DEPARTMENT OF ENERGY & CLIMATE CHANGE

Appraisal of Sustainability: Site Report for Bradwell

EN-6: Draft National Policy Statement for Nuclear Power Generation

Planning for new energy infrastructure

November 2009

Preface:

Appraisal of Sustainability of the draft Nuclear National Policy Statement

The Appraisal of Sustainability (AoS), incorporating Strategic Environmental Assessment (SEA), of the draft Nuclear National Policy Statement (Nuclear NPS) has been undertaken at a strategic level. It considers the effects of the proposed policy at a national level and the sites to be assessed for their suitability for the deployment of new nuclear power stations by 2025. These strategic appraisals are part of an ongoing assessment process that started in March 2008 and, following completion of this AoS, will continue with project level assessments when developers make applications for development consent in relation to specific projects. Applications for development consents to the Infrastructure Planning Commission (IPC) will need to be accompanied by an Environmental Statement having been the subject of a detailed Environmental Impact Assessment (EIA).

The AoS/SEA Reports are presented in the following documents:

AoS Non-Technical Summary

Main AoS Report of draft Nuclear NPS
Introduction
Approach and Methods
Alternatives
Radioactive Waste
Findings
Summary of Sites
Technical Appendices

Annexes to Main AoS Report: Reports on Sites
Site AoS Reports
Technical Appendices

All documents are available on the website of the Department of Energy and Climate Change (DECC) at http://www.energynpsconsultation.decc.gov.uk

This document is the Appraisal of Sustainability: Site Report for Bradwell of the draft Nuclear NPS and is subject to consultation alongside the draft Nuclear NPS for a period of a minimum of 12 weeks from the date of publication.

This report has been prepared by the Department of Energy and Climate Change (DECC) with expert input from a team of specialist planning and environmental consultancies led by MWH UK Ltd with Enfusion Ltd, Nicholas Pearson Associates Ltd, Studsvik UK Ltd and Metoc plc.

Contents

List of Tables

List of Figures

Appendices to Bradwell AoS Report

Summary of Key Findings

This report considers the nomination of the site at Bradwell in Essex as a possible location for new nuclear power station(s). The purpose of this Appraisal of Sustainability Site Report is to assess environmental and sustainability impacts on the Bradwell site and surrounding area. This report also identifies the significance of those effects, and suggests possible ways of mitigation. For more information on the methodology and background to the assessment please refer to Section 1. The national policy context, which also provides a background to the assessment, is included in Section 3.

The key findings of this assessment are included below (reproduced from Section 6 for ease of reference). These key findings are supported by site characterisation and the appraisal of sustainability, details of which are included in Section 4 and Section 5 of this report. Further details on the key findings and suggested mitigation of the potential effects identified by developing a nuclear power station at Bradwell are included in Section 6.

Summary of Key Findings

A number of the strategic effects identified for Bradwell will be similar across all the nominated sites, including positive effects for employment and well being. However a number of potential strategic effects have been identified that are of particular note for the nominated site at Bradwell. These are discussed below:.

There are potential negative effects on three national and internationally protected nature conservation sites, including the Essex Estuaries and Blackwater Estuary; effects on water quality and fish/shellfish populations in nearby coastal waters due to the abstraction and release of sea water for cooling.

Part of the site is in flood zone 3 and therefore at a higher risk from coastal flooding. There are both hard and soft flood defences already in place, but these may require upgrading over the lifetime of a new power station. This could have potential effects on erosion and visual appearance of the coastline. These effects are significant, but mitigation opportunities are likely to be available following further study.

A new nuclear power station would be set in the context of the existing nuclear power station at Bradwell, but the surrounding area is predominantly undeveloped and there is limited potential for mitigation of the adverse impact on the local landscape. There are no significant adverse effects anticipated on nationally designated landscapes.

Potential setting effects upon nearby scheduled monuments and listed buildings, and the West Mersea Conservation Area, could also be of regional or national importance, depending on distance and sight lines. The impact on the setting of Othona Roman fort and St. Peter's Chapel would be of exceptional significance. However, mitigation could be applied by siting the proposed facility close to the existing power stations on the western side of the nominated site. Detailed

assessment will be required at the project level Environmental Impact Assessment stage.

There remains some uncertainty relating to the significance of some effects and the most appropriate mitigation. It is expected that the mitigation measures will be refined iteratively as part of the development of the proposals for the nominated site, and will be assessed further in the project level Environmental Impact Assessment.

1 Introduction

This Appraisal of Sustainability Report

1.1 This report considers the site at Bradwell in Essex as a possible location for new nuclear power station(s). The report sets out the Appraisal of Sustainability (AoS) of the nomination of land alongside the existing nuclear power station at Bradwell. The nomination of land, as well as supporting information, was put forward by a developer. The AoS, which incorporates the Strategic Environmental Assessment (SEA), is a part of the Strategic Siting Assessment (SSA). The SSA is a process for identifying and assessing sites that could be suitable for new nuclear power stations by the end of 2025.

1.2 This report is one of the Appraisals of Sustainability that deal with individual sites. Together, these reports form an Annex to the Main AoS Report,[1] which accompanies the draft Nuclear National Policy Statement[2] (NPS). The Main AoS Report for the draft Nuclear NPS sets out the details of the AoS process, its methods, findings, conclusions and a summary of the appraisal of the nominated sites. The Main AoS Report also includes a non-technical summary.

1.3 This AoS has been undertaken at a strategic level and is intended only as a high level assessment of the suitability of the site from an environmental and sustainability perspective. The AoS is part of an assessment process that started in March 2008. The draft Nuclear NPS lists sites that have been assessed to be potentially suitable by the Government for new nuclear power stations. Developers will be able to apply for development consent for these sites from the Infrastructure Planning Commission (IPC). Each application from the developer for consent to build a new power station will need an Environmental Statement with a detailed Environmental Impact Assessment (EIA). The sites included in the draft Nuclear NPS will also be subject to other regulatory and licensing requirements.

The Draft Nuclear National Policy Statement

1.4 In the White Paper on Nuclear Power[3], the Government set out its policy on the role that new nuclear power stations could play alongside other low-carbon sources in the UK's future energy mix. The draft Nuclear NPS sets out the need for sites that are potentially suitable for the development of new nuclear power stations by 2025. The Government used an SSA to assess the potential suitability of nominated sites. This SSA process[4] drew on the emerging findings of the site AoSs and the Habitats Regulations Assessment (HRA)[5].

1 Main AoS Report http://www.energynpsconsultation.decc.gov.uk
2 Draft Nuclear NPS http://www.energynpsconsultation.decc.gov.uk
3 BERR (Jan 2008) Meeting the energy challenge: a white paper on nuclear power, URN 08/525
4 Towards a nuclear national policy statement : Government response to the consultation on the Strategic Siting Assessment process and criteria, January 2009, URN 09/581
5 Bradwell HRA Report http://www.energynpsconsultation.decc.gov.uk

Appraisal of Sustainability incorporating Strategic Environmental Assessment

1.5 The Planning Act (2008)[6] requires an AoS for all National Policy Statements. The purpose of an AoS is to consider the social, economic and environmental implications of the policy and to suggest possibilities for improving the sustainability of the NPS. The AoS incorporates the requirements of the European Strategic Environmental Assessment Directive[7] which aims to protect the environment and to promote sustainable development during preparation of certain plans and programmes. This is set out in more detail in the Main AoS Report of the draft Nuclear NPS.

1.6 The purpose of this AoS is to assess environmental and sustainability impacts on the Bradwell site. This AoS also identifies the significance of those effects, and suggests possible ways of mitigation. The AoS for the Bradwell site fed into the Strategic Siting Assessment (SSA) and the preparation of the draft Nuclear NPS. There would be further detailed studies at the EIA stage of any construction project. The following diagram explains the relationship between the Main AoS Report, the Site AoS Report and an EIA.

Appraisal of Sustainability (AoS) of Nuclear National Policy Statement (NPS)
- Strategic Appraisal of Nuclear NPS, including cumulative effects of the programme of nuclear sites (as outlined in the NPS)

Site Appraisal of Sustainability (AoS)
- Strategic appraisal of locating a nuclear power station at each nominated site to advise the Strategic Siting Assessment (SSA)
- A desktop study using existing information

Environmental Impact Assessment (EIA)*
- Detailed project-level assessment of likely impacts of the proposals on the environment to inform the Infrastructure Planning Commission (IPC) decision for each development proposal
- A detailed study based on firm project proposals, it will involve a more in-depth assessment (including commissioning studies and field surveys)

*as required by European Directive 85/337/EEC and *Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999*

[6] Planning Act 2008
[7] Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment, implemented through *The Environmental Assessment of Plans and Programmes Regulations* 2004

Appraisal of Sustainability Methods

1.7 In undertaking the AoS of each nominated site, a wide range of information was considered including the scoping report[8], the Environmental Study[9,] the Update Report[10], information from other Government departments, the statutory consultees and regulators, information from the nominators and other published reports. If additional local information was available, for example, an EIA scoping report or a locally relevant Strategic Flood Risk Assessment, it has been used to inform the appraisal where appropriate and referenced as footnotes.

1.8 The methods used for AoS/SEA are detailed in the Main AoS Report. The AoS uses objectives as a means of identifying and appraising the potential significant effects of building new nuclear power stations on the environment and communities. The sustainability objectives that have been agreed for the appraisal of the draft Nuclear NPS are detailed in Annex E of the Environmental Study and the Main AoS Report. Appendix I of this AoS Site Report sets out the guide questions that are used with each sustainability objective to help focus the appraisal in a more systematic way. The sustainability objectives used in the Environmental Study were grouped into themes for sustainable development in order to help focus on the key issues for appraisal. This is set out in the following table:

Table 1.1: Sustainable Development Themes and AoS/SEA Objectives

Sustainable Development Theme	AoS/SEA Objective (Numbers refer to Scoping Report[11] and Environmental Study[12])
Air Quality	to avoid adverse impacts on air quality (12)
Biodiversity and Ecosystems	to avoid adverse impacts on the integrity of wildlife sites of international and national importance (1) to avoid adverse impacts on valuable ecological networks and ecosystem functionality (2) to avoid adverse impacts on Priority Habitats and Species including European Protected Species (3)
Climate Change	to minimise greenhouse gas emissions (13)
Communities: population, employment and viability	to create employment opportunities (4) to encourage the development of sustainable communities (5) to avoid adverse impacts on property and land values and avoid planning blight (10)

[8] BERR (March 2008) Consultation of Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN08/680
[9] BERR July 2008 Environmental Study
[10] BERR January 2009 Update Report
[11] BERR (March 2008) Consultation of Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN08/680
[12] BERR July 2008 Environmental Study

Sustainable Development Theme	AoS/SEA Objective (Numbers refer to Scoping Report[11] and Environmental Study[12])
Communities: supporting infrastructure	to avoid adverse impacts on the function and efficiency of the strategic transport infrastructure (8) to avoid disruption to basic services and infrastructure (9)
Human Health and Well-Being	to avoid adverse impacts on physical health (6) to avoid adverse impacts on mental health (7) to avoid the loss of access and recreational opportunities, their quality and user convenience (11)
Cultural Heritage	to avoid adverse impacts on the internationally and nationally important features of the historic environment (22) to avoid adverse impacts on the setting and quality of built heritage, archaeology and historic landscapes (23)
Landscape	to avoid adverse impacts on nationally important landscapes (24) to avoid adverse impacts on landscape character, quality and tranquillity, diversity and distinctiveness (25)
Soils, Geology, Land Use	to avoid damage to geological resources (19) to avoid the use of greenfield land and encourage the re-use of brownfield sites (20) to avoid the contamination of soils and adverse impacts on soil functions (21)
Water Quality and Resources	to avoid adverse impacts on surface water hydrology and channel geomorphology (including coastal geomorphology) (15) to avoid adverse impacts on surface water quality (including coastal and marine water quality) and assist achievement of Water Framework Directive objectives (16) to avoid adverse impacts on the supply of water resources (17) to avoid adverse impacts on groundwater quality, distribution and flow and assist achievement of Water Framework Directive objectives (18)
Flood Risk	to avoid increased flood risk (including coastal flood risk) and seek to reduce risks where possible (14)

1.9 The AoS for each of the nominated sites considered the relevant policy context at a regional level, which helped to identify key sustainability objectives that need to be taken into account in the appraisal and gave insight into potential cumulative effects that could arise with other plans and projects. Policy context at the local government level is changing as a result of the new planning system. However, it will be required to conform to regional plans and programmes. Existing and emerging local policy documents were

considered, where relevant, for the characterisation of baseline conditions and the appraisal of effects. The regional policy context and regional baseline information is set out in Appendices 3 and 4 respectively.

Background to Nuclear Power Stations

1.10 This section provides some wider context on nuclear power stations. Nuclear power generation works in a similar way to conventional electricity generation, insofar as it depends on the creation of heat to generate steam, which in turn powers a turbine.

1.11 This process needs to be carefully managed because of the energy released in the process. The process is controlled by the use of a "moderator". All reactors have sufficient moderators to shut them down completely and fail-safes to ensure that this occurs in the event of any potential incidents. The early designs of nuclear power stations in the UK used graphite as a moderator. Later designs of nuclear power stations use water as a moderator. It is likely that any new nuclear power stations built in the UK would be water moderated.

1.12 The nuclear reactions that take place in nuclear power stations create a high level of radioactivity in the reactor. Radioactivity occurs naturally and is a normal part of our environment, but nuclear power stations create much higher intensities that require careful management while operating and after they have finished generating electricity.

1.13 The UK has strict, independent, safety and environment protection regimes for nuclear power. The Nuclear Installations Inspectorate (NII), a division of the Health and Safety Executive, and the Environment Agency regulate nuclear power stations in England and Wales. Any new nuclear power station will be subject to safety licensing conditions and will have to comply with the safety and environmental conditions set by the regulators. NII and the Environment Agency are currently assessing two new nuclear reactor designs through the Generic Design Assessment (GDA) process.

