internationally designated nature conservation sites. The Upper Nene Valley Gravel Pits SPA and Upper Nene Valley Gravel Pits Ramsar site are located 2km to the north-west of the Borough boundary. The sites are designated for their internationally important assemblage of wetland birds together with a number of specific bird species. They contain a range of wetland habitats including reedswamp, marsh, wet ditches and rush pasture and together these habitats collectively form one of the most important inland localities in England for waterbirds in the non-breeding season[15].

The Portholme SAC lies 11km east of the Borough boundary on the banks of the River Great Ouse and is designated for its lowland hay meadows, which include an area of 104ha of alluvial flood meadow (7% of the total UK resource)[16]. Eversden and Wimpole Woods SAC is located 13km to the east of the Borough and is designated for its bat interest. No other European designated sites are located within 15km of the Borough boundary.

There are eight nationally designated sites within Bedford Borough. All are reported as being in 'Favourable' or 'Favourable-Recovering' condition. In addition, there are a further 72 nationally designated sites within 15km of the Borough boundary, which comprise 69 SSSIs and 3 National Nature Reserves (NNRs).

Table 2-2: National designated sites within Bedford Borough and current (2013/2014) condition status

Site of Special Scientific Interest	Condition status
Swineshead Wood SSSI	Favourable
Yelden Meadows SSSI	Favourable
Odell Great Wood SSSI	Unfavourable recovering
Felmersham Gravel Pits SSSI	Unfavourable recovering
Stevington Marsh SSSI	Unfavourable recovering
Hanger Wood SSSI	Favourable
Biddenham Pit SSSI	Favourable
Tilwick Meadow SSSI	Favourable

Of those SSSIs within the Borough, Stevington Marsh SSSI is located adjacent to the River Great Ouse and comprises a series of marshes and wetland communities, which are uncommon in the Borough. Felmersham Gravel Pits SSSI, also located adjacent to the River Great Ouse, to the north west of Bedford, is a series of flooded gravel pits and supports fen communities and standing open water.

Eight Local Nature Reserves (LNR) are located within the Borough. These include Bromham Lake LNR[8], which was created from former mineral workings and supports grassland and woodland habitats and birds and Fenlake Meadow LNR in Bedford, which supports areas of floodplain grazing marsh and areas of marshy grassland[17].

2.5.2 Non-designated nature conservation sites

There are a variety of non-statutory designated sites across Bedford the surrounding area and include 33 designated Roadside Nature Reserves (RNR) and 400 County Wildlife Sites (CWS). The whole length of the River Great Ouse flowing through the Borough is identified as a CWS and the river acts as the main wildlife corridor within the Borough. In addition, a number of Wildlife Priority

[14] Bedfordshire and Luton Biodiversity Partnership (2012), Great Crested Newt Habitat Network in the Central and Western Marston Vale http://www.bedscape.org.uk/BRMC/newsite/docs/bedslife/species%20docs/FMV%20GCN%20rpt.pdf

[15] Joint Nature Conservation Committee (2013), Upper Nene Valley Gravel Pits Ramsar, Information Sheet http://jncc.defra.gov.uk/pdf/UK11083.pdf

[16] Joint Nature Conservation Committee (2013) http://jncc.defra.gov.uk

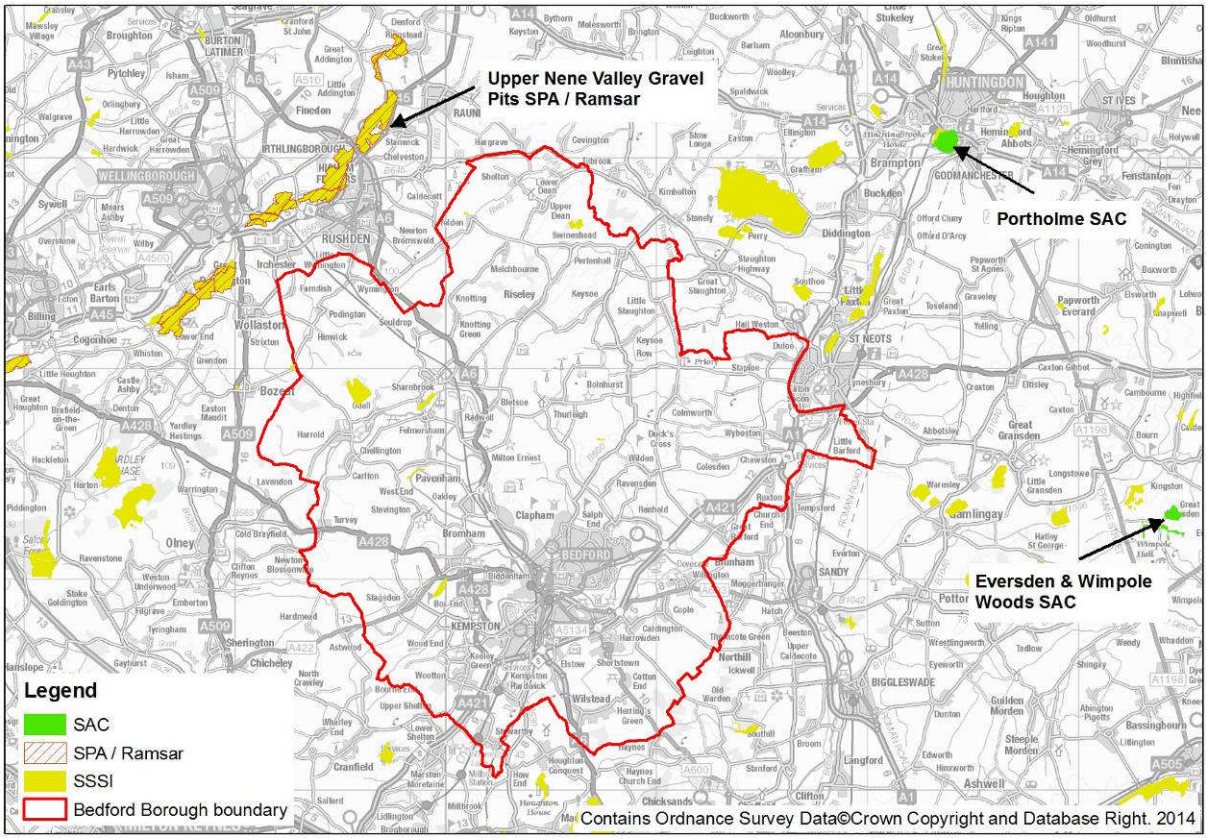
[17] Bedfordshire & Luton Biodiversity Action Plan (2013), Bedfordshire and Luton Biodiversity Recording and Monitoring Centre, http://www.bedscape.org.uk/BRMC/newsite/index.php

Areas have been identified within the Borough, including the Ouse Valley and the North Bedfordshire Ancient Woods[5].

2.5.3 Non-native invasive species

A number of non-native invasive species have been recorded in Bedford[18]. These include Japanese Knotweed, Himalayan Balsam, and Signal Crayfish. Flooding and flood risk management activities have the potential to cause the spread of these species through the movement of seeds and plant fragments or transportation of individual animals. Conversely, flood risk management actions also offer an opportunity to implement new control regimes to better manage or reduce the spread of these species.

Figure 2-1: European and nationally designated sites in Bedford Borough and surrounding area



2.5.4 Fisheries

The Upper Ouse catchment is of a flashy nature, which in combination with impermeable clay soils can lead to flooding that has been known to displace fish populations. Flooding along the Ouse Valley has caused the displacement of fish from adjacent gravel pits into the River Great Ouse and the loss of large carp from these gravel pits is of concern due to the potential for these species to out-compete native riverine species.

The River Great Ouse Radwell Backchannel Restoration Project involved the restoration of an unmaintained backwater channel. The channel was reconnected with the main river in 2012 by the Environment Agency as a natural floodplain feature. The restored backwater has created a suitable refuge area for fish in high flow conditions in the main river. A fish population survey showed the project was a success in providing refuge for fish during the high water levels experienced in 2012[19].

[18] Bedfordshire and Luton Biodiversity Partnership (2013), Species Distribution Maps http://www.bedscape.org.uk/BRMC/newsite/index.php

[19] Environment Agency (2013), Water for Life and Livelihoods, Anglian River Basin District: Challenges and choices, Facts and statistics summary information.

Key environmental issues:

The rural areas within Bedford are under increasing pressure from development and changes in land use, particularly as a result of changes in farming practice, alternative uses for buildings in the countryside and pressure for outdoor recreation, leisure and commercial uses. Wetlands in urban areas often suffer from recreational pressure including intensive angling.

A number of designated nature conservation sites, in particular Stevington Marsh SSSI, are largely dependent upon the underlying hydrological conditions and are therefore vulnerable to changes in the existing flooding regime i.e., increases in typical duration, frequency, depth or extent of flooding, and changes in soil quality, hydrology and habitat. The Borough also supports a number of species that are reliant on aquatic and riparian habitats, and subsequently are at risk from changes in flood events, poor water quality and habitat changes.

Fish populations in the River Ouse upstream of Bedford are in decline due to the presence of non-native Signal Crayfish and Otter predation, poor spawning habitat and a lack of suitable juvenile refuge areas. The LFRMS may provide opportunities to enhance habitats for fisheries and potentially improve fish passage, but such initiatives must take into account the potential adverse impacts of allowing non-native species to potentially extend their range.

Future changes in flooding could potentially damage and change the nature of habitats and supporting species composition within the designated nature conservation sites both within and outside the Borough. The LFRMS will need to consider whether any flood risk management measures will lead to adverse impacts on the waterbodies within the Borough and whether the LFRMS can help contribute to delivering any mitigation measures such as through improvements to fish passage. Implementation of the LFRMS may also provide opportunity to enhance or create new habitats within the Borough.

2.6 Water environment

2.6.1 Water resources

Main rivers in Bedford Borough include:

- The River Great Ouse, which enters the Borough from the west, flows through the centre of Bedford and then flows in a easterly direction out of the Borough;
- The River Till, Riseley Brook and Pertenhall Brook, which are located towards the northern edge of the Borough, and flow in a generally eastward direction to join the River Great Ouse at St Neots; and
- The Mina River is a short stretch of the River Nene west of Podington and flows in a northern direction towards the boundary with Northamptonshire.

Ordinary watercourses in the Borough include:

- Gadsey Brook is a tributary of the River Great Ouse and lies to the east of Bedford town;
- Kings Ditch flows through the centre of Bedford from St Mary's Embankment, near Borough Hall, through a series of culverts, before rejoining the River Great Ouse near Dame Alice Harpur School;
- Wood End Brook flows from Wood End, west of Kempston to its confluence with the River Great Ouse south west of Bedford;
- Elstow Brook rises from the Greensand ridge near Lidlington and flows towards the southern part of the Borough to join the River Great Ouse near Willington;
- Renhold Brook is a tributary of the River Great Ouse and lies to the north of Bedford;
- Harrowden Brook and Cople Brook flow in a north eastward direction to join Elstow Brook near Bedford;
- Sharn Brook is a tributary of the River Great Ouse and is located north of Bedford; and
- Colmworth Brook flows in an eastwards direction and join the River Great Ouse at St Neots.

In addition, there are numerous small watercourses and drainage ditches present in the southern part of the Borough associated with the Bedford Group of Internal Drainage Boards (IDBs). The Bedford Group IDBs are responsible for the management of smaller streams and watercourses

within the area they manage. Outside of the IDB area, ordinary watercourse (not Main River) regulation is the responsibility of Bedford Borough Council.

In terms of water resources the area is covered by the Upper Ouse and Bedford Ouse Catchment Abstraction Management Strategy. The largest surface water abstractions in the area are managed by Anglian Water Services Limited for public water supply. These abstractions are included in Anglian Waters Ruthamford Water Resource Zone.

Natural flows in the catchment derive from surface runoff from rainfall, and surface drainage and baseflow derived from springflow and groundwater. The major aquifers in the area are the Great Oolite and the Chalk and Woburn Sands. Nineteen groundwater boreholes are used to provide public water supply with the total amount of water abstracted accounting for approximately 55.8% of the total water licensed for abstraction in the catchment. In addition, individual householders abstract from wells or boreholes for their own domestic use. Industrial use accounts for approximately 3.5% of the total licensed volume, whilst public water supply from surface water abstractions make up approximately 93.5% of the water licensed for abstraction in the catchment. The remainder of water abstracted is used for a range of purposes including mineral washing, horticulture and agriculture[20].

The River Great Ouse is designated as a Drinking Water Protected Area (DrWPA) and Safeguard Zone because it is used extensively for public drinking water supply. The DrWPA objective is to ensure that water abstracted and treated for public supply meets the Drinking Water Directive (98/83/EC) requirements.

2.6.2 Water Framework Directive

Bedford is covered by the Anglian River Basin Management Plan (RBMP)[21], which identifies the current status of waterbodies in the Borough and sets objectives for making further improvements to their ecological and chemical quality.

The River Great Ouse is classified as a Heavily Modified Water Body (HMWB) and has been identified as a priority waterbody for improvement action under the Water Framework Directive (WFD). One of the key objectives under the WFD is the requirement to prevent deterioration in the current status of the waterbodies, whilst HMWB (and also artificial waterbodies) must achieve 'good ecological potential' within a set deadline. If an activity, such as flood risk management actions, has the potential to impact on the ecology or morphology of the waterbody (as defined by the biological, physio-chemical and hydromorphological Quality Elements of the WFD) the risk of causing deterioration in the status of a water body needs to be assessed. Overall, the River Great Ouse was classified as having Moderate status in the first Anglian RBMP because of phosphate and physical modification failures.

The River Great Ouse is designated as a Sensitive Area (eutrophic) under the Urban Waste Water Treatment Directive (UWWTD) and most of the catchment is designated as a Nitrate Vulnerable Zone. Issues affecting the surface waterbodies in the Borough include physical modifications, changes to the natural flow, non-native species and pollution from rural areas and waste water.

2.6.3 Surface water quality

Bedford is served by Bedford Sewage Treatment Works (STW) and the final effluent is discharged to the River Great Ouse. Sources of pollution from waste water discharges in the Borough include nutrients and chemicals such as phosphate, ammonia and organic matter from treated sewage. Discharges of chemicals, such as solvents, affect the quality of both surface and groundwater.

Other water quality issues in the catchment include nitrate and sediment from agricultural land, discharges from unsatisfactory sewage/trade treatment facilities, wrongly connected foul drainage, and general poor quality surface runoff from roads in urban areas[22].

[20] Environment Agency (2013), The Upper Ouse and Bedford Ouse Catchment Abstraction Management Strategy http://www.environment-agency.gov.uk/business/topics/water/119931.aspx

[21] Environment Agency (2009) Anglian River Basin Management Plan http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/cy/ymchwil/cynllunio/124725.aspx

[22] Environment Agency (2013), Upper Ouse and Bedford Ouse Catchment http://www.environment-agency.gov.uk/static/documents/Utility/Upper_Ouse_and_Bedford_Ouse_Catchment.pdf

2.6.4 Groundwater quality

Groundwater provides vital resources for public water supply in the Borough. Impacts on groundwater are broadly related to land use, with agricultural areas representing a major source of nitrates.

Bedford lies within a Groundwater Source Protection Zone (SPZ) and a Groundwater Vulnerability Zone, which highlights the importance of the groundwater resources in the area. Groundwater quality has been assessed under the WFD and is currently classified as at Poor or Good status (predicted to reach Good status by 2015) and is uncertain for current chemical quality (predicted to reach Good status in 2015)[23].

2.6.5 Flooding

Historically, the primary source of flooding in the Borough has been fluvial[24]. Flooding from the River Great Ouse occurs in Bedford and there is a risk of flooding from River Til, Pertenhall Brook and Riseley Brook in the northern part of the Borough. The Elstow Brook in particular has been identified as presenting a flood risk, it is classed as a Category 1A (high risk) watercourse according to the Bedford Group of IDBs categorisation system, with maintenance operations on this watercourse seen as a priority for the Board as a flood risk mitigation measure[24].

A total of 5,280 properties have been identified at risk of surface water flooding in the Borough with 3,400 properties identified in Bedford town[25].

Key environmental issues:

Pressures on water supplies in Bedford include population growth and development, water demand, climate change, leakage rates, recreation and meeting ecological requirements under the WFD. RBMP measures to help meet future demands include reusing effluent and restrictions on water usage.

The River Great Ouse and groundwater are important sources of drinking water in the Borough. The pressures on water resources and moderate WFD status have the potential to impact the level of water availability and water quality within the watercourses and groundwater bodies within the Borough. There is therefore a need to balance public water supplies against future demands, considering implications for water abstraction and flood risk.

Flooding has the potential to create pathways through which potential contamination sources (e.g. sewage treatment works) could result in pollution. Conversely LFRMS could help protect these sites and improve water quality.

The River Great Ouse currently fails to meet Good Ecological Potential under the WFD. The LFRMS will need to consider whether any flood risk management measures will lead to further deterioration in status, prevent achievement of Good Ecological Potential and whether the LFRMS can help contribute to achieving WFD objectives and improving water quality in the Borough.

2.7 Soils and geology

The underlying geology of the Borough is predominantly Oxford Clay and Kellaways Beds, with some small areas of Cornbrash and Great Oolite limestone formations. This underlying geology results in poor infiltration across the majority of the region[24]. The south and central areas of the Borough are underlain with mudstone, siltstone and sandstone from sedimentary bedrock that formed approximately 156 to 165 million years ago in the Jurassic Period. The undulating landscape of the majority of Bedford Borough is a result of the uniform underlying geology of the Oxford Clay. The west of the Borough is underlain by limestone creating the distinctive 'Wolds' landscape. In the southern part of the Borough the Oxford Clay has been extensively quarried for brick manufacture and is now occupied by large waterbodies as at Kempston Hardwick.

To the north of the River Great Ouse, the Oxford Clay is overlain by extensive deposits of boulder clay, which has created distinctive flat plateau landscapes to the east and north-east of Bedford.

[23] Environment Agency (2013), What's in your backyard? website www.https//maps. environmentagency.gov.uk

[24] Atkins Ltd (2008), Bedford Borough Strategic Flood Risk Assessment - Level 1

[25] Bedford Borough Council (2013), Flood Risk Management webpage http://www.bedford.gov.uk/environment_and_planning/regulatory_services/flood_risk_management/aspx

The boundary between the Limestone (Great Oolite) and Clay (Oxford Clay) geological formations is characterised by Cornbrash deposits which were deposited approximately 170 million years ago with the Cornbrash creating fertile soils. The clay plateau is cut by numerous small tributary streams that run south or westwards to the Ouse.

There are four soil types found within the Borough with each directly related to the underlying landform and influencing land use. Of these the Argilic Brown Earths and Alluvial Gley Soils are closely related to the underlying glacial and river gravels of the River Great Ouse and is associated with high-quality ALC Grade 1 and Grade 2 agricultural land. The soils are deep with a high groundwater level making them locally subject to winter flooding[10].

Biddenham Pit SSSI is a Geological Conservation Review Site (GCR) located in the Borough and is an old gravel pit important for its exposures of terrace gravel.

Key environmental issues:

Flood risk management could alter the extent or duration of flooding and therefore the LFRMS will need to consider implications for soil quality and the underlying geology. Impacts on soil quality could affect other environmental receptors, such as nature conservation sites that are reliant on the underlying soil characteristics.

Flooding has the potential to erode soils and cause waterlogging, which can reduce agricultural productivity; soil erosion also releases sediments that have an adverse impact on river water quality and ecology. There is also a need for the protection and maintenance of the integrity of the designated geological SSSI.

2.8 Historic environment

Bedford has a rich and diverse historic environment ranging from prehistoric sites, medieval buildings and historic brickworks to recent military remains. In addition, much of the rural landscape in the Borough reflects historic agricultural practices, particularly phases of land enclosure that are represented in the compact patchwork of fields located across the area. The Historic Landscape Characterisation of Bedfordshire study identifies a wide range of historic landscape types across the Borough, including ancient woodland in the north, historic field patterns and parkland. Along the River Great Ouse are a series of historic meadow sites, as are a number of important parkland areas.

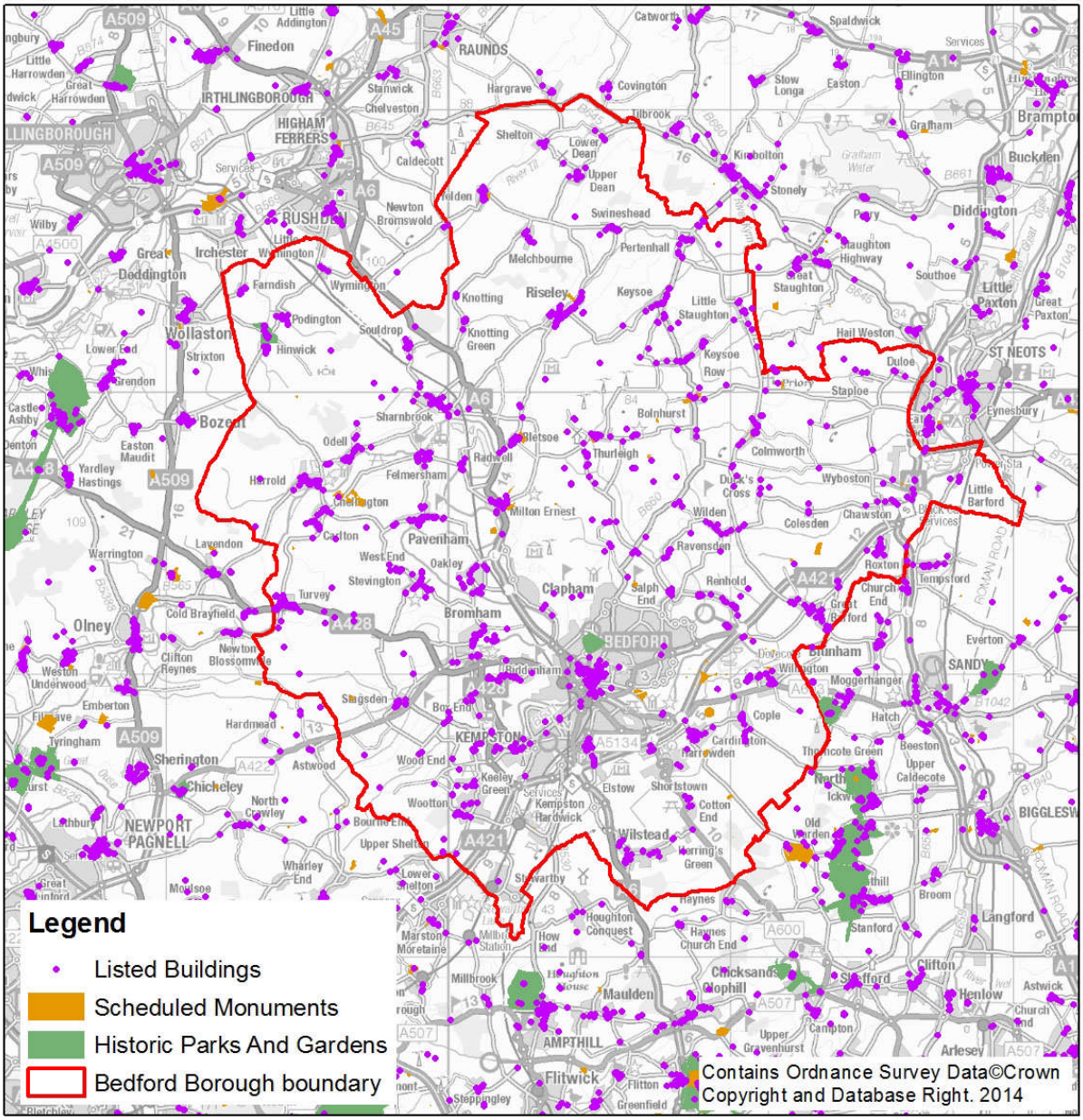
The Borough has a wealth of designated historic buildings and sites, situated in both Bedford town and the rural surrounding villages. Historic sites in the Borough include[26]:

- 69 Scheduled Monuments: these are historic sites of national importance and include Bedford Bridge, Bedford Castle Motte and Bailey and two mortuary enclosures[27]. Many of the sites are clustered to the north and east of Bedford;
- 1,328 listed buildings: these are statutorily designated and include 50 Grade I sites and 41 Grade II* sites;
- 4 historic parkland areas: these are sites included on the English Heritage Register of Parks and Gardens of Special Historic Interest; and
- 26 conservation areas.

[26] English Heritage (2013), Heritage Gateway website http://www.heritagegateway.org.uk/Gateway/Results.aspx

[27] Ancient Monuments (2013), Ancient Monuments in Bedford, Bedfordshire webpage http://www.ancientmonuments.info/monuments/bedford-bedfordshire

Figure 2-2: Designated historic sites in Bedford Borough and surrounding area



The English Heritage 'Heritage at Risk Register' (2012) identifies 11 sites at risk in the Borough. Bedford Conservation Area is included on the register and its condition is described as 'very bad' and 'deteriorating'[28]. Flood risk or water inundation has not been identified as the principle cause of vulnerability for any of these sites.

The Borough also contains a range of non-designated heritage assets, including unknown buried deposits such as preserved organic and palaeo-environmental remains. Such assets may be at risk from flooding or may be reliant upon frequent water inundation or waterlogged soils to protect and preserve their condition.

Key environmental issues:

Bedford contains a wealth of historic sites. However, a number of the most important of these sites are currently assessed as being under threat. There is a risk that adverse impacts upon aspects of Bedford's cultural heritage could arise from flooding and increased flood risk in the future, whilst the construction and implementation of the flood risk management options selected by the LFRMS could also have adverse effects on an assets integrity or setting. Potential benefits may also arise from reduced flood risk to assets as a result of implementation of the LFRMS.

[28] English Heritage (2013), Heritage at Risk Registerwebpage http://risk.english-heritage.org.uk/register.aspx

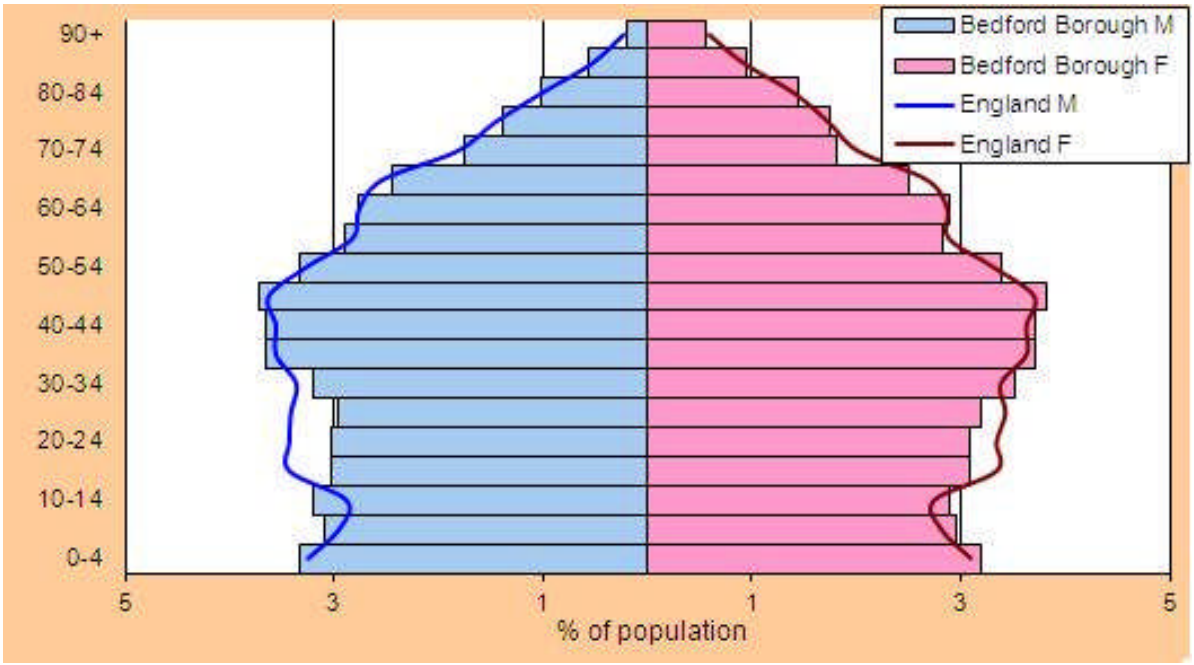
2.9 Population

Bedford has a population of approximately 160,000 (2012)[29] of which 64.2% live in the urban areas of Bedford and Kempston, with the remainder living in rural areas. The Borough has a slightly younger age structure than the regional average, with a median average age of 39.6, compared to and East England average of 40.7 years old[30].

The Borough's population rose from 148,100 to 159,200 between 2001 and 2012; an average annual increase of approximately 0.6%. While the Borough's total population rose by 7.5% between 2001 and 2012, the older age groups increased at a significantly higher rate. The population in the 85+ age group increased by nearly 35% over the same period, representing more than four times the rate of overall population growth. However, the proportion of older people (aged 65+) in the Borough is lower (16.4%) than the England average (18.2%)[29].

The Borough's population has been estimated to increase to over 170,000 by 2021, an increase of approximately 8% between 2011 and 2021. The older population in the Borough is forecast to increase at higher rate, with the 65+ population estimated to rise by 30% and the 85+ population to increase by 47%[31].

Figure 2-3: Age profile by gender in Bedford Borough (2012) (source: Bedford Borough Council)



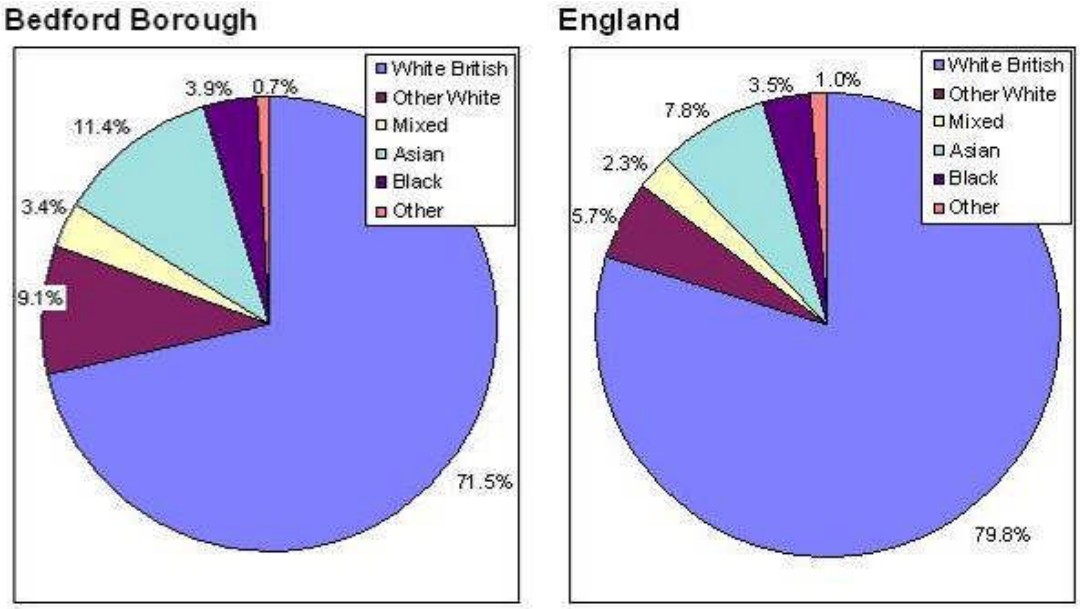
Bedford Borough is one of the most ethnically diverse authorities in East England, with approximately 100 resident ethnic groups. Around 28% of the Borough's population was comprised of Black and Minority Ethnic (BME) groups (defined as all ethnic groups other than White British) within the 2011 census. This is significantly higher than the England average (equating to 13.9% with the exclusion of the London Boroughs) and the East England regional average (14.7%).