1.14 Generating electricity by nuclear power creates radioactive waste, some of which remains potentially hazardous for thousands of years. The storage and disposal of this waste is an important part of the nuclear fuel cycle and needs careful long-term management. In June 2008 the Government published the White Paper on Managing Radioactive Waste Safely[13]. This set the framework for managing higher activity radioactive waste in the long term through geological disposal, coupled with safe and secure interim storage and ongoing research and development. Geological disposal involves isolating radioactive waste deep inside a suitable rock formation, to ensure that no harmful quantities of radioactivity ever reach the surface environment. The White Paper also invites communities to express an interest in opening up without commitment discussions with Government on the possibility of hosting a geological disposal facility at some point in the future.

[13] http://www.defra.gov.uk/environment/radioactivity/mrws/pdf/white-paper-final.pdf

1.15 When a nuclear power station reaches the end of its life, it has to be dismantled (normally referred to as decommissioning). This process also needs careful management. While many parts of the power station are easily decommissioned, some parts will be radioactive because they were exposed to high levels of radiation. In the UK, the Nuclear Decommissioning Authority (NDA) is responsible for the existing nuclear legacy and is decommissioning 20 civil public sector nuclear sites.

1.16 Operators of new nuclear power stations are required to have secure funding arrangements in place to cover the full costs of decommissioning and their full share of waste management and disposal costs.

New Nuclear Power Station Designs

1.17 The HSE and EA are undertaking a process of Generic Design Assessment (GDA) of new nuclear reactor designs. GDA allows the assessment of the generic safety, security and environmental implications of new nuclear reactor designs, before an application is made for permission to build a particular design on a particular site.

1.18 Given the strategic level of information required for the SSA, and the information available at this early stage, it is not intended to consider the implications of different nuclear power station designs at each nominated site. It is considered that these are better addressed at the planning application stage. Therefore, in order to appraise the sites, the AoS has made a number of assumptions about the generic design characteristics of new nuclear power stations, which is discussed in more detail in the Main AoS Report.

1.19 To provide a standardised approach to the appraisal of the nominated sites, the assumptions about generic design characteristics have been summarised into a base-case. The base-case was used to guide the assessment for each site, except in cases where a nominator has provided further detail at variance to the base-case. For example, if a nominator is proposing cooling towers instead of abstracting water for cooling, this has been considered in the assessment. The key assumptions used for the site level assessments are outlined in Table 1.2, with the variations considered in the Bradwell AoS Site Report provided in the right hand column.

Table 1.2: Base Case Assumptions and Variations Considered for Bradwell

Base Case	Variations considered for Bradwell
1 nuclear reactor	
Technology neutral (i.e. unknown reactor type)	
A requirement for cooling water abstraction	
Site boundary as indicated on nomination form	

Base Case	Variations considered for Bradwell
Discharges of cooling water	
Timescales: Construction: approximately 5-6 yrs Operation: approximately 60 years (life extension, which is subject to regulatory approval, could mean that the operating lifetime is longer) Decommissioning: approximately 30 years Lifetime of site: approximately 166 years[14]	
No. of employees: Construction: approx 4,000 (around 50% from within region) Operation: approx 500 Decommissioning: range of 400 – 800 at key phases[15] Associated employment creation: 2,000	
Coastal flood and protection measures (where relevant)	Land raising, flood defence improvements and coastal protection measures
Infrastructure for transporting reactor (for example, jetty, landing facility)	
Interim radioactive waste storage facilities will be capable for at least 160 years	
Highway improvements, access routes	
Associated transmission infrastructure	
Radioactive discharges will be within legal limits	

14 It is therefore possible to envisage a scenario in which onsite interim storage might be required for around 160 years from the start of the power station's operation, to enable an adequate cooling period for fuel discharged following the end of the power station's operation. However, this is based on some conservative assumptions and there are a number of factors that could reduce or potentially increase, the total duration of onsite spent fuel storage.

15 Estimates for existing nuclear power stations entering the decommissioning phase indicate up to 800 full time equivalent staff for defueling, then a minimal workforce (less than 50) during the care and maintenance phases, and a second peak of up to 600 for the final demolition and site clearance (source: http://www.nda.gov.uk/sites)

2 The Site: Bradwell

2.1 The site at Bradwell is located in the East of England region close to the Essex coast. It is situated in a rural area within the parish of Bradwell-on-Sea in the District of Maldon. The site is on the northern coast of the Dengie peninsula and at the mouth of the Blackwater River and Estuary. The location of the site is illustrated in Figure 1. Figure 2 shows the location of the site in a sub-regional context to help address any implications for cumulative effects on biodiversity and on socio-economic factors.

2.2 The Bradwell area has supported nuclear power facilities since the 1960s. Construction of Bradwell 'A' nuclear power station, the second nuclear power station in the UK, started in 1957. Bradwell 'A' operated from 1962 to 2002 with two 121 MWe Magnox reactors, and is now being decommissioned by the NDA. Prior to the closure of Bradwell 'A' in 2002, the site was proposed as a potential location for a Pressurised Water Reactor (PWR) power station.

2.3 Bradwell lies some 40km to the east of Chelmsford and 4km from the town of West Mersea across the Blackwater River and Estuary. It is 2km from the village of Bradwell-on-Sea, with the hamlet of Bradwell Waterside adjacent to the west. Other nearby settlements on the Dengie peninsula includes Tillingham, Southminster and Burnham-on-Crouch to the south and Ramsay Island to the west. Tollesbury village lies 4km across the estuary to the north west, and the town of Maldon lies some 15km to the west up the estuary. The site lies to the east and south of Bradwell 'A' power station, and comprises open agricultural land (largely arable), the former Bradwell Bay airfield, an existing electricity sub-station, a farmstead (Weymarks Farm), other agricultural buildings and areas of foreshore.

2.4 The nomination is for a nuclear power station development incorporating:

- At least one nuclear reactor
- Land raising, flood defence improvements and coastal protection measures
- Construction stage areas and facilities
- Infrastructure and facilities related to the operation of a nuclear power station
- Associated access roads and transmission and cooling water infrastructure
- Interim waste storage facilities

2.5 The site at Bradwell has been nominated into the SSA process, in respect of which nominations closed on 31 March 2009[16]. The Government is assessing the environmental and sustainability impacts of including the site in the list of potentially suitable sites in the draft Nuclear NPS (through the AoS site report).

[16] SSA process and criteria

2.6 The SSA required the nominator to supply an annotated Ordnance Survey map at 1:10,000 scale showing the boundary of the site which is provided in Figure 3.

3 Policy Context

Introduction

3.1 The Main AoS Report sets out the national policy context in relation to nuclear power stations, energy, climate change mitigation, use of natural resources, environmental protection and sustainability of communities. During the scoping stage[17], a review of national plans was undertaken to help identify key sustainability objectives that need to be met and contribute to the development of the AoS Framework of objectives for appraisal.

3.2 This section considers the policy context at the regional level relevant to the potential new nuclear power station at Bradwell and its surroundings. It aims to identify any key significant policy objectives that need to be considered for this strategic appraisal of the site. This also contributes to addressing the potential interactions and cumulative effects that may arise from the operation of a new nuclear power station on the site. This is covered in Section 5 of the Site AoS Reports and section 8 of the Main AoS Report.

What are the other Key Sustainability Objectives that need to be considered?

3.3 The relevant policy documents are reviewed in Appendix 3 of this report and are as follows:

- Revised Regional Spatial Strategy for the East of England 2008-2021, Government Office for the East of England (2008)
- A Shared Vision: The Regional Economic Strategy for the East of England, East of England Development Agency (2004)
- Sustainable Communities in the East of England, Office of the Deputy Prime Minister (2003)
- East of England Regional Waste Management Strategy, East of England Region Waste Technical Advisory Body (2002)
- Essex Biodiversity Action Plan, Essex Biodiversity Project (2006)
- Essex County Council Local Transport Plan 2006 – 2011, Essex County Council (2006)
- Renewable Energy Strategy for Essex, Essex County Council
- Combined Essex Catchment Abstraction Management Strategy, Environment Agency (2007)
- Essex Minerals Development Document Issues and Options Core Strategy 2007 – 2026, Essex County Council (2009)
- Draft River Basin Management Plan for the Anglian River Basin District, Environment Agency (2008)
- Essex Estuaries Coastal Habitat Management Plan, Environment Agency (2002)
- Maldon District Council Local Development Framework – Core Strategy Issues and Options, Maldon District Council (2007)
- Essex Estuaries Flood Management Strategy, Environment Agency

[17] BERR (March 2008) Scoping Report

- Mid Essex Strategic Flood Risk Assessment, Scott Wilson (2007)
- Bradwell Wind Farm, Npower Renewables (2006)
- Draft Water Resources Management Plan, Essex and Suffolk Water (2008)
- Essex Estuarine Strategies - Blackwater & Colne, Environment Agency

3.4 The key objectives for sustainability from these strategic policy documents can be summarised as follows:

- Protecting and enhancing biodiversity
- Mitigating and adapting to effects of climate change
- Reducing flood risk: fluvial and coastal
- Protecting and enhancing landscape, recreation, cultural heritage
- Maintaining the rural economy: agriculture, tourism, employment
- Improving sustainable transport and accessibility
- Protecting water quality and resources
- Accommodating increased population growth
- Increasing provision of affordable homes

3.5 These may have indirect and/or cumulative interactions and this is discussed further in Section 5: Interactions and Cumulative Effects with Other Plans and Projects.

4 Site Characterisation

Introduction

4.1 A general description of the site at Bradwell and its location is provided in Section 2.

4.2 This section describes the characteristics of the site at Bradwell and its surrounding areas in relation to the key sustainability themes identified in Section 3. Information on the local and regional environment and communities has been obtained and reviewed from publicly available sources of information and comparisons have been made with comparable regional and national data sources where possible and relevant. This information is available in Appendix 4. Key strategic networks for transport are shown in Figure 2 and key environmental constraints in Figure 4.

4.3 The Scoping Report identified the indicators used for baseline data collation at the national scale (used in the Environmental Study). It also set out the indicators to be used for each Site AoS following the nomination of sites, but recognised that the baseline data collation process would be refined at the site nomination stage. Therefore, following site nominations, the relevant national, regional and local data has been sourced. This has enabled a more detailed, but still strategic, assessment to be undertaken than at national SEA scoping. As this AoS is a strategic study, data that would typically be collated to inform an EIA (i.e. very site-specific data or data requiring the execution of surveys) has not been gathered. However, where relevant, information from available published reports of any previous detailed studies has been referenced to inform this strategic assessment. The scope of baseline data gathered for the AoS for Bradwell is presented in Table 4.1 below.

Table 4.1: Summary of Scope of Baseline Data Collated for Bradwell

Sustainable Development Theme	Scope of baseline data collated in this AoS
Air Quality	• Regional air quality index • Location of Air Quality Management Areas
Biodiversity and Ecosystems	• Location and description of Special Protection Areas, Special Areas of Conservation, Ramsar sites, Sites of Special Scientific Interest (SSSI), National Nature Reserves, Local Nature Reserves, Local Wildlife Sites
Climate Change	• Regional precipitation and temperatures • Greenhouse gas emissions – regional, county and local

Sustainable Development Theme	Scope of baseline data collated in this AoS
Communities and Supporting Infrastructure: Population Employment Community Viability Transport Waste and Minerals Energy	• Location of major settlements and areas of population • Age structure of population • Employment/unemployment and economic activity rates • Employment profile by industry • Socio-economic classification of population • Energy from low-carbon/ renewable resources • Regional Transport networks and links • Landfill sites and waste management facilities
Human Health and Well-Being	• Index of Multiple Deprivation • Age profile • General health • Life expectancy • Infant mortality • Proximity to medical services
Landscape and Cultural Heritage	• Location and description of National Parks, Areas of Outstanding Natural Beauty, Heritage Coasts • National Landscape Character Areas • Local landscape character areas / types • CPRE Tranquil Areas and Light Pollution mapping • Location and description of World Heritage Sites, Scheduled Monuments, Historic Battlefields, Historic Parks and Gardens, Designated Protected Wrecks, Conservation Areas, Listed Buildings
Soils, Geology, Land Use	• Agricultural land classification • Soil types • Geological SSSIs • Geological risks • Environmental hazards • Historic land use
Water: Hydrology Quality Resources Flood Risk	• Location of areas at risk of flooding • State of surface and ground waters: in river basin district and catchment • Predicted water demand and availability by Water Resource Zone • Designated waters under EU Directives

Air Quality

4.4 Air quality in Eastern England is relatively good with an average air quality index score of less than 3 (where 1-3 good, 4-6 moderate, 6-9 poor and 10 bad). However, pockets of relatively poor air quality exist in the region, particularly in urbanised areas and major route corridors that experience high levels of traffic flow.

4.5 There are 60 Air Quality Management Areas (AQMAs) in the Eastern Region of England. No AQMAs have been declared in Maldon District.

4.6 The average air pollution index for the east of England has been gradually increasing since 2002. Significant pressures on meeting air quality objectives are being experienced in a number of urban areas and major route corridors. This is reflected in the relatively large number of AQMAs and is largely as a result of increasing population, traffic and congestion in the region (there has been an increase of 19% of vehicles on the region's roads from 1995 – 2006).

4.7 The EA assesses non-radioactive aerial emissions (sulphur dioxide, nitrogen oxides and volatile organic compounds) from nuclear power stations are extremely low compared to other regulated industries. The EAs most recent available assessment of radioactive aerial emissions for regulated nuclear power stations indicates that all fall within authorised limits.[18]

4.8 The UK nuclear industry is highly regulated. All nuclear power stations require a licence to operate provided by the HSE/NII. The licence deals with all consents and changes from initial application to decommissioning and beyond.

Biodiversity and Ecosystems

4.9 There is a very high level of biodiversity interest surrounding Bradwell. The site lies in close proximity to the Essex Estuaries, which are made up of a complex suite of European designated sites. Further information on the European designated sites and their current condition is given in the separate HRA Report for Bradwell. These include the Essex Estuaries Special Area of Conservation (SAC) and numerous Special Protection Areas (SPA) and Ramsar sites, which make up the Mid-Essex Coast SPA/Ramsar complex[19].

4.10 The key interests of the designated sites are the valuable coastal and inter-tidal habitats, which support populations of internationally important birds, as well as nationally important plant and invertebrate species. All of the designated sites are closely interlinked with many of the important bird species moving between designations.