[29] Bedford Borough Council (2013), Statistics and census webpage http://www.bedford.gov.uk/council_and_democracy/statistics_and_census.aspx

[30] Bedford Borough Council (2013), Bedford Borough statistical profile http://www.bedford.gov.uk/council_and_democracy/statistics_and_census/borough_statistical_profile.aspx

[31] Bedford Borough Council (2013), Population estimates and forecasts webpage http://www.bedford.gov.uk/council_and_democracy/statistics_and_census/population_estimates.aspx

Figure 2-4: Ethnic groups as a proportion of the population of the Borough (source: Bedford Borough Council)



A key change between 2001 and 2011 was a major increase in the number of lone parent households (with dependent children) in the Borough, which increased from 3,200 to 4,850 over the 10 year period. Despite significant growth in the 65+ population over this period, the number of lone pensioner households fell from 7,800 to 7,600. This may reflect improvements in life expectancy, particularly male life expectancy[29].

2.9.1 Health

In general, the health of people in Bedford Borough is similar to the average in England. Life expectancy is rising for both men and women overall. However, there are inequalities across the Borough as shown in Figure 2-5.

Flood risk can affect health and well being through drowning or exposure to water that can cause harm as a consequence of the depth duration or velocity of the flood water. Additionally contact with flood waters can be harmful to health as a result of contamination or hazardous material being transported during a flood. Communities in properties affected by flooding can have longer term health and rehabilitation problems during the period to recover from a flood event (which can be protracted). Flood risk can result in direct and indirect commercial loss and disruption to business and commerce.

2.9.2 Deprivation

The Index of Multiple Deprivation (IMD) provides a measure of relative deprivation across England and was most recently published in 2010. Bedford is divided into several sub-ward geographic areas known as Lower Super Output Areas (LSOA) which average approximately 1,500 people. There are 32,482 LSOA in England and Bedford Borough has a total of 103 LSOAs across its 27 wards. Four LSOAs in the Borough were among the 10% most deprived areas in England on the overall IMD (compared to 3 in 2007). A further seven were among the 10-20% most deprived (6 in 2007)[29].

In the most deprived areas of the Borough, life expectancy is considerably lower than that in the least deprived areas. Inequalities in life expectancy places Bedford Borough in the worst 20% of local authorities in England, and average life expectancy is significantly lower than the East of England average[32].

Key environmental issues:

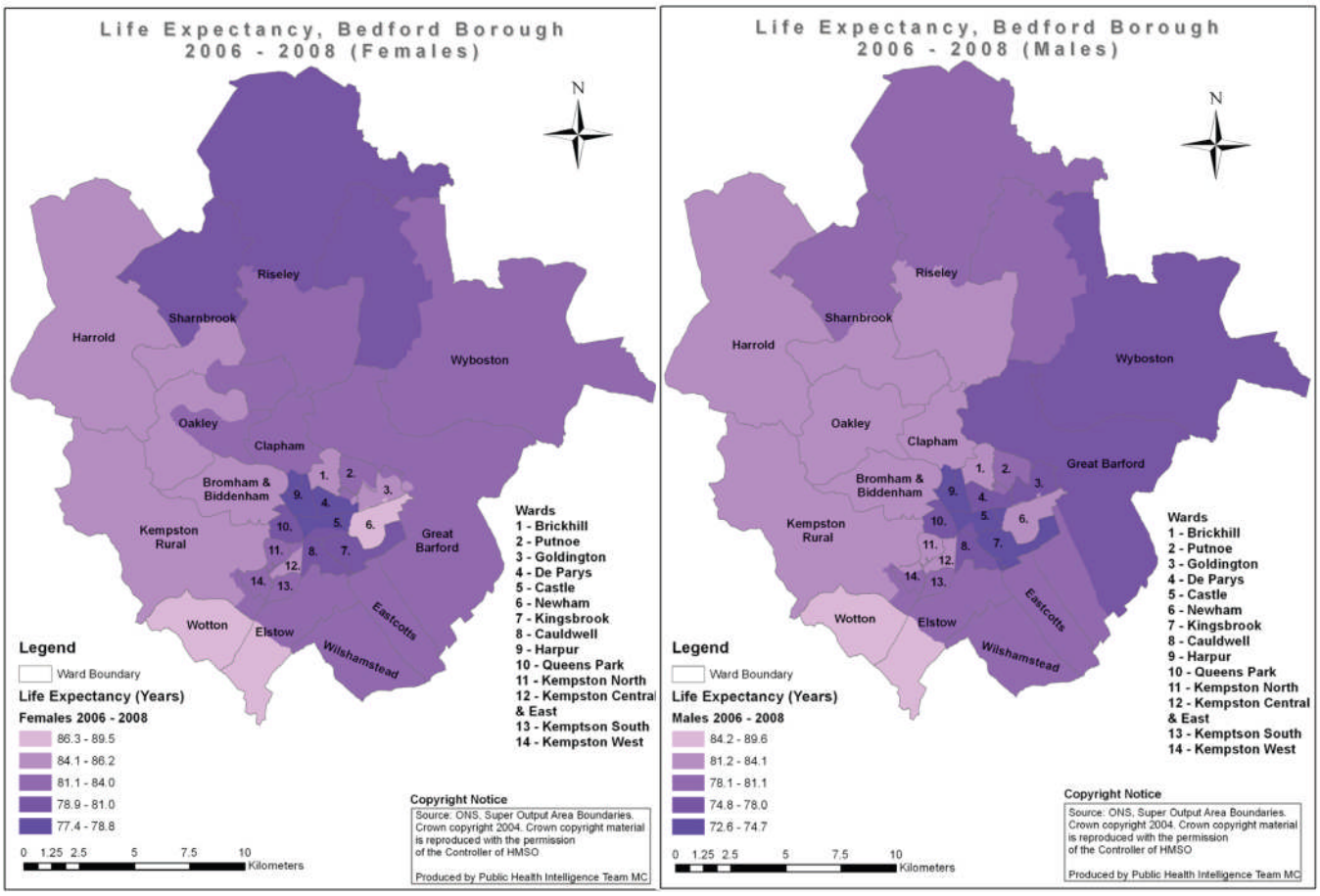
The population of Bedford is set to increase in the future and is predicted to comprise a significantly larger proportion of older people. The general health of the population is generally good, with

[32] Bedford Borough Council and NHS Bedfordshire (2012), Bedford Borough Health & Wellbeing Strategy

increased life expectancy leading towards an ageing population. Health levels do vary across the Borough, with poorer health linked to areas of higher social deprivation.

This growing population will place increased demand on a range of resources and the Borough's water and sewerage infrastructure, which could be exacerbated by the effects of climate change. Linked to this may be increased demands for development and pressure on the existing housing provision, which may result in greater need for development in areas at risk of flooding.

Figure 2-5: Life expectancy in Bedford Borough (2006 to 2008) (source: Bedford Borough Council)



2.10 Material assets

Bedford occupies a strategic position in the East of England and enjoys good rail connections and access to the motorway network and major regional airports such as at Luton. The road network comprises arterial routes from surrounding population centres such as Luton, Northampton, Milton Keynes, and Cambridge. There are good road links to the strategic road network and recent improvements to the national road network have made the A1 and M1 very accessible from Bedford. Bedford Borough Council is responsible for over 750km of road within the Borough.

The Borough is well connected to the surrounding regions by rail. The Thameslink Line provides services to London and the South Coast and serves both Luton and Gatwick airports. A new station at Wixams, on the Thameslink service, will be operational by 2014, bringing further improvements to the Borough's rail infrastructure[33].

2.10.1 Economy

Bedford is an important administrative centre for both public and private organisations and a regional base for professional, retail and cultural services. Bedford Borough is subject to pressure for growth, particularly the areas immediately around Bedford itself. Part of the Borough is designated as being

[33] Bedford Borough Council (2011), Local Transport Plan 2011-2021
https://www.bedford.gov.uk/health_and_social_care/bedford_borough_jsna/wider_determinants/transport_and_access/local_transport_plan.aspx

within the Milton Keynes & South Midlands Growth Area, which was established as part of the UK Government's Sustainable Communities Plan[34]. The sub-regional strategy for the growth area recognises the potential of the growth area to accommodate a significant volume of development in the future[35].

Bedford benefits as a tourist centre due to its rich cultural heritage and its attractive river frontage and embankment, which form the location for the River Festival, a major visitor attraction that takes place on alternate years. The Borough also has unique connections with the airship industry at Cardington and many picturesque villages with historical associations.

2.10.2 Green infrastructure

There is a strategic network of green spaces in the Borough, of which the most notable is the links between the River Great Ouse Valley and the Forest of Marston Vale. Initiatives influencing positive change within the Borough landscape are the Ivel and Ouse Countryside Project and the Forest of Marston Vale (FMV). Proposals for growth in Bedford Borough identified in the East of England Regional Plan include 15,570 additional dwellings and 16,000 additional jobs by 2021[36]. The Green Infrastructure Plan for Bedford Borough has identified a range of existing waterways, cycleways, footpaths and bridlepaths that are considered to be of strategic significance in the region. The assessment identified gaps in the connectivity of this strategic access route network, with poor accessibility and availability to the network for users in some areas. The need to improve and enhance the Public Rights of Way network to enhance connectivity and availability was identified[37].

Key environmental issues:

The Borough experiences good internal and external transport links, with further improvements planned. Flooding of these key social infrastructure assets could result in disruptions to the provision of services to communities within the Borough. Predicted population increases and an ageing population will place greater pressure on the transport network, which could be exacerbated by an increase in future development pressure. In addition, development and commercial pressures are set to place increased demand on land availability, which will in turn affect the existing transport network.

In addition, opportunities to create and enhance green infrastructure assets could be incorporated into flood risk management measures implemented as part of the LFRMS.

2.11 Air quality

Generally, air quality in Bedford meets the targets set by the UK Government in the Air Quality Objective (AQO). Bedford Borough Council conduct periodic reviews of local air quality during which the concentration of potentially harmful substances such as Ground Level Ozone (O_3), carbon monoxide (CO) and sulphur dioxide (SO_2) are measured and compared against the AQO. Should an area within the authority exceed the set quantities of any such contaminants, hence exceeding the objective, further more detailed assessments are undertaken. If further assessments verify the original finding of excessive contaminant concentrations the area is designated as an Air Quality Management Area (AQMA) for which objective contaminant levels are set and strategies to achieve them drawn up.

Three AQMAs were declared for NO_2 in the town centre of Bedford where concentrations exceeded the annual mean objective. A further AQMA was declared for SO_2 as concentrations exceeded the 15-minute mean objective around the village of Stewartby in the south west of the Borough.

Key environmental issues:

Generally, air quality in the Borough meets the targets set by the UK Government in the Air Quality Objective (AQO). However, greater pressures on air quality may occur in the future through

[34] ODPM (2003), Sustainable Communities: Building for the Future.

[35] ODPM (2003), Sustainable Communities: Building for the future http://webarchive.nationalarchives.gov.uk/20060502043818/odpm.gov.uk/index.asp?id=1139868

[36] Government Office for the East of England (2008), East of England Plan: The Revision to the Regional Spatial Strategy for the East of England http://www.broads-authority.gov.uk/broads/live/planning/future-planning-and-policies/RSS_East_of_England_Plan.pdf

[37] Bedford Borough Council (2009), Bedford Green Infrastructure Plan http://www.bedsandlutongreeninfrastructure.org/pdfs/Bedford_GI_plan.pdf

increases in the population of the Borough, greater development and increased traffic congestion. This could lead to the designation of additional AQMAs to address local impacts on air quality. However, the LFRMS is not likely to impact on air quality in the Borough, and any impacts, such as through increased flood risk management activity, are unlikely to be significant.

2.12 Climate

Bedford experiences a temperate climate with average winter temperatures of between 5ºC and 8ºC and average summer temperatures of between 19ºC and 22.5ºC. On average, winter rainfall in the region is between 150mm and 250mm, and summer rainfall between 105mm and 230mm[38].

The UK Climate Projection (UKCP09) provides probability-based projections of key climate variables, such as temperature and rainfall at a higher geographic resolution than has previously been available. Projections are based on the Intergovernmental Panel on Climate Change's 'business as usual' emissions scenario.

Current projections point to significant and more variable temperature and rainfall levels in future, with greater peak temperatures and prolonged hot periods forecast. Summer mean temperatures are predicted to rise, on average, by 4.5ºC. Minimum temperature rise is expected to be no less than 2.4ºC and maximum rise is not expected to exceed 7.5ºC. Winter mean temperature is also expected to increase - however by a lesser amount. The average, predicted rise is 3.7ºC, while the minimum increase expected is 2ºC and the maximum 5.7ºC[26].

Rainfall quantity is expected to increase only marginally. However, the amount received in Bedford during the summer months is expected to fall and more prolonged and severe rainfall events are predicted to occur during winter, potentially impacting on flood frequency.

Climate changes can affect local flood risk in several ways with impacts depending on local conditions. Wetter winters may increase river flooding with more intense rainfall leading to more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.

With rainfall frequency and intensity set to significantly increase in the coming decades, the likelihood of river flooding and overwhelming of drains and sewers will rise due to increased surface runoff. This in turn will lead to localised flood events and increased erosion. To accommodate the increased likelihood of such events, the LFRMS should seek to implement measures aimed at coping with them.

The LFRMS options, could potentially, both directly and indirectly, lead to an increase in greenhouse gas emissions as a result of construction and maintenance activities. Emissions could be reduced by selecting, sustainable building practices and materials[39].

Key environmental issues:

With rainfall frequency and intensity set to significantly increase in the coming decades, the likelihood of river flooding and overwhelming of drains and sewers will rise due to increased surface runoff. This in turn will lead to localised flood events and increased erosion. To accommodate the increased likelihood of such events the LFRMS must implement measures aimed at coping with them.

If such climate change projections are realised, the adverse risk and impact toward Bedford's infrastructure, public health and the natural environment has the potential to be great. With regard to the natural environment, changing climate, mainly that of changing temperatures poses the biggest threat. Species and habitat abundance and richness will become threatened as a result of changing habitats, drier soils and increased competition from non-native invasive species throughout the Borough's watercourses.

Flooding derived from increased rainfall and storm events of greater severity is expected to result in significant adverse impacts on utility, residential and transport infrastructure with subsequent economic consequences. Damage to infrastructure at the forecasted extent will inevitably incur

[38] Met Office (2013), Climate Data webpage http://www.metoffice.gov.uk/public/weather/climate/

[39] Central Bedfordshire Council and Milton Keynes Council (2011), Upper River Great Ouse Preliminary Flood Risk Assessment, Prepared for Bedford Borough Council.

large economic costs as well as social and public health implications as a result of the distress and disruption caused.

The LFRMS options, could potentially, both directly and indirectly, lead to an increase in greenhouse gas emissions as a result of construction and maintenance activities. Emissions could be reduced by selecting, sustainable building practices and materials that benefit flood risk and carbon emissions.

2.13 Scoping conclusions

Following the scoping consultation exercise it was possible to scope out air quality as an SEA issue as it is unlikely that there will be a significant environmental impact on air quality in the Borough from implementation of the LFRMS. A summary of the scoping conclusions are given in Table 2-3 below.

Table 2-3: SEA scoping assessment summary

Receptor	Scoped In	Scoped Out	Conclusion
Landscape and visual amenity	Yes	No	The landscape qualities and integrity of the Borough could be affected by changes to flood risk or land use/management, including new development, whilst increased flood risk could impact on locally important urban and rural landscapes and landscape features.
Biodiversity, flora and fauna	Yes	No	There are a number of SSSIs, NNRs and LNRs within Bedford at risk from flooding. Changes to the hydrological regime could potentially change the underlying nature of habitats and the LFRMS policies may present opportunities for biodiversity gain. LFRMS measures could improve the river channel by removal of impediments to fish passage. Habitat creation or enhancement could also be incorporated into LFRMS measures.
Water environment	Yes	No	Flooding has the potential to impact on water availability, the water quality of the watercourses within the Borough and the WFD objectives. There is the potential for indirect impacts on water dependent designated sites/species. Flood risk management measures could potentially affect the water environment both positively and negatively. The LFRMS could give rise to changes in flood risk and water quality, and could affect provision of water resources.
Soils and geology	Yes	No	Bedford contains a significant percentage of high grade agricultural land. Flooding has the potential to erode soils and cause waterlogging impacting on agricultural productivity. Impacts on soil quality could then affect other aspects of the environment such as biodiversity and water quality.
Historic environment	Yes	No	There are a large number of historic sites in the Borough that could be affected by changes to flooding and flood risk management measures. Opportunities may exist to protect important sites or negative impacts could occur due to increased flood risk to vulnerable sites.
Population	Yes	No	A range of socio-economic characteristics of the Borough including social deprivation levels, health and wellbeing, access and recreation, and employment opportunities influence vulnerability to flooding. Critical social infrastructure, including hospitals, schools, and residential and nursing homes could benefit from reduced flood risk. The LFRMS has the potential to provide significant positive benefits to the population of the Borough through reduced levels of flood risk to population generally and also vulnerable groups, and increased community resilience.
Material assets	Yes	No	Critical infrastructure including the transport network, waste sites, utilities services and emergency services could benefit from reduced flood risk. Conversely, increased flood risk to these sites could cause significant disruption to the Borough, impacting on human and economic activity and the environment.
Air quality	No	Yes	The LFRMS is not likely to have a significant effect on air quality

Receptor	Scoped In	Scoped Out	Conclusion
			in the Borough due to the localised nature of any potential impacts.
Climate	Yes	No	Changes in flood risk could affect resilience to the potential impacts of future climate change. This could have knock-on effects on a range of environmental aspects including biodiversity, water resources and the local landscape. Flood risk management measures could also result in increased carbon emissions associated with asset construction or increased management activities. The LFRMS may include mitigation, resilience and adaption responses and measures that could contribute to addressing the future impacts of climate change effects. Opportunities to improve climate change adaptation will be considered in the SEA.

3 SEA assessment framework

3.1 Introduction

The SEA assessment framework is used to identify and evaluate the potential environmental issues associated with the implementation of the LFRMS. The framework comprises a set of SEA objectives that have been developed to reflect the key environmental issues identified through the baseline information review. These objectives are supported by a series of indicators, which are used as a means to measure the potential significance of the environmental issues and can also be used to monitor implementation of the LFRMS objectives. These LFRMS objectives are tested against the SEA assessment framework to identify whether each option will support or inhibit achievement of each objective.

Table 3-1 below summarises the purpose and requirements of the SEA objectives and indicators.

Table 3-1: Definition of SEA objectives and indicators

	Purpose
Objective	Provide a benchmark 'intention' against which environmental effects of the plan can be tested. They need to be fit-for-purpose.
Indicator	Provide a means of measuring the progress towards achieving the environmental objectives over time. They need to be measurable and relevant and ideally rely on existing monitoring networks.

3.2 SEA objectives and indicators

SEA objectives and indicators have been compiled for each of the environmental receptors (or groups of environmental receptors) scoped into the study (see Table 2-3). The SEA objectives used to assess the LFRMS are given in Table 3-2below.

Table 3-2: SEA objectives and indicators

Receptor	Objective		Indicator
Landscape	1	Protect the integrity of the Borough's urban and rural landscapes.	Changes in the condition and extent of existing characteristic elements of the landscape. The condition and quality of new characteristics introduced to the landscape.
Biodiversity, flora and fauna	2	Protect and enhance important and notable habitats and species in the Borough.	Area of statutory designated nature conservation sites affected by flooding, and an assessment of the impact. Area of non-statutory designated nature conservation sites affected by flooding. Monitoring of reported conservation status of designated nature conservation sites. Net loss or net gain of land designated as nature conservation sites as a result of LFRMS measures. Area of habitat created as a result of implementation of the LFRMS (e.g. flood storage areas creating wetland habitat). Number of barriers to fish migration removed/modified. Length of river de-culverted.
	3	Maintain and enhance habitat connectivity and wildlife corridors within the Borough.	
	4	Maintain existing, and where possible create new, riverine habitat to benefit aquatic species and fisheries, and maintain upstream access.	
Water environment	5	Improve the quality and quantity of the water in the borough's rivers.	Number of SuDS schemes installed as part of the LFRMS. Numbers of sites with high pollution potential (e.g. landfill sites, waste water treatment works) at risk from flooding.
	6	Do not inhibit achievement of the WFD objectives and contribute to their achievement where possible.	Assessment of LFRMS options and their impact (e.g. disconnection/reconnection with floodplain, in-channel works/dredging, barriers to fish movement, reinstatement/removal of natural morphology).
Soils and geology	7	Reduce the risk of soil erosion and pollution.	Area of agricultural, rural and greenfield land affected by flooding or flood risk management measures. Areas of ALC Grade 1-3 land at risk of flooding. Areas of ALC Grade 4-5 land at risk of flooding.
Historic environment	8	Preserve and where possible enhance heritage assets in the Borough and their settings.	Number of heritage assets at risk from flooding. Proportion of conservation areas at risk from flooding. Number of flood risk management measures implemented that conserve and enhance heritage assets.
Population	9	Minimise the risk of flooding to communities.	Number of residential properties at risk of flooding. Number of key services (e.g. hospitals, health centres,

Receptor	Objective		Indicator
			residential/care homes, schools etc) at risk from flooding.
	10	Increase the use of sustainable drainage systems (SuDS), particularly in all new developments.	Number of SuDS schemes installed as part of the LFRMS.
Material assets	11	Minimise the impacts of flooding to the Borough's transport network and key critical infrastructure.	Length of road and rail infrastructure at risk from flooding. Number of key infrastructure assets at risk from flooding.
Climate	12	Reduce vulnerability to climate change impacts and promote measures to enable adaptation to climate change impacts.	Number of residential properties at risk of flooding. Number of key services (e.g. hospitals, health centres, residential/care homes, schools etc) at risk from flooding. Area of habitat created as a result of implementation of the LFRMS (e.g. flood storage areas creating wetland habitat). Number of barriers to fish migration removed.

4 Strategy alternatives

4.1 Developing alternatives

The SEA Directive requires an assessment of the plan and its 'reasonable alternatives'. In order to assess reasonable alternatives, different strategy options for delivering the LFRMS have been assessed at a strategic level against the SEA objectives, and the environmental baseline as detailed in Section 2. The results of this assessment will be used to inform the decision-making process in choosing a preferred way of delivering the LFRMS.

4.2 Appraisal of actions to improve flood risk

The LFRMS has the purpose of managing and reducing local flood risk in Bedford Borough. The strategy objectives have been assessed against the SEA objectives for each of the following options as shown in Table 4-1.

1. **Do nothing**: where no action is taken and existing assets and ordinary watercourses are abandoned.
2. **Maintain current flood risk management regime**: where existing assets and watercourses are maintained as present in line with current levels of flood risk. Existing infrastructure is not improved over time and the effects of climate change are not taken into account; and
3. **Manage and reduce local flood risk**: take action to reduce the social, economic and environmental impact due to flooding.

Table 4-1: Assessment of the strategy and alternative options against the SEA objectives

SEA Objectives		Options and Effects		
		Do Nothing	Maintain current flood risk management regime	Manage and reduce local flood risk
1	Protect the integrity of the Borough's urban and rural landscapes, and promote the key characteristics of the Area of Great Landscape Value.	Potential negative effect resulting from no management that could adversely impact on sensitive urban landscape character. However, abandonment of assets may allow for the development of a more natural watercourse, which may enhance the local landscape character, particularly in rural areas.	Little/no change to the baseline in the short to medium term. However, with increasing flood risk, negative effects could occur on sensitive urban landscape character, whilst positive effects may occur in rural areas as the Borough's watercourses increasingly reconnect to their floodplain.	Potential for managing and promoting this objective through sensitively designed flood risk management schemes, which enhance local landscape character, historic sites and the Area of Great Landscape Value. Conversely, inappropriate management schemes could damage key landscape features and characteristics.
2	Protect and enhance important and notable habitats and species in the Borough.	Potential for both adverse and beneficial impacts. For example, abandonment of assets may allow for the development of a more natural watercourse (enhancing certain notable species and habitats). However, there would be an increased risk of spreading non-native invasive species and potential impacts on water quality through increased flooding.	Little/no change to baseline in the short to medium term. Increased flooding in the future may provide opportunities for new habitat creation, but may also result in the spread non-native invasive species or adversely impact on habitats intolerant of increased inundation or changes in water quality.	Potential for both adverse and beneficial impacts as a result of active management. Opportunities may arise to enhance habitats and species through the implementation of multi-functional flood risk management measures, such as the provision of new green infrastructure.
3	Maintain and enhance habitat connectivity and wildlife corridors within the Borough.	Potential for both adverse and beneficial impacts. Abandonment of assets would allow for corridors to develop that would be unrestricted by flood risk assets. However, the increased risk of spreading non-native invasive species would inhibit the biodiversity value of wildlife corridors.	Little/no change to baseline in the short to medium term. Increased flooding in the future may provide opportunities for new habitat creation, but may also result in the spread non-native invasive species or adversely impact on habitats intolerant of increased inundation or changes in water quality.	Potential for both adverse and beneficial impacts as a result of active management. Opportunities may arise to enhance habitats and species through the implementation of multi-functional flood risk management measures, such as the provision of new green infrastructure.

SEA Objectives		Options and Effects		
		Do Nothing	Maintain current flood risk management regime	Manage and reduce local flood risk
4	Maintain existing, and where possible create new, riverine habitat to benefit aquatic species and fisheries, and maintain upstream access.	Potential for both adverse and beneficial impacts. For example, existing habitat may deteriorate as a result of increased flooding (however, this will often depend on what the site is designated for) and blockages may occur due to the movement of sediment. However, abandonment of assets may allow a more natural riverine system to develop.	Little/no change to baseline. However as a result of increased flooding in the future due to climate change new habitats may be created or existing wetland habitats enhanced. However, habitats intolerant of increased inundation or changes in water quality may be adversely affected.	Potential for both adverse and beneficial impacts as a result of active management. Significant opportunities may exist for habitat creation as a result of implementing measures to reduce local flood risk. Conversely, the introduction of new assets may damage riverine habitat and introduce blockages for fish access to upstream watercourses if not implemented appropriately.
5	Improve the quality and quantity of the water in the Borough's rivers.	Potential for both adverse and beneficial impacts. For example, abandonment of assets may allow for the development of a more natural watercourse and fewer assets are likely to reduce constrictions on water flow and hence water availability and quantity. However, there would be no management of water quality issues such as run-off, whilst flood risk to contaminated sites may increase, leading to increased surface and groundwater contamination.	Little/no change to baseline levels in the short to medium term. However, increased flood risk in the future may result in a reduction in surface water and groundwater quality due to contamination from surface water runoff or from contaminated sites.	Management of watercourses allows water quality to be monitored and potentially improved. Taking further action to reduce local flood risk may also improve water quality through reduced flood risk to potentially contaminated sites. However, the introduction of further flood risk assets to watercourses may result in constrictions to water flow, reducing water availability. Careful management of the implementation of such assets can prevent these adverse effects.
6	Do not inhibit achievement of the WFD objectives and contribute to their achievement where possible.	Potential for both adverse and beneficial impacts. For example, abandonment of assets may allow for the development of more natural watercourses. However, there would be an increased risk of spreading non-native, invasive species through flooding and pollution to watercourses could become more widespread.	Little/no change to current measures to meet WFD objectives.	Potential for both adverse and beneficial impacts depending upon the specific statuses and objectives of the waterbody as identified in the RBMP. Opportunities for achieving WFD objectives may arise through the implementation of measures to reduce local flood risk.
7	Reduce the risk of soil erosion and pollution.	Potential negative effect on soil quality, particularly in areas of high land quality, resulting from increased erosion of soils from flooding and no management of land contamination risks and subsequent effects.	Little/no change to baseline. However, in the future, as a result of climate change, adverse impacts may arise through erosion and land contamination from increased flooding.	Potential for managing and promoting this objective through reduced flood risk.
8	Preserve and where possible enhance heritage assets in the Borough and their settings.	Potential for both adverse and beneficial impacts. Historic environment assets and cultural heritage sites may be exposed to greater damage and deterioration through increased flood risk. Conversely, increased water inundation may help preserve some assets dependent on waterlogging, whilst the declining condition of flood risk management assets from no management and greater connectivity to the floodplain could improve the setting of historic sites.	Little/no change to baseline. However, in the future historic environment assets and cultural heritage may be exposed to increased flooding and damage due to climate change.	Potential for both adverse and beneficial impacts as a result of active management, for example through increased protection to vulnerable historic environment assets or improvements to their settings.

SEA Objectives		Options and Effects		
		Do Nothing	Maintain current flood risk management regime	Manage and reduce local flood risk
9	Minimise the risk of flooding to communities.	Increased exposure to flood risk from a combination of no management and climate change. This could lead to a greater number of people and their properties at risk of flooding, causing greater damage and disruption, and increases in social exclusion, deprivation and health risks.	No improvements to health and well-being as existing risk maintained and risk may increase in the future as a result of climate change.	Active management to reduce local flood risk should help to protect residential properties and key social infrastructure services from flooding. This has the potential to create a range of social benefits including reducing associated health impacts and social deprivation.
10	Increase the use of sustainable drainage systems (SuDS), particularly in all new developments.	This option would result in no increase in the use of SuDS in the future. Surface runoff volumes would be likely to increase, further exacerbating flood risk events. In addition, the declining condition from no management of existing SuDS schemes and lack of additional schemes may reduce the ability to manage future impacts of climate change.	Little/no change to the baseline in the short to medium term. However, with increasing flood risk, the lack of additional SuDS schemes may reduce the ability to manage future impacts of climate change.	Active management to reduce flood risk may incorporate the greater use of SuDS schemes to reduce the rate and volume of surface water runoff. This will contribute to climate change mitigation and adaptation initiatives and can provide a range of other environmental benefits, including biodiversity enhancements and the provision of new recreation and amenity opportunities.
11	Minimise the impacts of flooding to the Borough's transport network and key critical infrastructure.	This option is likely to result in increased flood risk to key infrastructure, which would cause significant disruption to the Borough, impacting on human and economic activity and the environment.	This option would maintain the current risk levels, although risk may increase in the future as a result of climate change.	Flood risk management options may reduce flood risk to key critical infrastructure, reducing disruption during flood events and enabling a more effective response.
12	Reduce vulnerability to climate change impacts and promote measures to enable adaptation to climate change impacts.	This option would result in no active adaptation or response to climate change (specifically, flood risk management). This would lead to a risk of adverse impacts to all receptors in the short, medium and long-term. However, the loss of existing flood risk management assets may result in a greater reconnection of the river to its floodplain, which could benefit a range of habitats and species.	No adaptation or response to climate change in terms of flood risk management. High risk for adverse impacts to all receptors in the short, medium and long-term.	The LFRMS includes full consideration of climate change adaptation in terms of flood risk management. This will reduce the overall risk of flooding and the potential for flood damages in the short, medium and long-term future, benefiting both people and property.