4.11 Within the wider landscape are additional habitats of national biodiversity value, including coastal grazing marsh, reedbeds, saline lagoons and sea walls.

4.12 Other UK Biodiversity Action Plan priority species within the local area include bats, great crested newts, water voles, otters, Allis shad, Twaite shad, shrill

18 Measuring Environmental Performance: Sector Report for the Nuclear Industry (Environment Agency, Nov 2005)

19 Ramsar sites are wetlands of international importance designated under the Ramsar Convention, first designated in the UK in 1976. The initial emphasis was on selecting sites of importance to waterbirds within the UK, and consequently many Ramsar sites are also SPAs, however non-bird features have been increasingly taken into account

carder bee and adder. Of these, bats, great crested newts and otters are European Protected Species.

Climate Change

4.13 The potential effects of climate change on the site, such as storm surges, coastal erosion, sea level rise and flooding, are explored in the sections on Flood Risk.

4.14 The East of England region is ranked 5th out of the 9 regions in the UK for its CO_2 emissions per head. Emissions from domestic sources are 780kg per head; compared to the English average of 750kg per head. A report by Essex County Council, entitled "Our Plan for a Greener Essex"[20] indicates that the largest contributors to the East of England's CO_2 emissions are its energy and industry sectors.

4.15 "Our Plan for a Greener Essex" outlines targets to reduce emissions across the entire County Council by 10% in 2010/2011 and by 60% by 2050. The County's key goals are to reduce emissions from transport by 3% year on year and reduce emissions from buildings by 3% year on year.

4.16 The East of England's Regional Spatial Strategy (RSS), entitled East of England Plan[21], outlines an overall target to contribute to meeting the national policy of cutting the UK's carbon dioxide emissions by 60% by 2050, with real progress by 2020. The RSS sets out a number of objectives in its 'Overall Spatial Vision', which include the following climate-change related goals:

- To reduce the region's impact on, and exposure to, the effects of climate change by:
    - locating development so as to reduce the need to travel;
    - effecting a major shift in travel away from car use towards public transport, walking and cycling;
    - maximising the energy efficiency of development and promoting the use of renewable and low carbon energy sources; and
    - reducing the risk of adverse impact of flooding on people, property and wildlife habitats.

4.17 The RSS also states that "the development of new facilities for renewable power generation should be supported, with the aim that by 2010 10% of the region's energy and by 2020 17% of the region's energy should to come from renewable sources […] (excludes offshore wind)." [22]

4.18 The region also has a number of integrated transport policies, which aim to contribute to the reduction of carbon emissions whilst addressing the expected population and transport infrastructure growth. Despite these

[20] http://www.essexcc.gov.uk
[21] http://www.go-east.gov.uk/goeast/planning/regional_planning/
[22] http://www.go-east.gov.uk/goeast/planning/regional_planning/

policies, carbon emissions are still relatively high because of sparse populations and dependence on personal car transport.

4.19 There are eight power stations within a 80km radius of the site, in addition to the Bradwell nuclear power station itself, which ceased operation in 2002. The eight power stations have a combined capcity of 6760MW. These are primarily coal, oil, gas CCGT and offshore wind. .

Communities: Population, Employment and Viability

4.20 The population in the East of England has steadily increased over the past 25 years and now totals approximately 5.6 million residents. According to the Office for National Statistics, the region's population grew between 1981 and 2006 by 16%, which is more than double the rate for the UK as a whole and second only to the South West. The largest percentage change occurred in East Cambridgeshire, with an increase of 48%. There are three additional, significant growth areas wholly or partly in the region: the whole of the London-Stansted-Cambridge-Peterborough growth area and parts of the Thames Gateway and Milton Keynes and South Midlands area (GO-East 2007).

4.21 Bradwell is within the Maldon district, Tillingham ward and the parish of Bradwell. Population density in the Maldon district and Tillingham ward is low, with an average of 0.37 people per ha, which is below the national average of 3.7 per ha.

4.22 Nearby settlements to the south of Bradwell are the villages of Bradwell-on-Sea (2km), Tillingham (5km), Southminster (10km) and Burnham-on-Crouch (16km). The town of West Mersea lies across the estuary, approximately 4km to the north of the site. From the 2001 Census, Tillingham Ward has a population of 2,181, and neighbouring wards Southminster and West Mersea have populations of 4,021 and 6,925 respectively. The local countryside and coastal areas are of importance to the local economy through agriculture, nature conservation, tourism and recreation, fisheries and shellfisheries.

4.23 Employment rates for people of working age in the East of England region are 77.4 % (2007), which is above the national average of 74.4%, and is amongst the highest levels of employment when compared to other English Regions. Within the East of England region, employment rates for Maldon District Council is below the average for the region (at 74.6%), but this is still slightly above the national average[23].

Communities: Supporting Infrastructure

4.24 Transport: Bradwell is located on the Dengie Peninsula on the River Blackwater estuary. It is accessed off the B1021 which is the main access route to Bradwell-on-sea and Bradwell Waterside. The B1021 leads to a network of minor roads including the B1018, B1010 and B1012. The B1012 connects with the A132 to the north of South Woodham Ferrers. The A132

[23] Office for National Statistics latest national employment rates (2007)

then connects to the north-south A130. The A130 is the key link between two routes to the M25 i.e. the A127 and the A12. The B1010 provides a route to the A414, connecting to the A12, to the east of Chelmsford. The site is located approximately 40km from the A130. The A12 is part of the Trans European Network and is a Trunk Road.

4.25 The nearest railway station to the site is at Southminster, which is approximately 14.5km to the south, which was used as a commuter route for employees during the operation of the existing power station.

4.26 The nearest shipping ports are Harwich and Felixstowe[24], with Bradwell Quay located in close proximity to the site.

4.27 Conventional waste: Essex County Council acts as the Waste Disposal Authority (WDA) for Maldon District Council. 732,400 tonnes of municipal wastes were generated within the area in 2007/08. Of this total, 62% was sent to landfill, and the remaining 38% recycled. There are currently nine non-hazardous landfill sites and five inert landfill sites in the region. A 2007 study forecast that Essex has sufficient landfill void space with development consent to last until approximately 2017.

4.28 There are currently no hazardous waste landfills or treatment facilities in Essex, although established waste management contractors are known to operate and provide services within the region.

4.29 Essex County Council is currently in the process of procuring a waste treatment facility at Basildon. The facility is to incorporate a Materials Recycling Facility (MRF) and either an Anaerobic Digestion (AD) or Mechanical Biological Treatment (MBT) plant, to treat waste and produce biogas or a Solid Recovered Fuel (SRF).

Human Health and Well-Being

4.30 The site at Bradwell is within the Super Output Area (SOA) known as Maldon 006E[25]. Indices of deprivation show that the Maldon SOA is not a deprived area although education deprivation and barriers to housing and services in the area are both greater than average. The age profile for this SOA shows that there are fewer children under sixteen and slightly more senior citizens (males over 65 and females over 60) than the English average. The profile also shows that there are slightly more working age people in the area than average.

4.31 In the most recent census (2001), people within the Maldon SOA generally reported good or fairly good health. This is reflected in a life expectancy approximately equal to the average for England. Infant mortality is well below both the English average and the regional average.

[24] http://www.maldon.gov.uk/NR/rdonlyres/CFCDDB21-037A-40DE-BE6F 1941ED9007F3/11921/MaldonCoreStrategySARV31_clean.pdf
[25] An SOA is a geographical unit, of roughly equivalent population size and smaller than a district council area, created in the UK by the Office of National Statistics to aid statistical analysis of data

4.32 With regard to mental health, the Health Profile 2008[26] for Maldon shows that estimates of the number of people claiming incapacity benefit for mental illness in the area (14.2 per 1000 population) are significantly below the English average (27.5 per 1000 population).

4.33 As might be expected from the educational deprivation figures referred to above, pupils in the Maldon SOA did not perform as well as their peers in the Maldon District Council area as a whole. However, they outperformed the average for students for England.

4.34 There are a greater percentage of unfit houses[27] within Maldon District Council's area than in the East of England region generally. However, the percentage in Maldon is the same as the average for England.

4.35 Figures from the Audit Commission for 2005[28] show that the crime rate in Maldon District Council's area is much lower than the UK national average.

4.36 The economic well-being of the area is reasonably positive, when compared to England as a whole, as can be seen from the local employment figures[29] (see 'Population, Employment and Viability' above - noted here as a measure of well-being). From July 2007 to June 2008, 75.8% of the population of the Maldon District Council area were employed. This number compares unfavourably with figures for the East of England region (77.7%) but favourably with the English average (74.5%).

4.37 Local access to medical services is good with two general practitioner (GP) practices within 5km of the site. There are also four further GP within 10km of the site. A local hospital (St. Peter's) is 28km from the site, although does not have an accident and emergency department. The nearest accident and emergency department is at Broomfield Hospital, Chelmsford (31km), whilst the nearest accident and emergency hospital with a medical physics department is Colchester Hospital (64.5km). Mental Health Services are provided by North Essex Mental Health Partnership in Colchester (64km).

4.38 One of the wider determinants of health and well-being is access to local recreational facilities. In this regard, the site is well served, with at least thirteen leisure centres within 20km of the site. In addition, as Maldon is in a rural and coastal location, the area offers good potential for outdoor recreational activities, such as walking, cycling and water sports since the district includes approximately 250 parks and open spaces and a number of beaches.

4.39 The existing nuclear power station at Bradwell was in operation between 1962 and 2002. Therefore the necessary data exist to enable a comparative study

[26] http://www.apho.org.uk/resource/view.aspx?RID=50213
[27] Dwellings not suitable for occupation as defined by various criteria in Section 604 of the Housing Act 1985 (as amended)
[28] http://www.areaprofiles.audit-commission.gov.uk/(rkgonp45u4sp1o55bc5scf55)/SingleAreaSearch.aspx
[29] https://www.nomisweb.co.uk/reports/lmp/la/2038431858/report.aspx?pc=IP164UR

between the incidence of cancer in the area and the average incidence of the cancer in the UK population as a whole.

4.40 The Committee on Medical Aspects of Radiation in the Environment (COMARE), a scientific advisory committee providing independent authoritative expert advice on all aspects of health risk to humans exposed to natural and man-made radiation, has, for over twenty years, investigated the incidence of childhood cancer and other cancers around nuclear sites starting with the Sellafield site in 1986.

4.41 COMARE has published a series of reports on topics related to exposure to radiation. Its view is that there is no evidence for unusual aggregations of childhood cancers in populations living near nuclear power stations in the UK.

4.42 COMARE's tenth report considered the incidence of childhood cancer around nuclear installations. These were divided into nuclear power generating stations and other nuclear sites. The results for the power generating stations supported the conclusion that 'there is no evidence from this very large study that living within 25 km of a nuclear generating site in Britain is associated with an increased risk of childhood cancer'.

4.43 In its eleventh report COMARE examined the general pattern of childhood leukaemia in Great Britain and concluded that many types of childhood cancers ‘have been shown not to occur in a random fashion’. It is also stated that ‘The results of analyses … suggest that there is no general clustering around nuclear installations.’

4.44 Following the KiKK study on childhood leukaemia around German nuclear power plants, COMARE requested that a reanalysis of the UK childhood cancer data used in COMARE's tenth report be carried out using the same methodology as the KiKK study as far as possible. This reanalysis - the Bithell paper - was published in December 2008. It showed that the conclusions of the COMARE tenth report remained valid when applying the KiKK methodology and did not support the findings of the KiKK study.

4.45 The KiKK study gave the results on childhood cancer in the vicinity of 16 German nuclear power plants from a dataset established by the German Childhood Cancer Registry, which included over 1500 childhood cancer cases from 1980 to 2003. In comparison, the dataset used for COMARE's tenth report and the subsequent Bithell paper contained over 32,000 cases of childhood cancer from 1969 to 1993. This is a verified national database and is believed to be the largest national database on childhood cancer in the world. The size of the database used by COMARE therefore gives considerable confidence in the results of the tenth report. In this context, the HPA and the German Commission on Radiological Protection have commented on the very low levels of radiation around nuclear power stations.

4.46 COMARE is currently undertaking a further review of the incidence of childhood cancer around nuclear power stations, with particular reference to

the KiKK study and COMARE's 10th and 11th reports. COMARE hope that the outcome of their review will be available at the start of 2010.

4.47 Radioactive monitoring carried out in 2007[30] found generally low concentrations of artificial radionuclides in water, sediment and beach samples and in meat and seafood samples taken around the existing Bradwell nuclear power station. From this sampling, the estimated total dosage levels to the public from all sources within the Bradwell area were assessed as being less than 7% of the dose limit for members of the public of 1mSv per year as specified in The Ionising Radiations Regulations 1999.

Cultural Heritage

4.48 There are ten scheduled monuments, one Conservation Area and around 132 listed buildings within an approximate distance of 5km of the site. The nearest scheduled monuments are a Saxon coastal fish weir and Othona Roman-Saxon Shore Fort, and Anglo-Saxon monastery, which both lie within 1.5km of the site. The Grade I listed St. Peter's Chapel, which is the subject of an annual pilgrimage, also lies within 1.5km of the site. Both Othona Fort and St. Peter's Chapel are sites of exceptional heritage significance. The site also contains RAF Bradwell Bay, a World War II airfield, and potential historic landscape. Prehistoric and Roman archaeology may also be present.

Landscape

4.49 The site is situated within Natural England's National Character Area 'the Greater Thames Estuary' (NCA 81). The nearest national landscape designation is the Dedham Vale AONB, 23km to the north east.

4.50 The site is situated on a headland, where the North Sea and River Blackwater meet. The landscape around the site is an open, low-lying coastal agricultural area, which is predominantly flat. This coastal landscape has a strong feeling of remoteness and wilderness.

4.51 Boundaries, hedgerows and trees have been limited by agricultural management. Dutch Elm disease eradicated a large amount of elm tree cover in the local area, which has not been replaced. Limited hedgerows demarcate large rectilinear fields, and the remaining tree cover is mainly situated around farmsteads and dwellings.