The assessment described in Table 4-1indicates that Option 1 (do nothing) is likely to result in a number of significant adverse impacts, particularly in relation to people and property, and other environmental assets including historic sites and biodiversity, where increased flooding may create new pathways for the spread of invasive non-native species. Surface water and groundwater quality could also be adversely affected, with increased flooding of contaminated sites leading to greater impacts on water resources. Conversely, increased flood risk may result in greater connectivity between watercourse and their floodplains, offering opportunities for habitat creation of benefit to a range of protected and notable species.

Option 2 (maintain current flood risk management regime) is likely to result in little or no change in the environmental baseline in the short to medium term as the existing flood risk management regime continues to maintain existing levels of flood protection. However, in the future, as a result of climate change, flood risk will increase, resulting in many of the impacts identified under Option 1, although potentially to a lesser extent and significance.

Option 3 (manage and reduce local flood risk) has the potential to provide a range of environmental benefits. Flood risk management initiatives, if designed and implemented in an appropriate manner,

could have multiple benefits. This could include reducing flood risk to people and property, contributing to the protection of heritage assets and improvements in water quality, and providing new opportunities for habitat creation and the provision of recreation and amenity assets. Conversely, flood risk management measures, if implemented in an inappropriate manner, could result in adverse effects on a range of environmental features. However, this risk is managed through the preparation of this SEA and through the planning and consenting process, which is likely to require consideration of the sustainability of a project prior to its implementation. Therefore, it is evident that by doing nothing or maintaining current levels of management, there are likely to be detrimental effects on the SEA objectives, which are likely to be prevented by carrying out active flood risk management as proposed by the LFRMS.

4.3 Strategy objectives and measures

The following draft LFRMS objectives and underpinning measures have been developed. The SEA appraises these objectives and measures to determine whether they would inhibit achievement of the SEA objectives, or conversely, contribute to their delivery.

Table 4-2: Assessment of the strategy and alternative options against the SEA objectives.

Objective No.	Objective	Measures
1	Improve understanding of local flood risk within Bedford Borough	• Map high risk areas for 'local' flood risk in the Borough • Identify vulnerable groups and key infrastructure • Maintain an up-to-date record of flood incidents • Carry out formal investigation of flood incidents • Communicate and improve the level of understanding of local risk to public and stakeholder groups • Record flood assets in a register and make available for public inspection • Develop greater understanding of surface water risks through targeted detailed investigations • Improve skills and knowledge of Council officers in sustainable flood risk management • Take part in Anglian Water Catchment pilots
2	Actively manage flood risk associated with new development and re-development proposals	• Establish a SuDS Approval Body (SAB) for Bedford Borough with clear processes in line with Defra guidance • Develop tools for development management to inform planning officers on local flood risk priorities • Publish SAB Policy and Guidance to require a zero increase in surface water flow from future development • Promote water recycling as part of new development • Influence land allocations in local plan using best available information to identify appropriate development potential
3	Communicate and engage the public in flood risk based decision making and improve community resilience to enable communities to help themselves	• Engage with communities to identify vulnerable groups and work with them to identify their risks and develop emergency plans • Develop long term communication strategy in partnership to improve communities resilience for local flood risk • Work with local communities to agree specific responsibilities and improve understanding of risks • Promote local flood groups where relevant and provide appropriate support and information to ensure their effectiveness • Embed the Local Flood Risk Management Strategy into Local Resilience's flood response and recovery plans
4	Take a risk based, proportionate approach to flood risk management to protect people, their property and key infrastructure	• Identify highest risk open and closed watercourses, highway drains and other drainage/flood features • Develop an affordable cyclical regime to manage and maintain assets for Highway drainage and ordinary watercourse assets and within the IDB area maintain current regime
5	Take a sustainable, holistic approach to flood risk management to deliver wider environmental benefits, sustainable communities and best use of local water resources	• Promote the concept of water cycle management, blue/green corridors and water sensitive urban design in master planning • Embed policies from local River Basin Management Plans, local environmental policies and 'European' protected sites into FRM procedures and programmes • Seek to enhance biodiversity and habitat creation within future capital schemes and SuDS • Promote SuDS to improve water quality, biodiversity and habitat creation

Objective No.	Objective	Measures
6	Take a collective, proactive and innovative approach to manage flood risk to pool resources and funds in an integrated way to achieve enhanced overall benefit	• Establish working flood risk framework with other Risk Management Authorities • Continue to develop the Bedford Borough Flood partnership and contribute to the Tri-area partnership and regional LLFA liaison group • Develop a pragmatic programme of schemes to be funded through Partnership Funding and Local Levy and opportunities to pool resources • Promote cost effective flood protection measures such as individual property protection and local action groups • Involve local communities in local initiatives and schemes
7	Encourage maintenance of privately owned flood defence structures and ordinary watercourses and minimise unnecessary constrictions.	• Promote clear processes and policy for consenting on ordinary watercourses for Bedford Borough drainage area for new structures to prevent works causing restrictions to flow • Develop process and policy for consenting on discharge rates to ordinary watercourses in Bedford Borough drainage area • Raise awareness of riparian owners responsibilities and promote within priority areas • Identify highest risk private flood defence and drainage assets and develop technical advice for owners to guide them to develop local maintenance plans • Develop and implement a policy on de-culverting • Establish a risk based designation process

5 Appraisal of LFRMS objectives to improve flood risk

5.1 Impact significance

The unmitigated impacts of the LFRMS objectives on achieving the SEA objectives were identified through the analysis of the baseline environmental conditions and use of professional judgement. The significance of effects was scored using the five point scale summarised in Table 5-1. If a high level of uncertainty regarding the likelihood and potential significance of an impact (either positive or negative) was identified, it was scored as uncertain.

Table 5-1: SEA appraisal codes

Impact significance	Impact symbol
Significant positive impact	++
Minor positive impact	+
Neutral impact	0
Minor negative impact	-
Significant negative impact	--
Uncertain impact	?

Throughout the assessment the following approach was applied:

- Positive, neutral and negative impacts are assessed, with uncertain impacts highlighted.
- The duration of the impact are considered over the short, medium and long term.
- The reversibility and permanence of the impact are assessed (e.g. temporary construction impacts, impacts which can be mitigated against/restored over time or completely irreversible changes to the environment).
- In-combination effects are also considered.

The significance of effects upon each of the SEA objectives are then evaluated and used to inform option selection.

Table 5-2 provides a summary of the outcomes of the environmental assessment of the draft LFRMS objectives and measures. Table 5-3 shows the results of the assessment of cumulative effects of the LFRMS objectives on achievement of the SEA objectives. This is a qualitative assessment that identifies the range of potential effects that the LFRMS may have on delivering each SEA objective. Where a particular LFRMS objective is underpinned by a series of measures, each of which may give rise to a range of environmental impacts, an overall impact has been identified for each SEA objective.

An overall summary of these assessments is shown in Table 5-4.

Table 5-2: Assessment of LFRMS objectives against SEA objectives

LFRMS objectives	LFRMS measures	SEA objectives												Comments
		1	2	3	4	5	6	7	8	9	10	11	12	
Objective 1: Improve understanding of local flood risk within Bedford Borough.	Map high risk areas for 'local' flood risk in the Borough.	0	0	0	0	0	0	0	+	+	0	+	+	Improving the understanding of local flood risk issues across the Borough has the potential to contribute to objectives 8, 9, 11 and 12, which focus on the reduction of flood risk to the built environment and communities, and adaptation to climate change effects. There is likely to be a neutral impact in relation to all other SEA objectives, with the exception of the LFRMS measure, 'Take part in Anglian Water Catchment Pilots', which has the potential to have a significant positive impact on biodiversity, flora and fauna and WFD objectives through active restoration of watercourses. This may in turn enhance and improve water quality and quantity, soil quality and landscape characteristics. Opportunities may also exist in the future, with better understanding of flood risk to the natural environment (which may cause degradation of habitats and species, soil erosion and disperse pollution), to alleviate the impacts of flooding to these natural environment receptors.
	Identify vulnerable groups and key infrastructure.	0	0	0	0	0	0	0	0	+	0	+	+	
	Maintain an up-to-date record of flood incidents.	0	0	0	0	0	0	0	+	+	0	+	+	
	Carry out formal investigation of flood incidents.	0	0	0	0	0	0	0	+	+	0	+	+	
	Communicate and improve the level of understanding of local risk to public and stakeholder groups	0	0	0	0	0	0	0	+	+	0	+	+	
	Record flood assets in a register and make available for public inspection.	0	0	0	0	0	0	0	+	+	0	+	+	
	Develop greater understanding of surface water risks through targeted detailed investigations.	0	0	0	0	0	0	0	+	+	0	+	+	
	Improve skills and knowledge of Council officers in sustainable flood risk management.	0	0	0	0	0	0	0	+	+	+	+	+	
	Take part in Anglian Water Catchment pilots.	+	++	++	++	+	++	+	+	+	0	+	+	
Objective 2: Actively manage flood risk associated with new development and re-development proposals.	Establish a SuDS Approval Body (SAB) for Bedford Borough with clear processes in-line with Defra guidance.	0	+	+	0	+	+	+	0	+	++	+	+	This strategy measure has the potential to benefit a range of social receptors and infrastructure, which may see a reduction in the impact of flooding from new developments as SuDS schemes become much more prominent in the planning system and therefore more widely adopted. Also this LFRMS action contributes towards specific SuDS and water-specific SEA objectives (objectives 6, 7 and 10). There should also be future benefits to the natural environment receptors (landscape, biodiversity, flora and fauna) as SuDS become more commonplace, better designed and with more effective maintenance regimes, with potential important benefits to biodiversity through the creation of new habitats and the linking of existing habitats.
	Develop tools for development management to inform planning officers on local flood risk priorities.	0	0	0	0	0	0	0	+	+	+	+	+	This action provides potential benefits through the reduction of flood risk to the built environment, communities, transport and infrastructure, and could aid measures to promote adaptation to climate change. As flood risk will be managed on a prioritised basis, the effects that cause greatest damage will be addressed within the planning system. For other SEA objectives, the effects of this measure are likely to be neutral and are more directly linked to any interventions that are subsequently delivered. Effects could be negative if interventions do not take wider environmental requirements into consideration, and could be of benefit if they also seek to deliver wider environmental objectives.
	Publish SAB Policy and Guidance to require a zero increase in surface water flow from future development.	0	0	0	0	+	+	+	0	+	++	+	+	This measure may benefit receptors that are adversely affected by surface water flood events, including population, material assets and soil erosion. In addition, water quality and quantity are likely to be better protected through better management of surface water flooding. This may also alleviate the need to implement hard engineering measures to manage surface water flood risk. There may be secondary indirect benefits to other natural environment objectives (including landscape, biodiversity, flora and fauna) as a result of a reduction in surface water flooding, but these impacts are difficult to determine at this stage.
	Promote water recycling as part of new development.	0	0	0	0	++	+	+	0	+	0	+	+	Water recycling may be of particular benefit to water quantity and quality (as less water will need to be abstracted). Water recycling will also contribute to the reduction of flood risk associated with new development by reducing surface run-off from the urban environment. This may benefit a range of social receptors and infrastructure, and could make a positive contribution to other natural environment objectives (including landscape, biodiversity, flora and fauna) as a result of a reduction in surface water flooding. However, these impacts are difficult to determine at this stage.
	Influence land allocations in local plan using best available information to identify appropriate development potential.	?	?	?	?	?	?	?	?	+	0	+	+	For the majority of SEA objectives, (excluding those focussed on reducing flood risk to the population, transport and the climate change adaptation objective) it is not possible to determine what effect allocating land in areas of least flood risk would have on achieving wider environmental objectives. Impacts will depend upon the specific constraints and opportunities associated with each allocated site, which will require site specific assessment. However, if wider environmental objectives are promoted during the land allocation process, there is potential to provide contributions to many of the SEA objectives; conversely, unsustainable land allocation could have a negative impact upon many of these objectives.

LFRMS objectives	LFRMS measures	SEA objectives												Comments
		1	2	3	4	5	6	7	8	9	10	11	12	
Objective 3: Communicate and engage the public in flood risk-based decision making and improve community resilience to enable communities to help themselves.	Engage with communities to identify vulnerable groups and work with them to identify their risks and develop emergency plans.	0	0	0	0	0	0	0	0	+	0	+	+	Communication and engagement with the local public regarding local flood risk issues and decision-making across the borough has the potential to provide a positive contribution to objectives 9, 11 and 12, which focus on the reduction of flood risk to communities, transport and infrastructure, and also aids adaptation to climate change effects. All other SEA objectives are not likely to be affected by these measures. Opportunities may exist in the future, with better understanding of flood risk to the natural environment (which may cause degradation of habitats and species, soil erosion and disperse pollution), to engage with the local public alleviate the impacts of flooding to these natural environment receptors.
	Develop long term communication strategy in partnership to improve communities' resilience for local flood risk.	0	0	0	0	0	0	0	0	+	0	+	+	
	Work with local communities to agree specific responsibilities and improve understanding of risks.	0	0	0	0	0	0	0	0	+	0	+	+	
	Promote local flood groups where relevant and provide appropriate support and information to ensure their effectiveness.	0	0	0	0	0	0	0	0	+	0	+	+	
	Embed the Local Flood Risk Management Strategy into Local Resilience's flood response and recovery plans.	0	0	0	0	0	0	0	+	+	+	+	+	
Objective 4: Take a risk-based, proportionate approach to flood risk management to protect people, their property and key infrastructure.	Identify highest risk open and closed watercourses, highway drains and other drainage/flood features.	0	0	0	0	0	0	0	+	+	0	+	+	Taking a risk-based approach to flood risk for people, property and infrastructure has the potential to have a positive impact on the corresponding SEA objectives. As this measure is focused on identifying high-risk areas rather than delivering physical interventions, other SEA objectives are not likely to be affected.
	Develop an affordable cyclical regime to manage and maintain assets for Highway drainage and ordinary watercourse assets and within the IDB area maintain current regime.	0	?	?	?	0	?	0	?	+	0	+	+	Management and maintenance of existing drainage and flood risk management assets could potentially have a range of environmental effects, both positive and negative, depending upon the asset type and location, and the type of maintenance to be undertaken. Given the lack of information at this stage as to what works could be undertaken as part of this measure, it is assessed as having an uncertain impact for several of the SEA objectives. However, given that the LFRMS is seeking to achieve a range of environmental benefits (see objective 5), it is likely that such interventions would be delivered in a more sustainable manner and could have a range of positive effects. Beneficial effects for several objectives are likely to occur through the ongoing management of flood risk.
Objective 5: Take a sustainable, holistic approach to flood risk management to deliver wider environmental benefits, sustainable communities and best use of local water resources.	Promote the concept of water cycle management, blue/green corridors and water sensitive urban design in master planning.	+	++	++	++	++	++	+	+	+	++	+	++	This measure provides significant opportunities to deliver a range of benefits for all SEA objectives. In particular, flood risk is reduced and managed in a sustainable way that offers an approach to support improvements to biodiversity, water quality and quantity.
	Embed policies from local River Basin Management Plans, local environmental policies and 'European' protected sites into FRM procedures and programmes.	+	++	++	++	++	++	+	+	+	++	+	++	The RBMP aims to deliver improvements to the water environment that will contribute to the achievement of many of the SEA objectives. In particular, the RBMP will deliver improvements to biodiversity, water quality and quantity. In turn, these impacts will add to the quality of landscapes and soil and contribute to the reduction of flood risk to the human environment. Improvements to designated sites are also likely to occur through the delivery of European biodiversity objectives, whilst delivery of local environmental policies will further contribute to the achievement of the SEA objectives.
	Seek to enhance biodiversity and habitat creation within future capital schemes and SuDS.	+	++	++	++	++	++	+	+	+	++	+	++	These measures offer an important opportunity to deliver significant benefits to biodiversity, water quality and quantity. Use of SuDS will also reduce flood risk to the human environment and indirectly benefit the landscape, riverine habitat and soil quality.
	Promote SuDS to improve water quality, biodiversity and habitat creation.	+	++	++	++	++	++	+	+	+	++	+	++	
Objective 6: Take a collective, proactive and innovative approach to manage flood risk to pool resources and funds in an integrated way to achieve enhanced overall benefit.	Establish working flood risk framework with other Risk Management Authorities.	0	0	0	0	0	0	0	0	+	0	+	+	These LFRMS measures are focussed on improving partnership working to deliver flood risk benefits rather than the delivery of specific physical interventions. Therefore, it is likely that they will not have an effect on many of the SEA objectives. However, taking a collective, proactive and innovative approach to managing flood risk will have a positive effect on flood risk management and is likely to benefit property and infrastructure, as well as offering opportunities to deliver actions that contribute towards climate change adaptation.
	Continue to develop the Bedford Borough Flood partnership and contribute to the Tri-area partnership and regional LLFA liaison group.	0	0	0	0	0	0	0	0	+	0	+	+	
	Develop a pragmatic programme of schemes to be funded through Partnership Funding and Local Levy and opportunities to pool resources.	?	?	?	?	?	?	?	?	+	0	+	+	These measures could deliver physical interventions to improve flood risk. If implemented in a sustainable manner that includes consideration of wider environmental issues, these measures could potentially contribute towards many of the SEA objectives. However, depending on the protection measures implemented, there is the risk of negatively impacting the natural environment, especially if inappropriate geo-engineering options are used. This risk is likely to be low as such effects would conflict with several strategy objectives see objective 5). This will depend upon the specific constraints and opportunities associated with each intervention, which will require site specific assessment.
	Promote cost effective flood protection measures such as individual property protection and local action groups.	?	?	?	?	?	?	?	?	+	+	+	+	
	Involve local communities in local initiatives and schemes.	0	0	0	0	0	0	0	0	+	0	+	+	Involving local communities in flood risk management initiatives may have a direct benefit to these communities, who will better understand local flood risk issues and management requirements. This could help to reduce the impacts of flooding and help with future climate change adaptation initiatives.