4.52 Due to the landscape's character, views are open and expansive to and from the site. The landscape of the site and surroundings is locally designated within a Special Landscape Area and the coastal zone.

4.53 The landscape within a 10km radius of the site is generally flat and open, allowing extensive views from surrounding areas of the existing nuclear power station at Bradwell, including from West Mersea and throughout the estuary.

[30] Food Standards Agency (2007). Radioactivity In Food and the Environment (RIFE 13) report.

Beyond a 10-15km radius from the site, tree cover and landform reduce the open views.

4.54 The Countryside Agency and Campaign to Protect Rural England (CPRE) county tranquillity map identifies the site as lying within one of the most tranquil parts of the South East of England.

Soils, Geology and Land Use

4.55 The site is located on Grade 3 agricultural land, which is lime-rich with low fertility. The soils are noted to be coarse and fine loamy permeable soils mainly over gravel and are variably affected by shallow groundwater. The local geology is Tidal Flat Deposits, Beach and Tidal Flat Deposits and Head, underlain by London Clay Formation.

4.56 Aside from the existing power station, the only other industrial land use in the area is the disused RAF Bradwell Bay airfield within the site.

4.57 There are no current or historic landfill sites within 1km of the site. Prior to 1994, the existing nuclear power station adjacent to the site operated an incinerator, which was an Integrated Pollution Control (IPC) registered waste site. Further information regarding the identified waste site, including extent, nature and quantities of waste will be obtained and assessed as part of a site specific EIA.

4.58 No mineral abstractions have been identified locally.

4.59 The British Geological Survey (BGS) have assessed generic geological risks in the area as follows:

- Potential for Compressible Ground Stability Hazards - moderate risk
- Potential for Landslide Ground Stability Hazards - very low risk
- Potential for Running Sand Ground Stability Hazards - very low to moderate risk
- Potential for Shrinking or Swelling Clay Ground Stability Hazards - low to moderate risk

4.60 An additional potential seismic risk of vibratory ground motion (earthquakes) is generally assessed as low in the UK. However, it is also noted that the most widely reported powerful earthquake experienced in the UK was in Essex in 1884.

Water Quality and Resources

4.61 The site is located in the Anglian River Basin District (RBD). In this RBD, only 5% of rivers (by length) meet the requirements for good ecological status (GES) or good ecological potential (GEP). Further, 15% of all surface waters are designated as artificial and 56% as heavily modified.

4.62 In total, 65% of groundwater bodies in the RBD meet the requirements for good status, while currently none of the estuaries and transitional and coastal waters meets the requirements for GES or GEP. The European

4.63 sets a target of achieving good ecological and chemical status for all water bodies by 2015, therefore significant improvements in water quality in the RBD are required.

4.64 Bradwell is located within the Combined Essex Zone (CEZ) of the Anglian RBD. Only 11km of rivers by length (approximately 2%) in the CEZ achieve GES or GEP. This is mainly a function of the impact of pressures, such as high phosphate and low dissolved oxygen levels. Local information for the area around the site from the EA website indicates that there are a number of watercourses on the Dengie Peninsula including Asheldham Brook but the catchment has not yet been assessed under the Water Framework Directive (WFD).

4.65 The site is located next to the Blackwater Estuary. There are three identified Shellfish Waters in close proximity, located in channels that feed into the estuary: Strood Channel, Tollesbury Channel and Salcott Channel. A large area of the Blackwater Estuary itself, adjacent to the site, is marked as designated Shellfish Waters on a 1999 schedule but it is not shown on the 2007 maps. There are Bathing Waters at West Mersea, 3km to the north of the site. The quality of these Bathing Waters has not been classified.

4.66 Groundwater is an important resource in the RBD, though only approximately 3% of total water supplied in the CEZ comes from groundwater. The main pressures on groundwater are abstraction for drinking water supply, agriculture and industry, and contamination with nitrates and saline water near to the coast.

4.67 The major aquifer present at Bradwell is Confined Chalk, which is overlain by London Clay and Essex Gravel deposits. The status of the Confined Chalk aquifer has not been assessed at Bradwell. The Essex Gravel aquifer is currently assessed as poor (quantitative) and the chemical quality has also been assessed as poor. The status is not expected to improve by 2015.

4.68 There are no groundwater source protection zones located in the vicinity of the site.

4.69 The site is located within the North Essex zone of the Combined Essex Catchment Abstraction Management Strategy area (CAMS), but is outside any of the assessed Water Resource Management Units (WRMU) and Groundwater Management Units (GWMU). The boundary with the South Essex CAMS area is located within 2km to the south of the Bradwell site.

4.70 Water related sites in close proximity to the Bradwell site include Sites of Special Scientific Interest (SSSIs) at Blackwater Estuary and Dengie, the Essex Estuaries Special Area of Conservation (SAC) which covers the Blackwater Estuary, a Special Protection Area (SPA) at Blackwater Estuary

and Dengie (both part of the Mid-Essex Coast SPA); and Ramsar sites at Blackwater Estuary and Dengie.

4.71 The site is located within Essex and Suffolk Water's supply area and in the 'Essex' Water Resource Zone (WRZ). The draft Water Resource Management Plan (WRMP) supply-demand balance results for the 'Essex' WRZ show that there is a significant water supply deficit in this WRZ to 2035, unless the two new resource developments planned for this zone are successfully implemented. With successful promotion of the full Abberton Scheme and the Chigwell Bulk Supply, the 'Essex' WRZ will move into surplus of supply over demand from 2014 until 2035.

4.72 The exact water requirements for the site are not yet finalised. The nominator does not express a preference for a particular cooling process or cooling water source.

4.73 The east coast of England, including the site at Bradwell, is influenced by the semi-diurnal tide of the Atlantic Ocean which transfers energy to the North Sea from both the north and the south (via the English Channel). The general direction of transport by both waves and tidal currents is towards the south. The southern part of the east coast has a higher tidal range and greater tidal currents than locations further north.

4.74 The site is located on the estuary of the River Blackwater. The area is made up of enclosed reclaimed marshes which are protected from inundation by an embankment and associated drainage. The existing power station is raised up 4m above the surrounding land. There is limited sediment seaward of the embankment as it is in constant contact with wave energy. There is no natural resilience to erosion at the site, but a jetty provides some protection from wave erosion, leading to the build up of sand and shell ridges in front of the existing power station.

Flood Risk

4.75 The site lies partly in Flood Zone 1 'Low Probability', but is largely in Flood Zone 3, 'High Probability', with the north and east part of the Bradwell site in Flood Zone 2 'Medium Probability' as indicated on the EA's current Flood Map. This means that the site is at risk from tidal flooding from the Blackwater Estuary and coastal flooding from the North Sea, with an annual probability of flooding lower than 0.5% in any one year in areas shown in Flood Zone 3, and an annual probability of between 0.5% and 0.1% of flooding in areas shown in Flood Zone 2.

4.76 There are a number of defences in the area of the site, comprising a combination of hard defences and earth embankments. The average condition of these existing defences is 'good condition but in need of improvement', with the average standard of protection of 1 in 5, which is well below the EA's standard requirement of 1 in 200 for tidal areas.

5 Appraisal of Sustainability

Introduction

5.1 This section considers the potential sustainability effects of including the site at Bradwell in the list of suitable/potentially suitable sites in the draft Nuclear NPS. The Main AoS Report considers the environmental and sustainability effects that may arise from the construction of nuclear power stations in general. Tthe site-level appraisal of sustainability looks specifically at the potential effects that could occur from constructing a new power station at Bradwell, should the nominated site be listed as potentially suitable in the draft Nuclear NPS and should an application for development consent be successful.

5.2 In accordance with the strategic nature and intent of the AoS, this section focuses on potential effects that are considered to be strategically significant at the Bradwell site and, where possible, suggests possibilities for mitigation. Where mitigation is uncertain or difficult, or where effects are likely to remain even after mitigation, this is made clear. Strategic significance is defined in Table 5.1 below.

5.3 The findings of the AoS were used to help the SSA process to identify those sites that are potentially suitable for new nuclear power stations and will be listed in the draft Nuclear NPS. The detailed matrices are presented in Appendix 2 of this report and the key findings of the AoS are discussed in Sections 5 and 6 of this report.

Table 5.1: The Assessment of Potential Significance in the Site-Level AoS

Local Effects
The AoS Site Reports identify potentially significant benefits and disbenefits of locating a new nuclear power station at each of the nominated sites. Some of the effects identified are significant at the local level and are more appropriately addressed through the development consent process to the IPC. Applications for development consent will include EIA, undertaken by the developer. Such local effects may include, for example, an adverse effect on a County Wildlife Site or disturbances to local communities arising from increased construction traffic during the construction phase. Effects of local significance are discussed in the detailed appraisal matrices set out in Appendix 2 of this AoS Report and are available to inform the IPC and others of issues that are likely to arise at the next stage of the planning and assessment processes. As with any major infrastructure project, there are likely to be effects during construction that have the potential for nuisance[31] and disturbance to local communities, demands on local services and supporting community infrastructure, and the risk of pollution and/or damage to environmental assets, such as biodiversity and water. The significance of such effects will be investigated at project level through the EIA process. These effects can often be minimised and controlled through careful design, working in accordance with good site practices, and managed through the use of Construction Environmental Management Plans (CEMPs), which will be agreed with, and monitored by, the environmental regulators and planning authorities.
Strategic Significant Effects
Other identified adverse or beneficial effects are more significant strategically, as they are potentially of wider national, or even international, importance. These may include, for example, an effect on biodiversity of national and international value (see also the HRA Report for Bradwell). Where an effect is considered to have significant implications for the wider region (in this case, the East of England), for example, a benefit for the regional economy, this has been considered as a strategically significant effect. Effects that are primarily of concern at the local or district scale have not been considered in this category. The significance of the potential strategic effects identified for each stage of the nomination, construction, operation and decommissioning, is summarised in Table 6.2.

Air Quality

5.4 There is potential for air quality impacts during the construction, operation and decommissioning stages of nuclear power stations. However, relative to some

[31] During the construction, operation and decommissioning of energy infrastructure there is potential for the release of a range of emissions such as odour, dust, steam, smoke, artificial light and for infestation of insects. All have the potential to have a detrimental impact on amenity or cause a common law nuisance or statutory nuisance under Part III, Environmental Protection Act 1990. For statutory nuisance effects section 4.21 of EN-1 applies.

other forms of power generation, nuclear power plants do not emit significant quantities of carbon dioxide, sulphur dioxide nitrogen oxides or particulates. Therefore, significant air pollution leading to deterioration in local or regional air quality is unlikely to arise during normal operation of the new nuclear power station. Construction and decommissioning impacts are potentially more problematic and will require control and management.

5.5 The construction of a nuclear power station at Bradwell is likely to have localised adverse effects on air quality in the short term (5-6 years), including dust and emissions from construction vehicles, Heavy Goods Vehicles (HGVs) and traffic movements generated by the estimated construction workforce. This has the potential to affect residential properties in the surrounding area and villages.

5.6 During operation, the traffic generated by the operational workforce has the potential to create longer-term adverse effects on air quality. Traffic and air quality assessments should be undertaken as part of the detailed EIA process, and likely mitigations may include highway improvements, traffic and construction management plans and the use of rail and port facilities where possible.

5.7 Whilst important at a local level, impacts on air quality arising from construction and increased traffic movements during operation and decommissioning are not considered to be of strategic significance. There is a small risk that increased concentrations of airborne pollutants or nutrients could have an adverse effect on adjacent sites of nature conservation interest. This is discussed further in the Biodiversity and Ecosystem Sections.

5.8 Radioactive releases to air, which could have a detrimental effect on local and regional air quality (in the event of a significant release), are strictly controlled in accordance with limits laid down in authorisations issued under the Radioactive Substances Act 1993 and subject to monitoring and reporting. Further consideration of the control of radioactive discharges to air is given in Section 7 of the Main AoS Report.

5.9 There is a very low risk of an accidental release of radioactive emissions from the Bradwell site, which could have a significant strategic effect on air quality. The HSE/NII and the EA will consider this matter during their risk assessments, which will be carried out as part of the consenting process to ensure that risks to public health and safety through accidental release of emissions are within acceptable limits. Whilst the risk is very low, the potential for a large number of people to be adversely affected means that, at this stage of assessment, the potential for strategic adverse sustainability effects has been identified.

5.10 <u>Strategic Effects on Air Quality</u>: The AoS has identified that there is a low risk for a significant urban and rural population to be affected by any significant accidental release of radioactive emissions from the Bradwell site. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk

assessment and regulatory processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.

Biodiversity and Ecosystems

5.11 Throughout the construction, operation and decommissioning phases of a nuclear power station, the potential exists for the accidental release of pollutants into the environment, which could have significant impacts on biodiversity. However, the risks of accidental releases would be minimised by the existing risk assessment and regulatory processes that are referred to in the sections on Air Quality. Construction activities, such as earthworks, new buildings and infrastructure could lead to direct habitat loss, increased noise disturbance and impacts on air and water quality, which, in turn, could affect sensitive ecosystems. During operation, cooling and discharge of heated water and routine discharge of radioactive material could affect aquatic habitats and species.

5.12 There is the potential that activities may lead to detrimental effects on coastal, inter-tidal and marine habitats and species within the Essex Estuaries SAC, the Blackwater Estuary SSSI/SPA/Ramsar site and the Dengie SSSI/SPA/Ramsar sites. These designations fall immediately adjacent to the site and development activities may encroach into these designated areas, for example the potential for a marine landing facility, cooling water infrastructure and upgraded coastal protection measures could all have adverse impacts.

5.13 Biodiversity could also be affected at a more local level if important habitats/species (for example, UK Biodiversity Action Plan habitats/species or legally protected species) are present within, or in close proximity to, the site.

5.14 Because of the complex nature of the Mid-Essex SPA/Ramsar designations and the fact that these designated sites are interlinked; impacts also need to be considered in the wider context. Key bird species, for example, may constantly be moving between designated sites.

5.15 Water intake from the coastal waters for cooling purposes could lead to the incidental mortality of fish and other aquatic species. Fish, larvae and eggs can be sucked into condenser units and be subjected to heat before being returned to the sea. This could lead to loss of fish or invertebrate food sources and could have an adverse effect on the important bird assemblages for which the SPA/Ramsar sites are designated. The design and siting of the intake system should be carefully considered so as to avoid/minimise depletion of such food sources.