LFRMS objectives	LFRMS measures	SEA objectives												Comments
		1	2	3	4	5	6	7	8	9	10	11	12	
Objective 7: Encourage maintenance of privately-owned flood defence structures and ordinary watercourses and minimise unnecessary constrictions.	Promote clear processes and policy for consenting on ordinary watercourses for Bedford Borough drainage area for new structures to prevent works causing restrictions to flow.	?	?	?	?	?	?	?	?	+	0	+	+	Consenting of new structures has the potential to provide positive benefits should wider environmental objectives be taken into account during the consenting process so as to achieve environmental gain (in accordance with the requirements of objective 5). Conversely, a lack of consideration may result in a negative effect as new structures could affect sensitive ecological and historic environment features. The potential impacts will therefore depend upon how this measure is implemented.
	Develop process and policy for consenting on discharge rates to ordinary watercourses in Bedford Borough drainage area.	0	+	+	+	+	+	+	+	+	0	+	+	New processes to improve discharge consenting has the potential to deliver a range of environmental benefits; most notably improvements to water quality and quantity, biodiversity and protection of assets at risk of flooding.
	Raise awareness of riparian owners' responsibilities and promote within priority areas.	0	0	0	0	0	0	0	0	+	0	+	+	Awareness raising and new guidance is not likely to contribute to many of the SEA objectives directly. However, if such measures lead directly to physical interventions by riparian owners, then such interventions could have positive or negative effects depending upon how they are implemented. Given that the LFRMS is seeking to achieve a range of environmental benefits (see objective 5), such interventions could be delivered in a more sustainable manner and could lead to a range of positive effects.
	Identify highest risk private flood defence and drainage assets and develop technical advice for owners to guide them to develop local maintenance plans.	0	0	0	0	0	0	0	0	+	0	+	+	
	Develop and implement a policy on de-culverting.	+	+	++	++	+	++	+	+	++	0	++	++	This measure offers an opportunity to deliver significant and direct benefits to the SEA objectives seeking to maintain and enhance riverine habitat and contribute to the WFD objectives, in addition to those focussed on the reduction of flooding to the human environment. This measure will also contribute to the maintenance and enhancement of the remaining natural environment SEA objectives that includes impacts on the riverine and/or riparian habitat. Benefits also to the human environment through the reduction of flood risk due from the minimisation of watercourse constrictions.
	Establish a risk based designation process.	0	0	0	0	0	0	0	0	+	0	+	+	Establishing a risk-based designation process for watercourses will benefit populations and the built environment that are at significant risk from flooding. Establishing this process is unlikely to have an effect on the remainder of the SEA objectives.

Table 5-3: Cumulative effects of the actions of the LFRMS on SEA objectives

	SEA Objectives											
LFRMS Objectives	1	2	3	4	5	6	7	8	9	10	11	12
1	0	+	+	+	0	+	0	++	++	0	++	++
2	?	?	?	?	++	+	+	?	++	++	++	++
3	0	0	0	0	0	0	0	0	++	0	++	++
4	0	?	?	?	0	?	0	?	++	0	++	++
5	++	++	++	++	++	++	++	++	++	++	++	++
6	?	?	?	?	?	?	?	?	++	0	++	++
7	0	0	+	+	0	+	0	0	++	0	++	++

Table 5-4: Summary of Effects of LFRMS objectives/actions on SEA objectives

Receptor	SEA Objective		Summary of effects	Mitigation requirement
Landscape	1	Protect the integrity of the Borough's urban and rural landscapes.	No potential negative effects have been identified. There is potential for positive effects associated with LFRMS objective 5, which seeks to ensure a sustainable approach to flood risk management, with specific measures related to the creation of blue and green corridors, and new habitat creation, which could benefit landscape character. Uncertain effects are identified from LFRMS objectives 2, 6 and 7, which may result in flood risk management interventions that could have positive or negative effects depending upon the manner by which they are implemented. However, this risk is likely to be low as such effects would conflict with several strategy objectives (particularly objective 5). Impacts will depend upon the specific constraints and opportunities associated with each intervention, which will require site specific assessment.	None required, although the implementation of LFRMS objectives 2, 6 and 7, may result in interventions that affect achievement of several SEA objectives. These risks are directly associated with the type, scale and location of flood risk management interventions, and their location in relation to important or sensitive environmental features. However, the LFRMS also includes actions to deliver a range of environmental improvements and so interventions that have a significant negative effect would be likely to conflict with delivery of the LFRMS. Therefore, the LFRMS should ensure integration of its objectives across all underpinning measures so that delivery of individual measures does not conflict with achievement of the wider strategy objectives, but instead
Biodiversity, flora and fauna	2	Protect and enhance important and notable habitats and species in the Borough.	No negative effects have been identified. There is potential for the LFRMS to provide significant positive contributions to these objectives, particularly through implementation of LFRMS objectives 1, 5 and 7, which seek delivery of environmental benefits through flood risk management interventions. Creation and enhancement of habitats through watercourse diversions and construction of flood storage areas provides opportunity for achievement of these SEA objectives, as does the promotion of responsible watercourse management. Uncertainties have been identified largely from a dependency on the location, nature and scale of implementation measures to reduce flood risk under LFRMS objectives 2, 4, 6 and 7.	
	3	Maintain and enhance habitat connectivity and wildlife corridors within the Borough.		
	4	Maintain existing, and where possible create new,		

Receptor	SEA Objective		Summary of effects	Mitigation requirement
		riverine habitat to benefit aquatic species and fisheries, and maintain upstream access.		seeks to contribute towards these objectives at all stages of the strategy's implementation.
Water environment	**5**	Improve the quality and quantity of the water in the borough's rivers.	No negative effects have been identified. Positive effects may arise from developing a better understanding flood risk in the Borough and actively managing flood risk from new development proposals and re-developments – water recycling will reduce abstraction from local watercourses, reduced surface water flooding should lower pollution levels and incidents in watercourses, and the greater use and management of SuDS may promote a range of water quality benefits. LFRMS objective 5 has the potential to provide a significant positive contribution to these objectives, as it promotes better water management and the delivery of local RBMP objectives. There is some uncertainty with regards to LFRMS objectives 2, 4, 6 and 7, due to the lack of detail on the specific nature of the interventions that would be implemented as part of these objectives. However, any risks are likely to be low as any significant adverse effects would conflict with several strategy objectives (particularly objective 5). Impacts will depend upon the specific constraints and opportunities associated with each intervention, which will require site specific assessment.	
	6	Do not inhibit achievement of the WFD objectives and contribute to their achievement where possible.		
Soils and geology	**7**	Reduce the risk of soil erosion and pollution.	No negative effects have been identified. Some positive effects may arise from better understanding flood risk and actively managing flood risk from new and re-development as this measure is likely to reduce the overall risk of surface water flooding, thereby reducing pollution incidents and soil erosion. Management of flood risk from new and re-development is likely to have a similar level of impact. Significant positive effects may arise through the creation of blue and green corridors, that will lessen soil erosion and in turn, riparian habitat management will also aid this. There is uncertainty surrounding the LFRMS objectives 2 and 6. This is due to the lack of detail on the specific nature of the interventions that would be implemented as part of these objectives.	
Historic environment	**8**	Preserve and where possible enhance heritage assets in the Borough and their settings.	No negative effects have been identified. Several positive effects could occur, most notably through those strategy objectives that focus on the reduction of flood risk to the built environment and communities, awareness raising initiatives that identify high priority areas, and measures to better manage surface water runoff. There is uncertainty surrounding the LFRMS objectives 2, 4, 6 and 7. This is due to the lack of detail on the specific nature of the interventions that would be implemented as part of these objectives. However, any risks are likely to be low as any significant adverse effects would conflict with several strategy objectives (particularly objective 5). Impacts will depend upon the specific constraints and opportunities associated with each intervention, which will require site specific assessment.	
Population	**9**	Minimise the risk of flooding to communities.	As expected of a strategy for managing flood risk, none of the measures are considered to have negative effects on this objective and the majority of measures within the strategy will contribute directly to achievement of this SEA objective. As a result, the strategy is likely to have a significant positive effect on reducing flood risk to local communities.	None required.
	10	Increase the use of sustainable drainage systems (SuDS), particularly in all new developments.	No negative impacts on this objective. LFRMS objectives 2 and 5 are likely to provide opportunities to deliver significant positive benefits through the wider use of SuDs, and better design and maintenance, which will be promoted through the establishment of the SAB and related policy and guidance, in addition to using SuDS to create habitat. Objectives 1, 3 and 6 are also likely to have a positive effect on this SEA objective through sustainable flood risk management, embedding the LFRMS (which promotes SuDS) into strategies and encouraging cost effective, local flood protection measures.	None required.
Material assets	**11**	Minimise the impacts of flooding to the Borough's transport network and key critical infrastructure.	As expected of a strategy for managing flood risk, none of the measures are considered to have negative effects on this objective and the majority of actions within the strategy are likely to help achievement of this SEA objective.	None required.
Climate	**12**	Reduce vulnerability to climate change impacts and promote measures to enable adaptation to climate change impacts.	As expected of a strategy for managing flood risk, none of the measures are considered to have negative effects on this objective and all of the actions within the strategy are likely to help achievement of this SEA objective. In particular, measures that promote better use of water resources, new habitat creation and better connection between existing habitats (such as de-culverting), could make a significant positive contribution to achievement of this SEA objective.	None required.

6 Conclusion and recommendations

6.1 Conclusions

The LFRMS aims to promote objectives that deliver sustainable flood risk management. It is an important tool to protect vulnerable communities and deliver sustainable regeneration and growth.

This SEA has been undertaken to identify the likely significant environmental impacts of implementation of the LFRMS. A proportionate approach was adopted towards establishing the scope of the SEA, reflecting the high-level nature of the LFRMS.

A range of different strategy options for delivering the LFRMS have been assessed at a strategic level against the SEA objectives. These alternatives include the 'do nothing' scenario, where no action is taken and existing assets and ordinary watercourses are abandoned, and the 'maintain current flood risk' scenario, where existing assets and watercourses are maintained as present in line with current levels of flood risk.

The assessment indicates that the 'do nothing' approach is likely to result in a number of significant adverse impacts, particularly due to increased flood risk to people and property, and effects on other environmental assets including water quality, historic sites and biodiversity, where increased flooding may create new pathways for the spread of invasive non-native species. These impacts would be likely to increase over time as responsible bodies will be unable to incorporate precautionary measures in existing or new developments in a response to climate change pressures. Conversely, increased flood risk may result in greater connectivity between watercourses and their floodplains, offering opportunities for habitat creation/enhancement of benefit to a range of protected and notable species.

The option to 'maintain current flood risk' is likely to result in little or no additional impact on the environment in the short to medium term as the existing flood risk management regime continues to maintain existing levels of flood protection. However, in the future, as a result of climate change, flood risk will increase, resulting in many of the impacts identified under the 'do nothing' scenario, although potentially to a lesser extent and significance.

Therefore, the SEA identifies that implementation of the LFRMS to 'manage and reduce local flood risk' is the only realistic approach to be employed by Bedford Borough Council as it has the potential to provide a range of environmental benefits and offers a pro-active approach to managing flood risk.

Assessment of the LFRMS objectives and underpinning measures against the SEA objectives has been undertaken. No negative environmental impacts have been identified, although a range of unknown effects have been highlighted.

Many of the proposed LFRMS measures have the potential for both direct and indirect environmental benefits. Objective 5 in particular has potential to provide a positive contribution to all of the SEA objectives and make a significant positive contribution to many of them. In addition, measures to promote the use of SuDS (objectives 2 and 5) and encourage better design and more effective maintenance have the potential to achieve a range of potential benefits. In particular, the LFRMS could achieve a range of biodiversity benefits, including new habitat creation, enhancement of existing habitats and greater habitat connectivity.

In addition, as expected of a strategy for managing flood risk, the majority of measures within the strategy will contribute to achievement of the SEA objectives that seek to reduce flood risk to people, property and infrastructure. As a result, the strategy is likely to have a significant positive effect on reducing flood risk to local communities.

Each of the strategy objectives is also likely to assist with climate change adaptation. In particular, measures that reduce flood risk, promote better use of water resources, seek to deliver new habitat creation and better connection between existing habitats (such as de-culverting), could make a significant positive contribution to achievement of this SEA objective.

At present, the potential effects associated with several of the LFRMS measures are unknown. Several measures (associated with objectives 4, 6 and 7) may result in physical interventions that could affect achievement of several other SEA objectives, depending upon how they are implemented. These risks are directly associated with the type and scale of flood risk management

interventions, and their location in relation to important or sensitive environmental features. However, given that the LFRMS includes measures to deliver a range of environmental improvements, such interventions, if delivered in an inappropriate manner, would be likely to conflict with delivery of the LFRMS. Therefore, the LFRMS should ensure integration of its objectives across all underpinning measures so that delivery of individual measures does not conflict with achievement of the wider strategy objectives, but instead seeks to contribute towards these objectives at all stages of the strategy's implementation. A detailed assessment of the potential cumulative effects of the LFRMS measures should be undertaken when further details regarding specific measures and their implementation are known.

6.2 Recommendations

The assessment of the LFRMS objectives and measures has identified a number of areas where the LFRMS could be strengthened to ensure delivery of a sustainable approach. These areas are associated with potential physical interventions to reduce flood risk, which have been identified in this assessment as having unknown effects. Specifically, these apply to the following LFRMS objectives/measures:

- Objective 2 – *Influence land allocations in local plan using best available information to identify appropriate development potential.*
- Objective 4 – *Develop an affordable cyclical regime to manage and maintain assets for Highway drainage and ordinary watercourse assets and within the IDB area maintain current regime.*
- Objective 6 – *Develop a pragmatic programme of schemes to be funded through Partnership Funding and Local Levy and opportunities to pool resources*; and *Promote cost effective flood protection measures such as individual property protection and local action groups*.
- Objective 7 – *Promote clear processes and policy for consenting on ordinary watercourses for Bedford Borough drainage area for new structures to prevent works causing restrictions to flow.*

The uncertainty of the impacts in this assessment associated with these measures arises from a lack of specific information relating to their delivery. However, these measures could conceivably cause a range of negative and positive environmental effects depending upon how they are implemented. In order to ensure that the LFRMS does not result in adverse effects, all strategy objectives should be integrated so that delivery of individual measures does not conflict with achievement of the wider strategy objectives. In addition, development and implementation of these measures should be effectively managed by ensuring that, where necessary, proposals are assessed to determine their potential environmental effects (positive and negative) in advance of their implementation and that appropriate mitigation measures are built into their delivery as required.

In addition, several of the LFRMS objectives have the potential to deliver significant environmental benefits. These are:

- Objective 1 – *Take part in Anglian Water Catchment pilots*.
- Objective 2 – all measures
- Objective 5 – all measures
- Objective 7 – *Develop and implement a policy on de-culverting*.

The LFRMS should seek to maximise the potential environmental benefits associated with delivery of these objectives/measures. This can be best achieved through the integration of LFRMS objectives and through close partnership working, so that appropriate resources and funding are effectively allocated.

6.3 Monitoring

The SEA Regulations require Bedford Borough Council to monitor the significant environmental effects (positive and negative) upon the implementation of the LFRMS. Key potential environmental effects that require monitoring are listed in Table 6-1. Several of these monitoring requirements are likely to require a partnership approach to effectively track the effects of the strategy. Possible partners for monitoring responsibility are therefore highlighted.

The monitoring indicators will enable the LFRMS to be monitored and any problems or shortfalls to be highlighted and remedied at an early stage. If failings are evident, it will be necessary for the

LFRMS to be revised so that the achievement of the SEA objectives is not compromised. Of note, it is unlikely that any effects negative or otherwise will be seen immediately and that the relative time scale for monitoring will vary for each indicator/target.

Table 6-1: SEA monitoring framework

LFRM objective / measure	SEA objectives	Potential significant effects	Monitoring indicator	Possible monitoring and/or delivery partners
Objective 1 / *Take part in Anglian Water Catchment pilots*	2, 3, 4 and 6	Potential positive impacts on biodiversity through active restoration of watercourses. Contribution to RBMP and European protected sites objectives	Area of designated and non-designated nature conservation sites affected by flooding. Monitoring of reported conservation status of designated nature conservation sites. Net loss or net gain of land designated as nature conservation sites as a result of LFRMS measures. Area of habitat created as a result of implementation of the LFRMS (e.g. flood storage areas creating wetland habitat). Number of barriers to fish migration removed.	Bedford Borough Council Natural England Anglian Water Environment Agency Bedford Group of IDBs
Objective 2 / *Promote water recycling as part of new development.*	5	Increased water recycling may reduce water demand from surface and ground waterbodies and result in improvements in water quality.	Assessment of LFRMS options and their impact (e.g. disconnection/ reconnection with floodplain, in-channel works/dredging, barriers to fish movement, reinstatement/removal of natural morphology).	Bedford Borough Council Anglian Water Environment Agency
Objective 2 / *Establish a SuDS Approval Body (SAB) for Bedford Borough with clear processes in-line with Defra guidance*; and *Publish SAB Policy and Guidance to require a zero increase in surface water flow from future development*.	10	Increased use of SuDS schemes and promotion of better design and maintenance	Number of SuDS schemes installed as part of the LFRMS.	Bedford Borough Council Anglian Water Environment Agency
Objective 5 / All measures.	2, 3, 4, 5, 6, 10 and 12.	Potential positive impacts on biodiversity through active restoration of watercourses. Creation of new blue/green corridors and new urban habitats Contribution to RBMP and European protected sites objectives New habitat creation through promotion of SuDS schemes Enhance existing riverine habitats and creation of new habitats Improvements to habitat connectivity.	Area of designated and non-designated nature conservation sites affected by flooding. Monitoring of reported conservation status of designated nature conservation sites. Net loss or net gain of land designated as nature conservation sites as a result of LFRMS measures. Area of habitat created as a result of implementation of the LFRMS (e.g. flood storage areas creating wetland habitat). Number of barriers to fish migration removed. Number of SuDS schemes installed as part of the LFRMS.	Bedford Borough Council Natural England Anglian Water Environment Agency Bedford Group of IDBs

Objective 7 / *Develop and implement a policy on de-culverting.*	3, 4, 6, 9 , 11 and 12	Enhancement of existing river habitats. Contribution to RBMP and European protected sites objectives Improvements to habitat connectivity.	Net loss or net gain of land designated as nature conservation sites as a result of LFRMS measures. Area of habitat created as a result of implementation of the LFRMS (e.g. flood storage areas creating wetland habitat). Number of barriers to fish migration removed. Length of river de-culverted.	Bedford Borough Council Natural England Anglian Water Environment Agency Bedford Group of IDBs

6.4 Habitats Regulations Assessment

A revised Test of Likely Significant Effect (screening assessment) has been prepared in accordance with the requirements of the Habitats Regulations to determine whether the LFRMS is likely to adversely affect the integrity of a European site (alone or in combination).

All European sites lying partially or wholly within 15km of the Borough boundary have been included in the assessment. Bedford Borough does not support any European sites (SACs, SPAs and Ramsar sites). However, there are four European sites within 15km of the Borough boundary:

- Upper Nene Valley Gravel Pits SPA
- Upper Nene Valley Gravel Pits Ramsar
- Portholme SAC
- Eversden and Wimpole Woods SAC

The outcome of this revised screening assessment is documented in Appendix 0 of this report. The screening assessment concludes that the LFRMS is not likely to have a significant adverse effect on a European site.

The LFRMS seeks to promote more sustainable flood risk management and includes objectives that aim to reduce the impacts of surface water flooding, promote better management of water resources and deliver a range of wider environmental benefits including new aquatic habitat creation. The LFRMS also includes a specific measure that aims to *'Embed policies from local River Basin Management Plans, local environmental policies and 'European' protected sites into FRM procedures and programmes'*, which could directly contribute towards achievement of European site objectives.

Only a small number of LFRMS measures could potentially result in physical interventions or construction work, or directly affect water management practices. However, at this stage, no information is available regarding how such measures will be implemented or what areas within Bedford Borough could be affected. Until these measures are developed further, it is not possible to reasonably predict whether any potential adverse effects are likely to occur. Nonetheless, implementation of any measures that could result in significant adverse effects on a European site would therefore conflict with the objectives of the LFRMS.

7 Next steps

The next stage of the SEA process (Stage D) involves consulting upon the draft LFRMS and draft SEA Environmental Report with statutory consultees, stakeholders and the public, and then making any necessary amendments and updates to the documents. All consultation responses received will be reviewed and taken into consideration for the next stage of appraisal process. This will involve the preparation of a Statement of Environmental Particulars (SoEP), which will set out how the findings of the Environmental Report and the views expressed during the consultation period have been taken into account as the LFRMS has been finalised and formally approved. The SoEP will also set out any additional monitoring requirements needed to track the significant environmental effects of the strategy.

7.1 Consultation

This Environmental Report will be subject to public consultation for 8 weeks alongside the draft Bedford Borough Council Flood Risk Management Strategy. All comments on the content of this Environmental Report should be sent to:

Melanie Crump
Senior Flood Risk Officer
Room 101
Bedford Borough Council
Borough Hall
Cauldwell Street
Bedford
MK42 9AP

Appendix A: Habitats Regulations Assessment

Test of Likely Significance

A.1 Record of Assessment of Likely Significant Effect on a European / International Site (SAC/SPA/Ramsar)

This assessment identifies and considers the likely adverse effects of the LFRMS, either individually or in combination with other plans or projects, upon a European site and considers whether these impacts are likely to be significant.

It comprises a series of tables that identify the European sites of relevance to this assessment (Table A-1); the potential hazards associated with the LFRMS objectives and measures and their relevance to these European sites (Tables A-2 and A-3); and the likelihood that these hazards would cause a significant adverse effect on a European site (Table A-4).

Table A-1: Assessment scope

Type or permission/activity	**Local Flood Risk Management Strategy (LFRMS)**
Project/File Ref. Number	Bedford Borough
National Grid Reference (NGR)	TL 070 488
Brief Description of the project	The LFRMS is a requirement under the Flood and Water Management Act (2010). The Act outlines the responsibility of the lead local flood authority to 'develop, maintain, apply and monitor' a strategy for local flood risk management. It notes that the strategy must identify or outline the following: • The risk management authorities in the area; • The flood and coastal erosion risk management functions that may be exercised by those authorities in relation to the area; • The objectives for managing local flood risk (including any objectives included in the authority's flood risk management plan prepared in accordance with the Flood Risk Regulations 2009; • The measures proposed to achieve those objectives; • How and when the measures are expected to be implemented; • The costs and benefits of those measures, and how they are to be paid for; • The assessment of local flood risk for the purpose of the strategy; • How and when the strategy is to be reviewed; and • How the strategy contributes to the achievement of wider environmental objectives.
European Site Name and Status	**Upper Nene Valley Gravel Pits Special Protection Area (SPA)**
Distance to site	2km
Site EU Reference Number	UK 9020296
Site Centre NGR	SP 939 683
List of Site Interest Features	Designated for : • Great bittern *Botaurus stellaris* supporting 2% of the UK population; • Golden plover *Pluvialis apricaria* supporting 2.3% of the North-western Europe breeding population; and • Gadwall *Anas strepera* supporting 2% of the North-western Europe breeding population. • An internationally important assemblage of birds.
European Site Name and Status	**Upper Nene Valley Gravel Pits Ramsar**
Distance to site	2km
Site EU Reference Number	UK 11083
Site Centre NGR	SP 939 683
List of Site Interest Features	Criterion 5: site regularly supports 20,000 or more waterbirds. Criterion 6: the site regularly supports 1% of the mute swan *Cygnus olor* and gadwall *Anas strepera* populations in any season.
European Site Name and Status	**Eversden and Wimpole Woods Special Area of Conservation (SAC)**
Distance to European/International Site	13km

Site EU Reference Number	UK0030331
Site Centre NGR	TL 340 526
List of Site Interest Features	Annex II species: Barbastelle bat *Barbastella barbastellus*
European Site Name and Status	**Portholme Special Area of Conservation (SAC)**
Distance to site	11km
Site EU Reference Number	UK0030054
Site Centre NGR	TL 237 708
List of Site Interest Features	Annex I habitats: Lowland hay meadows *(Alopecurus pratensis, Sanguisorba officinalis)*
Is this proposal directly connected with or necessary to the management of the site for nature conservation?	No

Table A-2: Potential hazards and effects to European sites associated with the LFRMS

Hazards and Effects in reference to the individual elements and consented activities of the project. Describe any hazards or effects with potential to give rise to impacts on the European Site (either alone or in combination with other plans or projects).		
Sensitive Interest Features	**Potential Hazard(s)**	**Potential Exposure to hazard and mechanism of effect/impact if known**
Terrestrial and wetland habitats Portholme SAC • Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)	None	The SAC site is located a significant distance (11km) from the boundary of Bedford Borough. Whilst the SAC is hydrologically linked to the Borough through the River Great Ouse, this river is classified as a Main River and will not be subject to any measures to be implemented by the LFRMS. The LFRMS seeks to implement flood risk management measures in the Borough and does not aim to influence flood risk or flood risk management activities at a wider regional level. Flood risk management activities introduced by the LFRMS will therefore have a local impact and will not extend a significant distance beyond the boundary of the Borough. No hazards related to the sensitive interest features would be likely to occur as a result of implementation of the LFRMS and it is not likely that the LFRMS would affect the flow regime and water quality of the River Great Ouse. **Therefore, no likely significant effects are predicted.**
Terrestrial species Eversden and Wimpole Woods SAC • Barbastelle *Barbastellus barbastellus*	None	The SAC site is located a significant distance (13km) from the boundary of Bedford Borough. The site is not hydrologically linked with the Borough and is not designated for wetland /hydrological interest features. The LFRMS seeks to implement flood risk management measures in the Borough and does not aim to influence flood risk or flood risk management activities at a wider regional level. Flood risk management activities introduced by the LFRMS will therefore have a local impact and will not extend a significant distance beyond the boundary of the Borough. No hazards will arise on the sensitive interest features as a result of implementation of the LFRMS. **Therefore, no likely significant effects are predicted.**
Wintering and migratory bird species Upper Nene Valley Gravel Pits SPA • Bittern *Botaurus stellaris* • Gadwall *Anas strepera* • Golden Plover *Pluvialis apricaria* • Internationally important assemblage of birds Upper Nene Valley Gravel Pits Ramsar • Gadwall *Anas strepera* • Mute Swan *Cynus olor* • Site regularly supports 20,000 or more waterbirds.	Changes in river flow or velocity Changes in water levels or table Changes in water chemistry Surface water flooding changes Toxic contamination (see Table A-3 for further information)	The sites are located 2km to the north of Bedford Borough and are hydrologically linked to the Borough through Knuston Brook and potentially through several other small watercourses as well as groundwater flow. Potential effects linked to the hazards identified associated with the LFRMS comprise the following: • Changes to surface and groundwater flow in the north of the Borough, which could affect flows along Knuston Brook. This could impact upon water availability in the SPA and Ramsar sites. • Physical modifications to watercourses in the north of the Borough or changes in surface runoff from land that could affect water quality in the SPA and Ramsar sites. The LFRMS objectives and measures include a number of actions that aim to deliver biodiversity benefits and in particular, the strategy seeks to *'Embed policies from local River Basin Management Plans, local environmental policies and 'European' protected sites into FRM procedures and programmes.'*

		Implementation of any measures that could result in significant adverse effects on a European site would conflict with this LFRMS objective. Assessment of each LFRMS objective and its underpinning measures has been undertaken (see Table A-3) to identify any potential likely significant effects on the SPA and Ramsar site.