5.16 Upgraded coastal protection measures and the potential marine landing facility could not only lead to direct habitat loss but could also exacerbate the effects of coastal squeeze which is a particular problem within the Essex Estuaries. This can prevent natural movement of coastal species and

important habitats such as saltmarsh and can alter coastal processes such as sediment regimes in both the local and wider context. Hard flood defences can also constrain opportunities for adaptation to rising sea levels as a result of climate change.

5.17 As part of the overall mitigation package an ecological mitigation and management plan (or similar document) could be produced which incorporates all detailed mitigation measures, good site environmental practices (such as pollution control) and ongoing monitoring measures that may be required after mitigation has been implemented. There should also be strategies put in place to deal with unforeseen outcomes which may arise as a result of post construction monitoring for example if mitigation measures appear to be failing. Opportunities should also be sought for habitat creation, enhancement and re-instatement, in particular saltmarsh habitats which are currently under threat in the Essex Estuaries.

5.18 Further studies carried out by the developer through the EIA process will be required in order to fully understand the potential effects on designated sites and on biodiversity in the area as a whole. Design and mitigation measures should in the first instance seek to avoid and minimise loss of habitat and avoid disturbance of legally protected species. Once defined, mitigation measures could be implemented through an ecological mitigation and management plan or similar document. Opportunities for biodiversity enhancement may be possible.

5.19 A separate report, documenting the HRA for Bradwell [32] has been undertaken. This report should be referred to for further information relating to the effects of a new nuclear power station at Bradwell on European-designated habitat sites.

5.20 <u>Strategic Effects on Biodiversity and Ecosystems:</u> The potential for adverse effects on sites and species considered to be of UK-wide and European nature conservation importance (the Essex Estuaries SAC, the Blackwater Estuary SSSI/SPA/Ramsar site and the Dengie SSSI/SPA/ Ramsar sites) means that significant strategic effects on the biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation or compensation of biodiversity effects, including the creation of replacement habitat for UK designated sites. Detailed baseline studies will form part of the project level EIA. The HRA for Bradwell should be referred to for further details and advice on the internationally designated sites.

Climate Change

5.21 The establishment of a new nuclear power station will contribute positively to the East of England region's climate change objectives. Short term increases in greenhouse gases during the construction and decommissioning phases of a new nuclear power station will be outweighed by the savings in overall

[32] Habitat Regulations Assessment Pilot Oldbury: HRA Screening and Appropriate Assessment Report

emissions during the lifetime of the facility compared to fossil-fuel powered stations of equivalent output.

5.22 Given the relatively remote location of the site and the lack of sustainable transport links, a new nuclear power station at Bradwell may result in increased emissions from the transport of goods and labour throughout the construction, operation and decommissioning phases. However, there is some potential for the developer to promote increased use of public transport through provision of appropriate transport links to the power station.

5.23 Complementary carbon emission mitigation measures could include sustainable design and construction, sustainable and low carbon technologies and transport, and potential increased investment in public transport and renewable energy services infrastructure.

5.24 **Strategic Effects on Climate Change: A new nuclear power station on the site would have positive long-term effects on climate change during the operational stage compared to conventional sources of energy, contributing positively to the East of England's climate change objectives. A lack of sustainable transport options to the site may result in emissions from the transport of goods and labour, but these emissions could be partially mitigated with green travel plans and investment in public transport.**

Communities: Population, Employment and Viability

5.25 Whilst there is likely to be significant positive effects for employment and local communities, the magnitude of these effects is reduced at a regional and national scale. An exception to this is likely to be the Isle of Mersea, which although relatively close to Bradwell, is located on the north coast of the estuary and has no direct transport links to the site. On a strategic regional level, impacts are considered to be positive. However, some uncertainty has been identified, as the project may lead to a shortage of local construction workers to meet the needs of other industries and major projects within the region.

5.26 There is some potential for short-term negative effects on local communities due to the likely significant in-migration of workers to the area during construction. This could have consequent pressures on basic services, housing, crime and policing, and local traffic routes to and from Bradwell. However, these effects could be mitigated by the developer's plans to accommodate and provide support services for construction workers, which would draw on monitoring previously carried out for Sizewell B[33].

5.27 Job losses from closure of the existing power station adjacent to the site are likely to be offset by labour demands from construction and operation of a new nuclear power station. However, the time lag between job losses and job

[33] Glasson, J., 2005. Better monitoring for better impact management: The local socio-economic impacts of constructing Bradwell B nuclear power station. *Impact Assessment and Project Appraisal*, volume 23, no.3, September, pp.215-226. Beech Tree Publishing

creation and possible differences in skill requirements may require workers to seek temporary employment elsewhere.

5.28 Increased labour demand within the region could lead to improved provision of education and training for the local population. Upskilling of employees and contractors associated with the new nuclear power station would also be beneficial to the region as a whole.

5.29 Measures to maximise local benefits to the community could include the provision of training in relevant skills, enabling a higher proportion of construction and operational workforces to be locally based, and utilising local suppliers and contractors.

5.30 It is commonly perceived that proximity to a nuclear facility such as a power station would have an adverse effect on property values. However, the evidence for this is inconclusive and contradictory. A study of effects in America[34] found that property values were actually increased in the vicinity of nuclear facilities, although the authors caution that this finding is subject to several caveats including being based on a small sample and may be unrepresentative. It is suggested that in relatively poor areas, or where the local economy is depressed, the income generated by employment at a new nuclear facility may have a positive effect on local property values. For the present appraisal, any effect on property values is not considered to be strategically significant because it is limited to the local area.

5.31 <u>Strategic Effects on Communities: Population, Employment and Viability</u>: Positive effects of local economic significance are likely to occur, although these are less significant at the regional scale. A potential negative effect of regional significance is the project leading to a shortage of local construction labour available to other industries.

Communities: Supporting Infrastructure

5.32 Negative effects at a local scale are likely due to increased pressure on basic services and infrastructure in Maldon, including conventional waste management facilities, wastewater treatment, electricity, and on local transport networks. The significance of effects is dependent on the detailed timing of decommissioning of the existing facilities and construction of a new power station on the site. For example, if substantial volumes of construction and decommissioning work were undertaken concurrently, it would place increased pressure on transport and conventional waste networks. This is considered to be a local, rather than strategic effect.

5.33 Transport: The A12 is recognised as a corridor likely to come under increased traffic pressure in the future. It forms the main link between London and the Haven Gateway sub-region. The A12 especially around Chelmsford will see some changes in traffic pattern. The proposed development of a new Park and Ride site will generate additional small trips around the A12. Some

[34] Bezdek, R.H. and Wendling, R.M. (2006) 'The impacts of nuclear facilities on property values and other factors in the surrounding communities', Int. J. Nuclear Governance, Economy and Ecology, Vol. 1, No. 1, pp.122–144

projected growth to the north of the Chelmsford is planned to be accompanied by the provision of a new north-east bypass route connecting onto the A12 at the Boreham interchange. The interchange will have to be upgraded.

5.34 The A127 is a key spine through the Essex part of the Thames Gateway, with the A13. As such it is likely to see increased traffic pressure.

5.35 Notwithstanding this, the effect of a nuclear power station on the Bradwell site on these key roads is likely to be minor. The main impact of development on the site will be on the minor roads leading to it. This impact can be mitigated to a certain extent by green travel planning promoting alternative to single car use to the site. This could include provision of dedicated public transport links with connection with existing rail services to the area or promotion of car sharing. The impact of construction traffic could be mitigated by taking advantage of the coastal location of the Bradwell site, although, it is recognised that no existing port facilities currently serve the site.

5.36 Public transport in the Dengie Peninsula has been identified in the Core Strategy as being inadequate. The site would draw more people (employees) to the area, which has the potential to increase pressure on an already inadequate public transport system. The Crouch Valley Branch Line to Southminster was used as a commuter route for employees during the operation of the existing power station currently being decommissioned, and the line has remained open due to significant local lobbying. The site could help ensure the line remains open by increasing its use by commuters to a new power station.

5.37 Conventional waste: Waste material will be generated during construction, operation and decommissioning of a development. Local impacts may be expected upon local regional facilities however the scale of operation is not considered to be significant in the long/medium term. Waste management facilities will be available to deal with construction projects for the foreseeable future and waste/recycling sites should not be detrimentally impacted. Good site practices and the site-specific EIA should look to further mitigate these risks and many impacts may be positive such as the generation of significant quantities of secondary aggregate during demolition.

5.38 Radioactive waste[35] The operation of a new nuclear power station at the site would require the interim storage of spent fuel and intermediate level waste on site for a period of up to 100 years after operation has ceased. Nominators were asked that when nominating a site for the SSA, they make provision within the area of land nominated for the safe and secure storage of all the spent fuel and intermediate level waste produced through operation and decommissioning until it can be sent for disposal in a geological disposal facility. The detailed design and location of the storage facility within the Bradwell site boundary will be determined at the project level, within the design submitted by the developer. The generic process for dealing with all types of radioactive and hazardous waste arising from the operation and

35 Radioactive waste is waste regulated under Radioactive Substances Act 1993.

decommissioning of new nuclear power stations, (including gaseous and liquid radioactive discharges), are appraised in Chapter 7 of the Main AoS Report.

5.39 Electricity transmission: The development of a nuclear power station at Bradwell may require new power lines to be built, or existing lines to be upgraded, to connect the facility with the National Grid. The potential impact of new or upgraded power lines will be considered in a separate Networks NPS.

5.40 <u>Strategic Effects on Communities: Supporting Infrastructure</u>: There may be some adverse impacts locally from additional traffic generated during construction. However, these effects can be mitigated through measures such as green travel plans and by consideration of transport alternatives, for example by transferring large freight from road to sea and rail transport. Locally adverse impacts may be expected upon waste facilities from non-radioactive waste produced at the site, but the scale of this activity is not considered to be significant in the long/medium term.

Human Health and Well-Being

<u>Radiological Health Issues</u>

5.41 Radiation occurs naturally in the environment. The Health Protection Agency (the HPA) which regularly reviews the radiation exposure of the UK population, has calculated that the overall average annual dose to a member of the general public from all sources of radioactivity is 2.7 millisieverts (mSv, a measure of dose) per year, about 84% of which is from natural sources and about 15% is from medical procedures. The HPA calculates that the average dose to a member of the public due to radioactive discharges from the nuclear power industry is less than 0.01% of the annual dose from all sources.[36]

5.42 By law, the radiation to which members of the public are exposed by the operations of a nuclear power station is limited to 1 mSv per year.[37] This limit applies to all members of the public, including those who receive the highest doses as a result of the location of their homes and their habits of life. It also applies to the cumulative effects of planned exposures from all sources of radiation, excluding medical exposures of patients and natural background radiation. Therefore, the exposures of people living near to a new nuclear power stations have to be less than the dose limit taking into account exposures from any other nearby sites and any past controlled releases. This

[36] Ionising Radiation Exposure of the UK Population: 2005 Review HPA-RPD-001

[37] This is through the Ionising Radiations Regulations 1999 http://www.statutelaw.gov.uk (which includes all activities carried out under a nuclear site licence granted by the Nuclear Installations Inspectorate under the Nuclear Installations Act 1965) http://www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1965/cukpga_19650057_en_1, the Radioactive Substances Direction 2000 http://www.defra.gov.uk/ENVIRONMENT/radioactivity/government/legislation/pdf/rsd2000.pdf and the Radioactive Substances (Basic Safety Standards) (Scotland) Regulations 2000 http://www.opsi.gov.uk/legislation/scotland/ssi2000/20000100.htm

statutory dose limit is reinforced by the concept of ALARP (As Low As Reasonably Practicable), which is used by the nuclear regulators to reduce doses to as low as is reasonably practicable.

5.43 The environment agencies run monitoring programmes to provide an independent check on the impacts of radioactive discharges. In 2008, they published a report covering 2007, showing that radiation doses to people living around nuclear sites remained below the statutory dose limit of 1 mSv per year.[38]In England and Wales, the main regulatory bodies are the NII, a division of the Health and Safety Executive and the EA. These agencies regulate radioactive discharges from nuclear power stations and have responsibilities for ensuring that workers, the general public and the environment are protected against exposure to radioactivity. Regulation of all disposals, including discharges to air, water and land, of radioactive waste off or on nuclear sites is regulated under the Radioactive Substances Act 1993[39]. This regulatory system will apply to a potential new nuclear power station at Bradwell and should ensure that permitted radioactive discharges do not cause unacceptable risk to health.

Regulatory Justification

5.44 Before the UK can adopt any new class or type of practice involving the use of ionising radiation, it must first be 'Justified', i.e. it must be demonstrated that any benefits resulting from its introduction outweigh the associated health detriment. European Council Directive 96/29/Euratom of 13 May 1996 (the Basic Safety Standards Directive)[40] requires Member States to ensure that, in advance of being first adopted or first approved, all new classes or types of practice resulting in exposure to ionising radiation are justified by their economic, social or other benefits in relation to the health detriment they may cause. This process is known as Regulatory Justification and the Secretary of State for Energy and Climate Change is the Justifying Authority[41].

5.45 The basic safety standards for the protection of the workforce and general public against the dangers of ionising radiation set out in the Directive are further enforced before, during and after operation of nuclear power stations, including the management and disposal of waste by the UK's regulatory

[38] Radioactivity in Food and the Environment, 2007 RIFE-13, Environment Agency, Scottish Environment Protection Agency, Food Standards Agency, Northern Ireland Environment Agency 2008 http://publications.environment-agency.gov.uk/pdf/GEHO1108BPBH-e-e.pdf?lang=_e (see Table S.1 "Radiation doses due to discharges of radioactive waste in the United Kingdom, 2007" of this publication).
[39] Radioactive Substances Act 1993 http://www.opsi.gov.uk/acts/acts1993/ukpga_19930012_en_1
[40] Council Directive 96/29/Euratom of 13 May 1996, laying down basic safety standards for the health protection of the workforce and general public against the dangers of ionising radiation. Official Journal of the European Communities (OJ ***L 159***, ***29.6.1996***, p.1)
http://ec.europa.eu/energy/nuclear/radioprotection/doc/legislation/9629_en.pdf

[41] Completion of the Regulatory Justification process is not dependent on consent being granted by the IPC and similarly there is no need for the IPC to wait for completion of the Regulatory Justification process before granting consent.

framework. This aims to reduce potential health impacts to acceptable levels and ensure that radiation doses are within internationally agreed limits.