Table A-3: Potential hazards to the Upper Nene Valley Gravel Pits SPA and Ramsar site associated with the LFRMS objectives and measures (Key: X = no potential hazard; ✓ = potential hazard)

LFRMS objective	LFRMS measures	Potential hazards								
		Habitat loss	Physical damage	Construction of barriers to movement	Disturbance (noise or visual)	Changes in river flow or velocity	Changes in water levels or table	Changes in water chemistry	Surface water flooding changes	Toxic contamination
Improve understanding of local flood risk within Bedford Borough	Map high risk areas for 'local' flood risk in the Borough	X	X	X	X	X	X	X	X	X
	Identify vulnerable groups and key infrastructure	X	X	X	X	X	X	X	X	X
	Maintain an up-to-date record of flood incidents	X	X	X	X	X	X	X	X	X
	Carry out formal investigation of flood incidents	X	X	X	X	X	X	X	X	X
	Communicate and improve the level of understanding of local risk to public and stakeholder groups	X	X	X	X	X	X	X	X	X
	Record flood assets in a register and make available for public inspection	X	X	X	X	X	X	X	X	X
	Develop greater understanding of surface water risks through targeted detailed investigations	X	X	X	X	X	X	X	X	X
	Improve skills and knowledge of Council officers in sustainable flood risk management	X	X	X	X	X	X	X	X	X
	Take part in Anglian Water Catchment pilots	X	X	X	X	✓	✓	✓	✓	✓
Actively manage flood risk associated with new development and re-development proposals	Establish a SuDS Approval Body (SAB) for Bedford Borough with clear processes inline with Defra guidance	X	X	X	X	✓	✓	✓	✓	✓
	Develop tools for development management to inform planning officers on local flood risk priorities	X	X	X	X	X	X	X	X	X
	Publish SAB Policy and Guidance to require a zero increase in surface water flow from future development	X	X	X	X	X	X	X	X	X
	Promote water recycling as part of new development	X	X	X	X	X	X	X	X	X
	Influence land allocations in local plan using best available information to identify appropriate development potential	X	X	X	X	✓	✓	✓	✓	✓

LFRMS objective	LFRMS measures	Potential hazards								
		Habitat loss	Physical damage	Construction of barriers to movement	Disturbance (noise or visual)	Changes in river flow or velocity	Changes in water levels or table	Changes in water chemistry	Surface water flooding changes	Toxic contamination
Communicate and engage the public in flood risk based decision making and improve community resilience to enable communities to help themselves	Engage with communities to identify vulnerable groups and work with them to identify their risks and develop emergency plan	X	X	X	X	X	X	X	X	X
	Develop long term communication strategy in partnership to improve communities resilience for local flood risk	X	X	X	X	X	X	X	X	X
	Work with local communities to agree specific responsibilities and improve understanding of risks	X	X	X	X	X	X	X	X	X
	Promote local flood groups where relevant and provide appropriate support and information to ensure their effectiveness	X	X	X	X	X	X	X	X	X
	Embed the Local Flood Risk Management Strategy into Local Resilience's flood response and recovery plans	X	X	X	X	X	X	X	X	X
Take a risk based, proportionate approach to flood risk management to protect people, their property and key infrastructure	Identify highest risk open and closed watercourses, highway drains and other drainage/flood features	X	X	X	X	X	X	X	X	X
	Develop an affordable cyclical regime to manage and maintain assets for Highway drainage and ordinary watercourse assets and within the IDB area maintain current regime	X	X	X	X	✓	✓	✓	✓	✓
Take a sustainable, holistic approach to flood risk management to deliver wider environmental benefits, sustainable communities and best use of local water resources	Promote the concept of water cycle management, blue/green corridors and water sensitive urban design in master planning	X	X	X	X	X	X	X	X	X
	Embed policies from local River Basin Management Plans, local environmental policies and 'European' protected sites into FRM procedures and programmes	X	X	X	X	X	X	X	X	X
	Seek to enhance biodiversity and habitat creation within future capital schemes and SuDS	X	X	X	X	X	X	X	X	X
	Promote SuDS to improve water quality, biodiversity and habitat creation	X	X	X	X	X	X	X	X	X

LFRMS objective	LFRMS measures	Potential hazards								
		Habitat loss	Physical damage	Construction of barriers to movement	Disturbance (noise or visual)	Changes in river flow or velocity	Changes in water levels or table	Changes in water chemistry	Surface water flooding changes	Toxic contamination
Take a collective, proactive and innovative approach to manage flood risk to pool resources and funds in an integrated way to achieve enhanced overall benefit	Establish working flood risk framework with other Risk Management Authorities	X	X	X	X	X	X	X	X	X
	Continue to develop the Bedford Borough Flood partnership and contribute to the Tri-area partnership and regional LLFA liaison group	X	X	X	X	X	X	X	X	X
	Develop a pragmatic programme of schemes to be funded through Partnership Funding and Local Levy and opportunities to pool resources	X	X	X	X	✓	✓	✓	✓	✓
	Promote cost effective flood protection measures such as individual property protection and local action groups	X	X	X	X	X	X	X	X	X
	Involve local communities in local initiatives and schemes	X	X	X	X	X	X	X	X	X
Encourage maintenance of privately owned flood defence structures and ordinary watercourses and minimise unnecessary constrictions.	Promote clear processes and policy for consenting on ordinary watercourses for Bedford Borough drainage area for new structures to prevent works causing restrictions to flow	X	X	X	X	X	X	X	X	X
	Develop process and policy for consenting on discharge rates to ordinary watercourses in Bedford Borough drainage area	X	X	X	X	X	X	X	X	X
	Raise awareness of riparian owners responsibilities and promote within priority areas	X	X	X	X	X	X	X	X	X
	Identify highest risk private flood defence and drainage assets and develop technical advice for owners to guide them to develop local maintenance plans	X	X	X	X	X	X	X	X	X
	Develop and implement a policy on de-culverting	X	X	X	X	X	X	X	X	X
	Establish a risk based designation process	X	X	X	X	X	X	X	X	X

Table A-4: Assessment of likely significant effects on the Upper Nene Valley Gravel Pits SPA and Ramsar site associated with relevant LFRMS measures

LFRMS objective	Relevant LFRMS measures	Potential hazards	Potential for likely significant effect
Improve understanding of local flood risk within Bedford Borough	Take part in Anglian Water Catchment pilots	• Changes in river flow or velocity • Changes in water levels or table • Changes in water chemistry • Surface water flooding changes • Toxic contamination	This strategy objective and its underpinning measures seek to develop the evidence base to guide future flood risk management actions. The objective is not likely to directly lead to any physical interventions, construction works or changes in water management, and so is not likely to have a significant adverse effect on the interest features of the SPA or Ramsar site. The potential exception to this is the measure *'Take part in Anglian Water Catchment pilots'*. This measure aims to encourage greater participation in the Defra/Environment Agency led catchment pilot studies, which focus on catchment-scale sustainable land and water management, and seek to deliver a range of large-scale environmental benefits. The pilot projects form part of the programme of actions to deliver the WFD objectives; the WFD seeks to support the Habitats Regulations and protection/enhancement of European sites, and it is possible that this measure could have a beneficial effect on the interest features of the SPA and Ramsar if targeted at ordinary watercourses in the north of the Borough. Therefore, it is likely that the catchment pilots would be implemented in a manner that is consistent with the objectives of the Habitats Regulations and would not have an adverse effect on the SPA or Ramsar site. Nonetheless, the risk and extent to which potential hazards may result in adverse effects is directly linked to the implementation of this measure; in particular, the scale and location of any proposed engineering works or water management actions and how these could affect the bird species for which the SPA and Ramsar site are designated. A project is likely to have a significant adverse effect if it may reasonably be predicted to affect the conservation objectives of the features for which a European site was designated. This excludes trivial or inconsequential effects. No information is available at this stage of the LFRMS regarding the potential scale or location of any actions that could be associated with the implementation of this measure. Therefore, until this measure is developed further, it is not possible to reasonably predict whether any potential effects are likely to occur. This conclusion does not preclude the need for further Habitats Regulations Assessment (HRA) at subsequent stages of the development and implementation of this measure. It is important to note that this stage of the development and implementation of the LFRMS does not place any constraints on how or where the measure will be implemented. Before any physical works or water management actions are implemented, they will be subject to the requirements of the Habitats Regulations as a matter of law and government policy. An Appropriate Assessment would be required where such works/actions are likely to have a significant adverse effect on the integrity of a European site. **Conclusion: No likely significant effect on the Upper Nene Valley Gravel Pits SPA and Ramsar site.**
Actively manage flood risk associated with new development and re-development proposals	Establish a SuDS Approval Body (SAB) for Bedford Borough with clear processes inline with Defra guidance Influence land allocations in local plan using best available information to identify appropriate development potential		The measure *'Establish a SuDS Approval Body (SAB) for Bedford Borough with clear processes inline with Defra guidance'* will result in the establishment of a SAB for Bedford Borough. The SAB will influence the design, approval and adoption of SuDS within any new development or redevelopment consisting of two or more properties. The SAB will enforce the requirements of national standards for SuDS. These standards aim to reduce flood risk from surface water and improve water quality and the water environment. This measure is not likely to result in modifications to any watercourses or cause any adverse effects on water quantity or quality in surface waters or groundwaters. The converse is true; this measure is likely to result in more sustainable water management and potential improvements in water quality and quantity, as well as provide direct biodiversity benefits through new or enhanced habitat creation. As such, this measure is not likely to cause a significant adverse effect on the SPA or Ramsar site. The measure *'Influence land allocations in the local plan using best available information to identify appropriate development potential'* aims to influence strategic planning to promote better allocation of development land in the Borough. At this stage in the development of the LFRMS, no information is available regarding how this measure will be implemented or what areas of

LFRMS objective	Relevant LFRMS measures	Potential hazards	Potential for likely significant effect
			the Borough could be affected as a result of its implementation. However, it is likely that the LFRMS will seek to influence land allocation so as to reduce inappropriate development in flood risk areas and will aim to promote other LFRMS measures. Until this measure is developed further, it is not possible to reasonably predict whether any potential effects are likely to occur. This conclusion does not preclude the need for further HRA at subsequent stages of the development and implementation of this measure. The land allocation process and development plan process will be subject to the requirements of the Habitats Regulations as a matter of law and government policy. Therefore, it can be reasonably concluded at this stage that implementation of this measure is not likely to have a significant adverse effect on the SPA or Ramsar site. **Conclusion: No likely significant effect on the Upper Nene Valley Gravel Pits SPA and Ramsar site.**
Communicate and engage the public in flood risk based decision making and improve community resilience to enable communities to help themselves	None		This strategy objective and its underpinning measures aim to raise public awareness of local flood risk issues and engage with the public to promote greater participation in flood risk management. The objective is not likely to directly lead to any physical interventions, construction works or changes in water management, and so is not likely to have a significant adverse effect on the interest features of the SPA or Ramsar site. **Conclusion: No likely significant effect on the Upper Nene Valley Gravel Pits SPA and Ramsar site.**
Take a risk based, proportionate approach to flood risk management to protect people, their property and key infrastructure	Develop an affordable cyclical regime to manage and maintain assets for Highway drainage and ordinary watercourse assets and within the IDB area maintain current regime		This strategy objective aims to ensure a proportionate approach to flood risk management directly linked to the level of flood risk. The measure *'Develop an affordable cyclical regime to manage and maintain assets for Highway drainage and ordinary watercourse assets and within the IDB area maintain current regime'* could conceivably result in changes to existing watercourse management and maintenance practices. However, the risk and extent to which potential adverse effects are likely to occur is directly linked to the implementation of this measure; in particular, the scale and location of any proposed works or changes in water management practices. No information is available at this stage of the LFRMS regarding the potential scale or location of any actions that could be associated with the implementation of this measure. Therefore, until this measure is developed further, it is not possible to reasonably predict whether any potential effects are likely to occur. This conclusion does not preclude the need for further HRA at subsequent stages of the development and implementation of this measure. **Conclusion: No likely significant effect on the Upper Nene Valley Gravel Pits SPA and Ramsar site.**
Take a sustainable, holistic approach to flood risk management to deliver wider environmental benefits, sustainable communities and best use of local water resources	None		This objective and its associated measures aim to deliver a range of environmental benefits through sustainable flood risk management. In particular, it seeks to embed the environmental protection objectives for European sites within flood risk management procedures and programmes. Implementation of this objective may lead to a range of positive environmental impacts, including the creation of new aquatic habitats and improvements to water quality and quantity. This objective is therefore not likely to have a significant adverse effect on the interest features of the SPA or Ramsar site. **Conclusion: No likely significant effect on the Upper Nene Valley Gravel Pits SPA and Ramsar site.**

LFRMS objective	Relevant LFRMS measures	Potential hazards	Potential for likely significant effect
Take a collective, proactive and innovative approach to manage flood risk to pool resources and funds in an integrated way to achieve enhanced overall benefit	• Develop a pragmatic programme of schemes to be funded through Partnership Funding and Local Levy and opportunities to pool resources	• Changes in river flow or velocity • Changes in water levels or table • Changes in water chemistry • Surface water flooding changes • Toxic contamination	This strategy objective and its underpinning measures aim to promote greater partnership working to deliver integrated flood risk management. The majority of measures are directly related to partnership working and are not likely to result in physical interventions or construction works and are not likely to result in changes to water flow/availability or changes in water quality. The measure *'Develop a pragmatic programme of schemes to be funded through Partnership Funding and Local Levy and opportunities to pool resources'* aims to identify and promote a programme of potential flood risk management schemes. However, they are not likely to result in the direct implementation of any scheme. Any such schemes are likely to be subject to further authorisations, either through the planning process and/or another consenting process. Before any physical works or water management actions are implemented, they will be subject to the requirements of the Habitats Regulations as a matter of law and government policy. An Appropriate Assessment would be required where such works/actions are likely to have a significant adverse effect on the integrity of a European site. Therefore, it can be reasonably concluded at this stage that implementation of this measure is not likely to have a significant adverse effect on the SPA or Ramsar site. **Conclusion: No likely significant effect on the Upper Nene Valley Gravel Pits SPA and Ramsar site.**
Encourage maintenance of privately owned flood defence structures and ordinary watercourses and minimise unnecessary constrictions.	None		This strategy objective and its associated measures aims to promote better management and maintenance of privately-owned flood defence assets and better management of discharges to ordinary watercourses. They aim to reduce constrictions or restrictions to river flow and could result in a range of environmental benefits through the implementation of a de-culverting policy. The majority of measures are focused on developing good practice policy and processes or awareness raising, and are not likely to result in physical interventions or construction works, or cause adverse impacts on water flow/availability or water quality. Therefore, this objective and its associated measures are not likely to cause a significant adverse effect on the SPA or Ramsar site. **Conclusion: No likely significant effect on the Upper Nene Valley Gravel Pits SPA and Ramsar site.**

Table A-4: Assessment conclusions

In reference to the site interest features and their conservation objectives, describe any likely direct, indirect or secondary effects from the uncompleted and/or continuing consented activities of the project (either alone or in combination with other plans or projects) likely to give rise to significant effects on the European/Ramsar Site.	The LFRMS seeks to promote more sustainable flood risk management and includes objectives that aim to reduce the impacts of surface water flooding, promote better management of water resources and deliver a range of wider environmental benefits including new wetland habitat creation. The LFRMS also includes a specific measure that aims to *Embed policies from local River Basin Management Plans, local environmental policies and 'European' protected sites into FRM procedures and programmes'*, which could directly contribute towards achievement of European site objectives. Only a small number of LFRMS measures could potentially result in physical interventions or construction work, or directly affect water management practices. However, at this stage, no information is available regarding how such measures will be implemented or what areas within Bedford Borough could be affected. Until these measures are developed further, it is not possible to reasonably predict whether any potential adverse effects are likely to occur. Nonetheless, implementation of any measures that could result in significant adverse effects on a European site would therefore conflict with the objectives of the LFRMS. Therefore, it can be reasonably concluded at this stage that the LFRMS is not likely to have a significant adverse effect on the Upper Nene Valley Gravel Pits SPA and Ramsar site. This conclusion does not preclude the need for further HRA at subsequent stages of the development and implementation of the LFRMS.
Is the project likely to have a significant effect 'alone'?	No.
If there is no likely significant effect 'alone', are there other projects or plans that in-combination with the project being assessed could affect the site?	No.
Is the project likely to have a significant effect 'in-combination'?	No.
List of agencies consulted (Contact name and telephone/email address)	
NE Consultation response comments: **NE Signature:**	

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