Construction and Operational Effects

5.46 During the operation of a nuclear power station, there is a risk of unplanned radioactive discharges into the environment which could potentially lead to adverse health impacts. However, the risk of such an accident is judged to be very small because of the strict regulatory regime in the UK[42]. The HSE site licensing process will also ensure that accident management and emergency preparedness strategies are prepared and that all reasonably practicable steps have been taken to minimise the radiological consequences of an accident.

5.47 The transportation of radioactive materials to and from a nuclear power station increases the possibility of an accident resulting in an unplanned radioactive discharge. However, the safety record for the transport of nuclear material suggests that the risks are very low. Data from the Radioactive Materials Transport Event Database (RAMTED) for the period 1958 to 2008 showed that of the recorded 913 events associated with the transport of radioactive materials no 'significant dose events' were associated with the nuclear power industry[43].

5.48 The scale of construction work associated with a potential new nuclear power station at Bradwell may result in higher risk of health and safety incidents at the site. Construction would be subject to the Construction (Design and Management) Regulations and other relevant regulations applicable to construction.

5.49 During the operation of a potential nuclear power plant at Bradwell, activities will be regulated in accordance with the Health and Safety at Work Act 1974, Nuclear Installations Act 1965 and the Ionising Radiations Regulations 1999. The potential operator must have a Nuclear Site Licence from the Nuclear Installations Inspectorate (NII) prior to the construction commencing and this licence will only be granted if the NII is satisfied that the power station can be built, operated and decommissioned safely with risks being kept to 'as low as reasonably practicable' (ALARP) at all times. The licence will, therefore, have conditions attached to it which will allow the NII to monitor safety risks throughout the lifetime of the project.

5.50 It is possible that the proposed power station will require an upgrade to existing electricity transmission lines or additional transmission lines to link its output to the National Grid. The potential impact of new power lines will be considered in a separate Electricity Networks National Policy Statement. Given the current uncertainty regarding the health effects of prolonged low level exposure to electromagnetic fields (EMFs) it is recommended that, in

[42] White Paper Website Ref
[43] http://www.hpa.org.uk/HPA/Publications/Radiation/HPARPDSeriesReports/

keeping with Health Protection Agency advice[44], a precautionary approach is adopted to the routing of any required power lines.

5.51 The presence of, and more particularly the construction of, a nuclear power station at the Bradwell site will increase community disturbance to some degree. Such disturbance may include noise and vibration, dust in the construction phase and increased traffic in all phases. To mitigate construction phase disturbances an environmental management plan should be developed, implemented and monitored for effectiveness throughout the construction period. Potential traffic issues in all the project's phases can be mitigated through the adoption of a transport plan aimed at minimising community disturbance whilst also promoting 'green' travel.

5.52 Noise emissions will arise from the nuclear power station construction, operational and decommissioning phases. Construction noise will emanate from plant, site activity and transportation sources. Similarly, during operation noise will arise from fixed installations, on-site mobile plant sources and off-site transport sources. Construction noise will be variable and transient in nature and will need to be mitigated by the use of good construction practice, regulation and timing of construction operations, the use of noise controlled plant and equipment and noise and vibration monitoring. These would be strategically and operationally managed through implementation of a formal construction/environmental management plan and associated procedures.

5.53 Noise emissions from nuclear power stations are relatively low. Minimisation of operational noise emissions would require consideration at the design/ layout stage of the scheme. In particular, significant benefits would result if potential sources of noise emissions could be reduced through a combination of engineering design solutions. These could include the careful siting of noise emitting plant within the overall facility (at high or low level and in relation to local noise sensitive locations) and careful selection of trafficking routes and access points. Particular emphasis would need to be taken of any low frequency and constant emission sources. Overall, noise background and prediction assessment following relevant international (ISO) and British (BS) standards would need to be applied so that the noise impact of the proposals could be determined for planning purposes. Given the relatively lightly populated locality, it is considered that noise and vibration impacts would not be a significant issue and pose a constraint to development at Bradwell.

Local Health and Recreation

5.54 With regard to recreation, there is a potential impact associated with the coastal path which passes the site. It is likely that this path may need to be closed during some phases of power station construction but this effect will be temporary and can readily be mitigated by providing a bypass path around the site.

[44] http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1195733817602

5.55 There is a possibility that the influx of workers required for the construction and operational phases of the proposed new power station may put a strain on local health and other services and lead to community integration and conflict issues. In order to realistically gauge whether or not this will be a problem, a review should be carried out during the planning process to determine the need for additional health service capacity and community assistance in the area. This review could comprise a Health Impact Assessment (HIA). However, whilst this may be considered good practice it is noted that HIA is not a statutory requirement for current energy applications. The applicability of an HIA may be considered on a case by case basis.

5.56 It is possible that the presence of a nuclear power plant may lead to increased stress levels in certain individuals, due to potential perception of risk associated with living or working near a power station. However, there is little literature available on this potential impact which suggests that it has not been a significant problem in the past. In any event, in the case of the nominated site, people living and working nearby have had a long time to get used to there being an adjacent nuclear plant so this is unlikely to be a problem at this location.

5.57 It is probable that building, operating and decommissioning a new nuclear power station at Bradwell will lead to an increase in employment, community wealth, housing stock and other associated neighbourhood infrastructure. These positive effects on the community are likely to be more significant than any potential negative consequences of the project assuming there are no adverse effects on the health of the local population.

5.58 <u>Strategic Effects on Human Health and Well-Being:</u> The rigorous system of regulation of routine discharges from the proposed nuclear power station at Bradwell should ensure that there are no unacceptable risks to the health of the local population when the plant is operating normally. There is also a very small risk of adverse health impacts arising from an accidental release of radiation but the multiple safety features within modern nuclear plants makes such an event exceedingly unlikely. Overall, the likely enhancement in employment, community wealth, housing stock and other associated neighbourhood infrastructure should improve community well-being and health generally.

Cultural Heritage

5.59 The main impacts of the development within the footprint of the proposed facility would be felt at a local to regional scale. Potential setting effects upon nearby scheduled monuments and listed buildings, and the West Mersea Conservation Area, could also be of regional or national importance, depending on distance and sight lines. However, the impact on the setting of Othona Roman fort and St. Peter's Chapel would be of exceptional significance especially if the development occurs on the eastern side of the site. However, mitigation could be applied by siting the proposed facility close to the existing power station on the western side of the site. Detailed

assessment, including consultation of the Essex Historic Landscape Characterisation, consideration of Conservation Areas and other heritage assets will be required at the project level EIA stage.

5.60 RAF Bradwell Bay is not a scheduled or listed monument and there is no prescribed or designated regime for dealing with it or hindering the development of the site. Should development of this site go ahead it is recommended that good practice be employed and the buildings/structures should be surveyed and recorded (before being demolished if necessary).

5.61 In addition there may be potential off-site effects on cultural heritage assets caused by an increase in traffic and the development of new infrastructure. Detailed assessment will be required at the project level EIA stage.

5.62 An archaeological (buried) resource of Prehistoric, Roman or later date is potentially present within the site and maritime archaeology may also be present. Detailed investigations (including consultation with the Local Authority Archaeologist, geophysical survey, trial trenching etc.) may be required to inform the project level EIA. Depending on the results this may lead to an excavation prior to construction and/or a watching brief during the construction phase (during ground preparations and excavations).

5.63 <u>Strategic Effects on Cultural Heritage:</u> The AoS has identified potential, adverse effects on the settings of Othona Roman Fort and St Peter's Chapel, other nearby scheduled monuments, listed buildings and the West Mersea Conservation Area, as well as on buried archaeology of potentially high importance. However, there is a possibility that these effects can be mitigated. Further detailed assessment at project level will be required.

Landscape

5.64 Dedham Vale AONB is situated approximately 23km to the north east. The development of a new nuclear power station on this site may add to the existing building visual mass, but the effects on any views are likely to be negligible due to distance and probable intervening topography and vegetation.

5.65 The new power station would be seen in the context of existing power station facilities, prior to decommissioning. However, further development alongside the existing nuclear power station is likely to lead to a perceptible deterioration in some local views, which would not be able to be mitigated, given the scale of possible new building. During construction and operation, there are likely to be significant adverse direct and indirect effects upon local landscape character of the area, including areas locally designated as Special Landscape Areas and the coastal zone.

5.66 During construction and operation, the direct impacts on landscape character and features on the site are likely to be adverse. This is particularly relevant given the likely historic integrity of landscape features which could be

impacted. These include historic field boundaries, ditches and remnants of old sea walls. There are, however, some opportunities for effective protection of trees, hedgerows, ditches and the shoreline and for some positive habitat/landscape compensation and enhancement measures. Specifically, there is potential for a new landscape framework to contribute to existing published local landscape management and restoration guidelines for this local area.

5.67 During and after decommissioning, with the removal of buildings and potential for landscape restoration, the potential effects of the new power station could reduce to a neutral level. However, there is some uncertainty over future land uses on the site given the timescales involved.

5.68 <u>Strategic Effects on Landscape</u>: The AoS has identified potential, adverse indirect effects on the local surrounding landscape and some direct effects on features of the site. There are no significant adverse effects anticipated on nationally designated landscape. However, there are likely to be indirect adverse effects of the development on nearby Special Landscape areas. In visual terms, the new power station would be seen in the context of existing power station facilities, prior to any decommissioning. It is predicted that there will be limited further potential for mitigation of these local visual impacts, given the scale of the development, until after decommissioning. Therefore, overall, impacts are considered to be of minor adverse strategic significance.

Soils, Geology and Land Use

5.69 The construction of the power station at the Bradwell site and associated infrastructure (including transmission lines/towers) may lead to the direct loss of soil structure. This may include impacts on soils that maintain terrestrial habitats, including designated nature conservation sites; the Essex Estuaries SAC, the Blackwater Estuary SSSI/SPA/Ramsar site and the Dengie SSSI/SPA/Ramsar sites. This is considered further in the biodiversity appraisal above.

5.70 Such effects can be mitigated through limitation of the footprint of the development, which would reduce the area of soils affected, and recognised best practice soil and water management measures during construction.

5.71 As noted in the BERR Consultation on the Strategic Siting Assessment Process and Siting Criteria for New Nuclear Power Stations in the UK (July 2008)[45], and in line with the SEA Scoping Report, the assessment of the suitability of the site in respect of seismic risks, including the relevance of the Colchester earthquake in 1884, is part of the SSA process and is outside the scope of this AoS.

5.72 The development of the site may result in the increased risk of pollution and potential contamination of soils and controlled waters. These risks can be mitigated by the use of Environmental Management Plans during the

[45] http://www.berr.gov.uk/files/file47136.pdf

construction and decommissioning stages of the site redevelopment. Any decommissioning would be required to meet specific clean-up criteria approved by the regulators.

5.73 Blight of land is a likely effect of the development of a new nuclear power station on the site, but is considered of local or district significance. Likewise, effects on existing land uses, including surrounding areas of touristic value, are considered to be of local impact.

5.74 **Strategic Effects on Soils, Geology and Land Use: The AoS has identified potential, adverse, indirect effects on soils that are important for biodiversity sites. However, there is potential for mitigation through careful planning of construction and operational facilities.**

Water Quality and Resources

5.75 The site is surrounded by areas which are shown on EA maps as being at risk of flooding from rivers and sea without defences. During the lifespan of the proposed nuclear power station, and as a result of potential sea-level rises, the site is likely to require the construction of new flood defences. These defences would be designed to counteract the effects of existing fluvial and coastal processes, but are likely to have the secondary effect of impacting the movement of sediment in the river system and along the coast. The effects of the construction and long-term presence of upgraded coastal defences on coastal process, hydrodynamics and sediment transport along the coast could be reduced or possibly eliminated by the adoption of suitable, environmentally-friendly designs.

5.76 If cooling water is returned to the sea at elevated temperatures, this could have adverse effects on both sediment transport and water quality in coastal waters. Nearby coastal waters include the Essex Estuaries SAC, the Blackwater Estuary SSSI/SPA/Ramsar site and the Dengie SSSI/SPA/Ramsar sites. A more detailed appraisal is required by the developer at the project EIA level to assess the implications of this thermal discharge. This process will include an assessment of the impacts of any discharges to the aquatic environment, including impacts on specific designated sites under both the Habitats and Shellfish Directives.

5.77 The new Marine Management Organisation (MMO) set up under the forthcoming Marine and Coastal Access Bill will have a role in advising the IPC on conditions that should be imposed to mitigate any adverse impacts the development may have on the marine environment or other uses of the sea.

5.78 Future possible thermal discharges will need to be considered as part of the project level EIA for the site and are likely to be subject to the requirements of discharge consent from the EA. The EA are likely to require the discharge to meet existing regulatory standards or to avoid further deterioration of estuarine or coastal waters (whichever is the most stringent). EA consenting policy is currently under modification with proposed risk-based consents as part of the Environmental Permitting Procedures. This new framework

accounts for the specific risks from discharges to surface waters and in particular requires assessment of specific receptors, such as shell fisheries. As part of the process of consenting discharges, the EA may require modelling and other studies to assess the impacts of any proposed discharges, including thermal impacts, on water quality and ecology in the estuarial and coastal waters.

5.79 The development of a new nuclear power station on the site may have the short-term effect of increasing water demand during the construction phase, due to an increased population. The potential magnitude and duration is dependent on the timing of new development in relation to the activities (operation or decommissioning) of the existing nuclear facilities. It is anticipated that, as the operation of a new nuclear power station on the site is likely to have a similar or lower demand for water to the existing power station, no adverse long-term impacts are expected on water resources, although this will need to be confirmed as part of the planning for this site. However, it should be noted that the site is located within the Essex Water Resource Zone (WRZ), which is currently in deficit and will remain so unless two new resource developments planned for this zone are successfully implemented. With successful promotion of planned resource developments, the Essex WRZ will move into surplus of supply over demand from 2014 until 2035. If these resource developments are not implemented then the increased water supply required at the site would probably need to be derived from outside the existing ESW Essex WRZ, with water transferred from adjacent resource zones or water companies. This could impact other catchments or groundwater bodies.

5.80 Similar comments apply to wastewater production from the site, although there is likely to be a short-term effect of increasing wastewater production due to an increased population during the construction phase.

5.81 A minor impact could occur as a result of the effect of the development on the quality and quantity of groundwater at the site. The site is located on the Essex Gravel Formation. Groundwater from the Essex Gravel aquifer is not currently used for water supply. The Essex Gravel aquifer could be used locally for private water supplies, and discharges from this groundwater body may support local groundwater-dependent surface water aquatic ecosystems. Localised groundwater pathways in the Essex Gravel aquifer are likely to exist, hence accidental discharges or construction disturbance at Bradwell could cause deterioration in groundwater quality and flow quantity. Impacts on the groundwater can be mitigated through good environmental management processes during construction, operation and development stages.

5.82 <u>Strategic Effects on Water Quality and Resources:</u> The AoS has identified potential, adverse, effects on water quality and coastal processes, including sediment transport. Adverse effects on water resources, including groundwater resources, could occur through increased demand, particularly during construction. Indirect effects on nationally and internationally designated habitats, including from the

thermal impact of cooling water discharges have also been identified. This is of potential wider significance because of indirect effects on national and European designated habitat sites.

Flood Risk

5.83 Development of the site is not likely to increase the existing risk of flooding. However, as a result of climate change and sea level rise, flood risks to the site over the lifetime of the development are likely to increase. Current UKCIP figures on sea level rise indicate that over the next 100 years sea level rise will be in the order of 1.04m in this area.

5.84 To mitigate against this risk, the continued management of the existing defences and/ or improvement may be required. Further mitigation could be provided by local land raising of the site. However, local land raising could increase flood risk to surrounding areas and this would need to be assessed in a site specific assessment.

5.85 The modification/improvement of defences has the potential to affect existing estuarine and coastal hydrodynamics and associated movement of sediment, which may have secondary effects on estuarine and marine ecosystem structure and functioning. This is particularly noteworthy given the existing issues of sedimentation and deposition in the Blackwater estuary. However, the use of appropriate design, management and construction methods, and a full understanding of the hydrodynamics and sediment transport could minimise the potential effects.

5.86 To fully assess the flood risks to the site it is recommended that the developer ensures a detailed site-specific study is undertaken to fully establish the baseline conditions with respect to the protection afforded by existing defences. In addition, combined probability analyses should be undertaken with respect to the likelihood of storm surges and fluvial events, taking into account sea level rise. The developer should also ensure detailed flood hazard mapping is undertaken to identify the area of risk in the event of breach or overtopping of defences. A detailed Flood Risk Assessment should be undertaken in accordance with the requirements set out in PPS25 'Development and Flood Risk'.

5.87 <u>Strategic Effects on Flood Risk:</u> The AoS has identified potential, adverse effects relating to flood risk due to rising sea levels, especially during the later stages of operation and decommissioning. This is considered a wider national issue, because of the potential impact on national energy supply and infrastructure. Possible secondary impacts on coastal processes, hydrodynamics and sediment transport from any necessary new or upgraded coastal defences have also been identified. Mitigation may be possible through appropriate design and construction of defences.

Key Interactions between Sustainable Development Themes

5.88 Interactions and synergistic effects can occur between the different topics or sustainable development themes being appraised. A number of interactions and potential interactions have been identified for the AoS Site Reports. For example, rising sea levels and increased predictions for coastal flooding due to climate change will require new coastal defences. Construction of coastal defences could have adverse effects on water quality and biodiversity through changes to hydrology, sedimentation and loss of habitat.

5.89 Where applicable, key interactions have been considered in the topic-specific paragraphs above.

Interactions and Cumulative Effects with other Key Regional Plans, Programmes and Projects

5.90 The sustainability factors within a given plan or proposal can interact with each other to create cumulative effects (for example, climate change could increase flood risk; impacts on landscape could affect well-being). Interactions and cumulative effects between sustainability factors can also occur within the plan or proposal being appraised and those set out in other key plans and policies. This AoS has identified other relevant plans and programmes with sustainability objectives, which need to be considered. These are reported in Section 3: Policy Context and Appendix 3: Plans and Programmes Review. The key plans that might lead to cumulative effects when combined with the draft Nuclear NPS and the Bradwell nomination were identified as follows:

- Revised Regional Spatial Strategy for the East of England 2008-2021, Government Office for the East of England (2008)
- A Shared Vision: The Regional Economic Strategy for the East of England, East of England Development Agency (2004)
- East of England Regional Waste Management Strategy, East of England Region Waste Technical Advisory Body (2002)
- Essex Biodiversity Action Plan, Essex Biodiversity Project (2006)
- Renewable Energy Strategy for Essex, Essex County Council
- Combined Essex Catchment Abstraction Management Strategy, Environment Agency (2007)
- Draft River Basin Management Plan for the Anglian River Basin District, Environment Agency (2008)
- Draft Water Resources Management Plan, Essex and Suffolk Water (2008)
- Essex Estuaries Coastal Habitat Management Plan, EA (2002)
- Maldon District Council Local Development Framework – Core Strategy Issues and Options, Maldon District Council (2007)

5.91 Other key projects that might have significant interactions with the proposals for a new nuclear power station at Bradwell were identified as follows:

- Decommissioning of the existing nuclear power station at Bradwell

- Wind farm developments within the region:
  - Bradwell wind farm. This proposed development is for 10 onshore wind turbines on the Dengie Peninsula. However, it is subject to a new planning inquiry scheduled for November 2009, following successful challenge to the earlier permission granted on appeal
  - Under construction offshore – Gunfleet Sands, 48 turbines off the Essex coast in the Clacton area
  - Under construction offshore - Greater Gabbard, located off the Sufffolk coast, a major offshore wind farm where up to 140 turbines are planned
  - Consented offshore – London Array, a major development located in the Outer Thames Estuary

5.92 The cumulative effects associated with the potential development of a nuclear power station at Sizewell have been considered as part of this assessment. It has been determined that no cumulative effects would exist between these sites.

5.93 The appraisal of cumulative sustainability effects arising through interactions between a new nuclear power station being developed at Bradwell through the draft Nuclear NPS, and other key plans and projects, is presented in Table 5.2.

Table 5.2: Interactions with Other Key Regional Plans, Programmes and Projects

AoS Sustainable Development Theme	Interactions and Cumulative Effects, both positive and negative
Biodiversity and Ecosystems	• The RSS aims to protect and conserve the natural environment in the East of England. It plans to enhance nationally and internationally designated sites and protect all sites from the impacts of development. The Essex Biodiversity Action Plan has identified 25 species and 11 habitats within the area for which specific action plans have been produced • Opportunities for promoting the restoration and re-establishment of habitats and species populations may arise in conjunction with development proposals and as a result of climate change, for example saltmarsh creation on the Essex coast. The site will have an influence on the likely creation of new habitats along the coast • The site could potentially have an impact on the sites protected by the CHaMP and may influence the type of protection and enhancement they receive

AoS Sustainable Development Theme	Interactions and Cumulative Effects, both positive and negative
Climate Change	• The existing Bradwell power station has an influence over the level of coastal protection required in the area, which would continue and be extended if the site was progressed • The RSS and the Renewable Energy Strategy for Essex encourage the increasing use of decentralised, renewable and low carbon energy. The development supports this statement, as nuclear energy is a low-carbon energy source as defined by Government's Nuclear White Paper. It would not, however, progress the region's target of 17% of energy from renewable sources by 2020 • A 10-turbine wind farm is proposed on land at Bradwell-on-Sea to produce up to 49,900 MWh of electricity a year, which would help meet regional targets for renewable and low carbon energy. Significant cumulative effects are likely if both wind and nuclear power developments are implemented, for example on the landscape, heritage, biodiversity, local communities, transport and employment
Communities: Population, Employment and Viability	• The RSS aims to bring 56,000 jobs to the mid Essex region and 2,400 new homes to Maldon. This increase in residential and employment infrastructure is likely to increase the local population in the district and region, and could increase recreational visits to the coast and tourism • The coastline, wetlands and nature reserves in the north and east of the region are particular environmental assets and tourist destinations • It could create further employment and expansion of an energy hub in the area, which could bring local and wider economic and social benefits, in line with RSS and RES objectives
Communities: Supporting infrastructure	• The Crouch Valley Branch Line to Southminster was used as a commuter route for employees during the operation of the existing power station currently being decommissioned, and the line has remained open due to significant local lobbying. The site could help ensure the line remains open by increasing its use by commuters to a new power station • Decommissioning of existing nuclear facilities at Bradwell may coincide with construction of a new nuclear power station to create adverse effects on supporting infrastructure, in particular transport networks • Need to reduce the environmental impact of waste produced in line with Regional Waste Management Strategy

AoS Sustainable Development Theme	Interactions and Cumulative Effects, both positive and negative
Landscape	• Landscape policies of the RSS, including ENV6: The Historic Environment, highlight the need to protect and enhance the rural and historic landscape character and features • Significant cumulative effects are likely if both on shore wind and nuclear power developments are implemented together in the local area. The scale, massing, and siting of both a nuclear power development and wind farm is likely to be highly visible, in comparison to the existing baseline, and cause some deterioration to the local natural coastal landscape setting • Possible significant impacts on locally valued landscape character and visual impacts are likely to arise from in combination effects from new energy infrastructure, which could include new grid connections. Leading to possible loss of local landscape features (for example, hedgerows, walls etc
Water Quality and Resources	• Surface and groundwater quality should be improved to 'good' ecological status in the long-term by actions proposed in the draft River Basin Management Plan • A new power station at the site would influence strategies used along this stretch of coast to prevent flooding and is likely to influence the strategies being developed in shoreline and coastal habitat management plans • The need to protect the site from flooding may affect sediment movement in the Blackwater Estuary, which will have an impact on the local species and habitats • The development is likely to increase water demand and may require additional water resources to be developed either within the Essex and Suffolk Water local Water Resource Zone or with the transfer of water resources from neighbouring zones • The EA has a duty to protect and enhance internationally designated nature conservation sites through sustainable water resources management, by controlling water abstractions which may affect their integrity

6 Summary Appraisal of Sustainability, Key Findings and Possible Mitigation

6.1 This Section summarises the key findings of the AoS assessment and explores possible mitigation which could be undertaken to reduce impacts. Table 6.1 presents a summary of the significance of potential effects and Table 6.2 provides a more detailed breakdown of the potential effects and possible mitigation.

6.2 The AoS has explored both adverse and beneficial potential effects of building a new nuclear power station at Bradwell. Both beneficial and adverse effects were identified as potentially significant at the local level and it is recommended that these need to be further considered by the developer, regulators and the decision-maker (the IPC), during project level assessments.

6.3 The AoS process has included recommendations to inform the development of the draft Nuclear NPS. This site report for Bradwell has helped to inform the decision-making for the SSA. It has included advice regarding the strategic significant effects arising from the construction of a new nuclear power station at Bradwell, and suggestions where possible for how adverse effects may be mitigated, including proposed mitigation measures which could be considered as part of project level EIA.

6.4 A number of the strategic effects identified for Bradwell will be similar across all the sites, including positive effects for employment and well being. However a number of potential strategic effects have been identified that are of particular note for the site at Bradwell. These are discussed below.

6.5 There are potential negative effects on three national and internationally protected nature conservation sites, including the Essex Estuaries and Blackwater Estuary; effects on water quality and fish/shellfish populations in nearby coastal waters due to the abstraction and release of sea water for cooling.

6.6 Part of the site is at high risk from coastal flooding and there are both hard and soft flood defences already in place, but these may require upgrading over the lifetime of a new power station. This could have potential effects on erosion and visual appearance of the coastline. These effects are significant, but mitigation opportunities are likely to be available following further study.

6.7 A new nuclear power station would be set in the context of the existing power station at Bradwell, but the surrounding area is predominantly undeveloped and there is limited potential for mitigation of the adverse impact on the local landscape. There are no significant adverse effects anticipated on nationally designated landscapes.

6.8 Potential setting effects upon nearby scheduled monuments and listed buildings, and the West Mersea Conservation Area, could also be of regional

or national importance, depending on distance and sight lines. The impact on the setting of Othona Roman fort and St. Peter's Chapel would be of exceptional significance. However, mitigation could be applied by siting the proposed facility close to the existing power station on the western side of the site. Detailed assessment will be required at the project level EIA stage.

6.9 There remains some uncertainty relating to the significance of some effects and the most appropriate mitigation. It is expected that the mitigation measures will be refined iteratively as part of the development of the proposals for the site, and will be assessed further in the project level EIA.

6.10 Table 6.1 provides an overall summary of the significance of the environmental and sustainability effects for the Bradwell site. Each sustainable development theme and each development stage has been considered. The symbols and colours used are explained in the key.

Table 6.1: Summary of the Significance of Potential Strategic Sustainability Effects

Sustainable Development Themes:	Significance of potential strategic effect at each Development stage:		
	Construction	Operation	Decommissioning
Air Quality	-	- ?	- ?
Biodiversity and Ecosystems	-- ?	-- ?	-- ?
Climate Change	-	++	- ?
Communities: Population, Employment and Viability	+ ?	+ ?	0
Communities: Supporting Infrastructure	-	-	-
Human Health and Well-Being	+	+	+
Cultural Heritage	-- ?	-- ?	+ ?
Landscape	-	-	0 ?
Soils, Geology and Land Use	- ?	- ?	- ?
Water Quality and Resources	-	-	- ?
Flood Risk	-	-	-

Key: Significance and Categories of Potential Strategic Effects	
++	Development actively encouraged as it would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
+	No sustainability constraints and development acceptable; effect considered to be of regional/ national/international significance
0	Neutral effect
-	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance
--	Problematical because of known sustainability issues; mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/ international significance
Uncertainty	
?	Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of '?'

6.11 Potential environmental and sustainability effects considered to be of a wider strategic significance were also identified. These are summarised in Table 6.2. This table includes a summary of how the potential adverse effects may be mitigated and includes possible suggestions for mitigation to be considered at the project level. Some of these mitigation options could be addressed by the HSE, EA, HPA and others, when they consider the development consent application stage. Other mitigation options could be proposed by the developer as part of the project design process and through EIA.

6.12 At this strategic level of appraisal, there are some uncertainties on the significance of some impacts and the effectiveness of suggested mitigation measures. Further detailed studies should therefore be carried out by the developer and the regulators at the project level stage.

6.13 Mitigation measures should be considered in all stages of the project with the aim to develop a strategy that avoids impacts, and if they cannot be avoided, to reduce them. Levels of mitigation can range from the highest (avoidance at source), through to minimisation, and lastly to compensation. Options for mitigating through project design or management should firstly consider avoidance, addressing impacts at source before considering impacts at the receptor, and ensuring that a commitment is made to implementing and monitoring the effectiveness of the proposed mitigation.

Table 6.2: Summary of Potential Strategic Significant Effects and Mitigation Possibilities (for Adverse Effects)

Potential Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
Air Quality	
Adverse Effects: • Potential for related effects on national and European-designated wildlife sites due to increase in airborne pollutants and nutrients during construction.	**Mitigation Possibilities:** • Preparation of an environmental management plan for construction, operation and decommissioning should include methods to reduce airborne pollutants.
• Potential accidental release of radioactive emissions could have a significant strategic effect on air quality.	• The nuclear regulators will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.

Potential Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
Biodiversity and Ecosystems	
Adverse Effects: • Noise, visual and light disturbance, particularly during construction, on legally protected species, in particular nationally and internationally important assemblages of breeding and wintering birds associated with the Essex Estuaries SAC, and the Blackwater Estuary and Dengie SPA/Ramsar sites.	**Mitigation Possibilities:** • All mitigation measures should be incorporated into an ecological mitigation and management plan. • Avoid/minimise impacts on important bird assemblages through careful design and site layout. • Incorporate shielding to reduce light pollution. • Locate noisy activities away from sensitive zones, acoustic screening and time activities to avoid sensitive periods for key bird species. • Use machinery with lower noise outputs. • Make workforce aware of sensitive periods for birds. • Protective buffer zones around sensitive habitats.
• Loss, damage or fragmentation of important habitats and subsequent disturbance to protected species due to new buildings and infrastructure, including encroachment of development into the coastal fringe within the Essex Estuaries SAC and Blackwater Estuary and Dengie SPA/Ramsar sites from a marine landing platform, cooling water infrastructure and upgraded coastal defences.	• Require site layout and design to avoid or mitigate habitat losses. • Protective buffer zones around sensitive habitats. • Maintain connectivity between designated sites. • Reinstate to original condition areas affected by construction works.

Potential Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
• Loss, damage or fragmentation of habitats locally and in a wider context due to coastal defence measures/the marine landing facility exacerbating the effects of coastal squeeze.	• Avoid the effects of coastal squeeze. • Require environmentally sensitive designs for all coastal defence structures and marine landing facilities. • Strategic coastal management document such as the CHaMP and Shoreline Management Plan (available in 2010) should be considered to help determine the best form of flood defence. • Soft engineering, managed realignment and foreshore recharge should be considered as possible flood defence techniques. • Maintain connectivity between designated sites.
• Discharge of heated water into aquatic habitats could alter ecosystem in Essex Estuaries SAC and Blackwater Estuary SPA/Ramsar sites.	• Careful design and siting of the discharge system to avoid/minimise any impacts on habitats and species of value.

Potential Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
• Abstraction of water for cooling purposes could lead to incidental mortality of fish and aquatic invertebrates, with secondary effects on the interest features (particularly birds of the Blackwater Estuary and Dengie SPA/Ramsar sites).	• Careful design and siting of the cooling water intake system to avoid/minimise any impacts on habitats and species of value.
• Abstraction of freshwater from groundwater (for example, for offsite potable water resources) could deplete water supplies and in turn impact on water tables of sensitive habitats.	• Require studies to ensure that local groundwater bodies are investigated and suitable design is adopted to avoid or mitigate potential impacts on sensitive habitats/species.
• Routine releases of radioactive discharge into water could impact on aquatic ecosystems either directly or indirectly, for example through bioaccumulation of toxins within food chains, within the Essex Estuaries SAC and Blackwater Estuary SPA/Ramsar sites.	• Modern techniques to minimise radioactive discharges.
• Risks to designated sites of accidental pollution and impacts from construction of water cooling infrastructure, which could lead to re-suspension of sediments.	• Layout and siting of potential sources of pollution to avoid and minimise potential impacts on sensitive areas.
• Impacts to be considered in a wider context due to important bird species moving between designated sites within the Mid-Essex SPA/Ramsar complex and the dynamic nature of estuarine systems.	• Maintain connectivity between designated sites.

Potential Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
• Reduction in air quality, particularly during construction, due to increased dust and vehicle emissions, which could impact on biodiversity associated with designated sites.	• Dust impacts should be minimised for example by placing dust generating activities away from sensitive locations and in zones which give maximum protection from wind.
Climate Change	
Adverse Effects: • Potential short term increases in greenhouse gas emissions during construction and decommissioning	**Mitigation Possibilities:** • Monitor greenhouse gas emissions
• A lack of sustainable transport options may result in emissions from the transport of goods and labour throughout construction, operation and decommissioning phases	• Green travel plans • Further investment in public transport
Beneficial Effects • A nuclear power station on the site would result in lower greenhouse gas emissions during the operational stage compared to fossil fuel sources, with positive long-term effects on climate change	
Communities: Population, Employment and Viability	
Adverse Effects: • Pressure on basic services from likely large scale in-migration of construction workers	**Mitigation Possibilities:** • Measures to manage potential negative effects on local communities; enhance employment capacity through training; provision of services for staff and local community
• Project may lead to a shortage of local construction workers to meet the needs of other industries and major projects in the region	• Measures to address likely difficulties in sourcing labour and the effects of this on the local/regional construction industry

<table>
<tr><th>Potential Significant Effects (adverse and beneficial effects)</th><th>Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC</th></tr>
<tr><td colspan="2">Beneficial Effects
Short to medium-term positive effects due to creation of new jobs for local and regional populations
New power station may offset job losses from decommission of the existing power station at the site. However, time differences between decommissioning may require workers to seek employment elsewhere
Provision of education, training, upskilling for employees and contractors in the region
Positive multiplier effects as income from new population of workers will help support local economy
Potential for property values to increase within vicinity of site, based on previous studies</td></tr>
<tr><td colspan="2">Communities: Supporting Infrastructure</td></tr>
<tr><td>Adverse effects:
Potential for negative effects on regional road infrastructure.</td><td>Mitigation Possibilities:
Provision of transportation management plans and green travel plans.
Consideration of alternatives to road for the transport of large loads</td></tr>
<tr><td>Potential for significant impacts regarding radioactive and conventional waste</td><td>Conventional waste: good site practices, implementation of waste hierarchy (reduce, reuse recycle) and waste management
Radioactive waste: appropriate storage and management</td></tr>
<tr><td colspan="2">Human Health and Well-Being</td></tr>
<tr><td>Adverse Effects:
The potential requirement for appropriate additional health service capacity for the influx of both construction and operational workers</td><td>Mitigation Possibilities:
Developer to carry out a review of local health provision to ensure it is adequate for the expected influx of power station workers</td></tr>
<tr><td>The construction and operation of the proposed nuclear power station may lead to unacceptable community disturbance</td><td>Developer to ensure a Construction Environmental Management Plan and an all-phase Travel Plan are produced, observed and monitored</td></tr>
<tr><td>Possibility of local and regional health risks from accidental discharges</td><td>Ensure continuation of current programme of monitoring power station discharges and their effects on health</td></tr>
<tr><td colspan="2">Beneficial Effects
Likely positive effects on health via increase in employment, community wealth, additional housing and health care facilities and other associated neighbourhood infrastructure</td></tr>
</table>

Potential Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
Cultural Heritage	
Adverse Effects: • If a buried archaeological resource, historic landscape and any structures/features associated with the wartime airfield are present, the main effects would be at a local to regional scale, but within the footprint of the development. Effects would be permanent and irreversible	**Mitigation Possibilities:** • Detailed archaeological investigations (trial trenching, etc.) prior to construction, with an excavation and/or watching brief prior to and during construction • Detailed survey of the wartime airfield prior to construction
• Immediately surrounding the site, there may be potential effects on the settings of historic assets, including a Grade 1 listed building and scheduled ancient monuments. The significance will depend on distance, topography and the ability to mitigate	• Potential adverse setting effects on heritage assets may be minimised through siting the development adjacent to the existing power station, and through appropriate landscaping/planting
Landscape	
Adverse Effects: • Potential for adverse landscape character and visual impacts, during construction and operation, on the surrounding local area, including direct and indirect effects on designated Special Landscape Areas and the coastal zone	**Mitigation Possibilities:** • Locating the development closest to the existing power station may reduce the potential for significant broadening of visual impacts. Otherwise mitigation opportunities during operation are likely to be limited
• Potential direct adverse effects on local landscape character and some landscape features with historic integrity	• There are some opportunities for landscape protection, compensation and enhancement associated with landscape features: historic ditches, dykes, un-improved grassland, native historic hedgerows, native trees, new inter-tidal habitats, historic sea defences and drained marsh

Potential Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
• Adverse visual impacts likely, which could extend up to 15km throughout estuary, including for local coastal towns, during the construction and operational phases	• Mitigation opportunities likely to be limited
Beneficial Effects • Decommissioning may allow some landscape restoration of previously developed areas in the long term, however, long term land uses for the restored areas are difficult to predict at this stage	
Soils, Geology and Land Use	
Adverse Effects: • The construction of the power station and associated infrastructure will lead to the direct loss of soil structure. This may include impacts on soils that maintain terrestrial habitats, including designated nature conservation sites, considered further in the Biodiversity and Ecosystems sections of this report	**Mitigation Possibilities:** • Such effects could be mitigated through limitation of the footprint of the development reducing the area of soils affected, and recognised best practice soil and water management measures during construction.
Water Quality and Resources	
Adverse Effects: • New coastal and fluvial defence works, and marine landing station, may potentially impact on coastal processes, hydrodynamics and sediment transport, and any indirect effects on internationally designated habitats • Works to provide (and discharge) cooling water on coastal processes, hydrodynamics and sediment transport, and any indirect effects on internationally designated habitats	**Mitigation Possibilities:** • Further investigations into possible impacts may be required during design of coastal and defence works. • Suitable design, location and construction methods for flood defence works and marine landing station (NB any indirect effects on internationally designated habitats would be addressed by the mitigation methods described in the Biodiversity and Ecosystems section of this table). • Sediment transport modelling

Potential Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
• Thermal impact of cooling water discharges. This effect is of local and regional significance	• Thermal discharges may need to be consented by the EA. The discharge quality will need to comply with existing standards or meet the no deterioration standard
• Increased demand for water during the construction phase • Increased wastewater production	• Further investigations required • Studies to ensure that capacity of water and wastewater infrastructure in the WRZ is sufficient
• Potential impacts on local groundwater bodies. Impacts from construction disturbances and accidental discharges. Potential impacts on other linked groundwater bodies resulting from water abstraction	• Studies to ensure that local groundwater bodies are investigated and suitable design is adopted to mitigate potential impacts • Potential for ongoing monitoring of impacts on groundwater bodies
Flood Risk	
Adverse effects: • Sea level rise could be a threat to nearby defences during the latter stages of the operational and decommissioning phases	**Mitigation Possibilities:** • Further flood/coastal defence measures may be required

Abbreviations

AA	Appropriate Assessment
AOD	Above Ordnance Datum
ALARP	As Low As Reasonably Practicable
AoS	Appraisal of Sustainability
AoS Report	Report setting out environmental and sustainability effects of the Nuclear NPS. It will incorporate the requirements of the SEA Directive
AQMA	Air Quality Management Area
BGS	British Geological Survey
BS	British Standards
CAMS	Catchment Abstraction Management Plan
CO_2	Carbon Dioxide
CEZ	Combined Essex Zone
COMARE	Committee on Medical Aspects of Radiation in the Environment
CPRE	Campaign to Protect Rural England
DECC	Department of Energy and Climate Change
Defra	Department for the Environment, Food and Rural Affairs
EA	Environment Agency
EIA	Environmental Impact Assessment
EMF	Electromagnetic fields
ESW	Essex and Suffolk Water
EU	European Union
GEP	Good Ecological Potential
GES	Good Ecological Status
GP	General Practitioner
GW	Giga Watt
GWMU	Groundwater Management Unit
HRA	Habitats Regulations Assessment
HSE	Health and Safety Executive
ISO	International Organization for Standardization
IPC	Infrastructure Planning Commission.
MBT	Mechanical Biological Treatment
MRF	Materials Recycling Facility
mSv	Millisievert
MWe	Mega Watt (electrical)
MWt	Mega Watt (thermal)
NDA	Nuclear Decommissioning Authority
NCA	National Character Area
NII	Nuclear Installations Inspectorate
Nuclear NPS	The proposed National Policy Statement for new nuclear power stations
NPS	National Policy Statement
OSPAR	Oslo and Paris Conventions
PWR	Pressurised Water Reactor
RAMTED	Radioactive Materials Transport Events Database
RBD	River Basin District

RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SEA	Strategic Environmental Assessment
SOA	Super Output Area
SPA	Special Protection Area
SRF	Solid Recovered Fuel
SSA	Strategic Siting Assessment
SSSI	Site of Special Scientific Interest
UKCIP	UK Climate Impacts Programme
WFD	Water Framework Directive
WRMP	Water Resources Management Plan
WRMU	Water Resources Management Unit
WRZ	Water Resources Zone

Appendices Available Separately

1 Sustainable Development Themes and AoS/SEA Objectives
2 Appraisal Matrices
3 Plans and Programmes Review (Regional)
4 Baseline Information (Regional and Local)

Office for Nuclear Development
Department of Energy & Climate Change
Area 3D
3 Whitehall Place
London SW1A 2HD
www.decc.gov.uk

URN: 09D/624