

Habitats Regulations Assessment Site Report for Bradwell

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

Habitats Regulations Assessment of the revised draft Nuclear National Policy Statement

Habitats Regulations Assessment (HRA) screening and Appropriate Assessment (AA) of the revised draft Nuclear NPS including potentially suitable sites, has been undertaken in parallel with the Appraisal of Sustainability (AoS). These strategic assessments are part of an ongoing assessment process that will continue with project level assessments. Applications for development consent will need to take account of the issues identified and recommendations made in the strategic, plan level HRA/AA; and include more detailed project level HRA as necessary.

The Habitats Regulations Assessment is provided in the following documents:

HRA Non-Technical Summary

Main HRA of the revised draft Nuclear NPS

- Introduction
- Methods
- Findings
- Summary of Sites
- Technical Appendices

Annexes to the Main HRA Report: Reports on Sites

- Site HRA Reports
- Technical Appendices

All documents are available on the website of the Department of Energy and Climate Change at www.energynpsconsultation.decc.gov.uk

This document is the Habitats Regulations Assessment Site Report for Bradwell.

This document has been produced by the Department of Energy and Climate Change based on technical assessment undertaken by MWH UK Ltd with Enfusion Ltd and Nicholas Pearson Associates Ltd.

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1 Introduction

This HRA Report

- 1.1 This report sets out the Habitats Regulations Assessment (HRA) Screening and Appropriate Assessment components of the HRA of the proposals for Bradwell. This site was nominated into the Strategic Sites Assessment (SSA) process to be considered as a potentially suitable site for the deployment of a new nuclear power station(s) by 2025. This site report is one of the Site HRA Reports comprising Part III of the HRA Report that accompanies the revised draft Nuclear National Policy Statement (NPS). Part II of the HRA report for the draft Nuclear NPS sets out details of the HRA process, methods, findings and summary of the individual assessments at the nominated sites. Part I of the HRA report is a Non-Technical Summary.
- 1.2 This HRA has been undertaken at a strategic level and is part of an ongoing assessment process that started in July 2008 and will continue with project level assessments. Sites that are assessed to be potentially suitable for the deployment of new nuclear power stations by the end of 2025, will be listed in the Nuclear NPS; developers will be able to apply to the Infrastructure Planning Commission¹ for development consent to develop new nuclear power stations at those sites.
- 1.3 Each development consent will need to be accompanied by a project level HRA report, alongside an Environmental Statement reporting the findings of a detailed Environmental Impact Assessment (EIA). The proposals will also be subject to various other regulatory and licensing requirements.

The Nuclear National Policy Statement

- 1.4 The revised draft Nuclear NPS sets out a list of sites that, following the Strategic Siting Assessment, have been found to be potentially suitable for the siting of new nuclear power stations by 2025, and the framework by which development consent applications on these sites should be considered by the Infrastructure Planning Commission.

¹ The Government announced in June 2010 its intention to amend the Planning Act 2008 and abolish the Infrastructure Planning Commission (IPC). In its place, the Government envisages that a Major Infrastructure Planning Unit (MIPU) will be established within the Planning Inspectorate. Once established, the MIPU would hear examinations for development consent and would then make a recommendation to the Secretary of State. It would not itself determine applications and decisions would be taken by the relevant Secretary of State. These proposed reforms require primary legislation. Until such time as the Planning Act 2008 is amended, the IPC will continue as set out in that Act. As a result, the NPSs will provide the framework for decisions by the IPC on applications for development consent for major infrastructure projects, and under the new arrangements will provide the framework for recommendations by the MIPU to the Secretary of State.

HRA Process

- 1.5 The Habitats Directive² protects habitats and species of European nature conservation importance. Together with the Birds Directive³, the Habitats Directive established a network of internationally important sites designated for their ecological status. Special Protection Areas (SPAs) are designated under the Birds Directive in order to protect rare, vulnerable and migratory birds. Special Areas of Conservation (SACs), and Sites of Community Importance (SCIs) are designated and defined under the Habitats Directive and promote the protection of flora, fauna and habitats. Internationally important wetlands are designated under the Ramsar Convention 1971. UK Government policy states that the Ramsar sites and potential SPAs⁴ are afforded the same protection as SPAs and SACs for the purpose of considering development proposals that may affect them⁵. These sites combine to create a Europe-wide 'Natura 2000' network of European Sites, which are hereafter referred to as 'European Sites'⁶ in this and other HRA reports⁷.
- 1.6 HRA tests whether the impacts identified as arising from a proposal, plan or project are likely to have a significant effect on European Sites of nature conservation importance. Article 6(3) of the Habitats Directive requires an 'appropriate assessment' to be undertaken on proposed plans or projects which are not necessary for the management of the European Site, but which are likely to have a significant effect on one or more European Sites either individually, or in combination with other plans, programmes or projects. In England and Wales this requirement is transposed into UK law by the Conservation of Habitats and Species Regulations 2010⁸ (the 'Habitats Regulations'). The process of fulfilling the requirements of the Directive and the Regulations is now in practice referred to as HRA, and Appropriate Assessment (AA) if required, forms a stage within the overall HRA process.
- 1.7 The full details of the HRA method and process, including the key principles and any assumptions made in this plan level HRA of the Nuclear NPS and nominated sites; are outlined in Part II of the HRA Report. This report covers the HRA Screening and Appropriate Assessment (AA) stages of the HRA for the nominated site at Bradwell, as outlined in Table 1. It takes into account the information contained within the site nomination submitted to Government by the nominator (the Nuclear Decommissioning Authority) on 31 March 2009⁹. The HRA

² Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna

³ Council Directive 79/409/EEC on the protection of wild birds:

<http://eur-lex.europa.eu/LexUriServ/site/en/consleg/1979/L/01979L0409-20070101-en.pdf>

⁴ 'Potential' sites are sites which have been consulted upon but are awaiting formal designation.

⁵ ODPM, 2005, Planning Policy Statement 9: Biological and Geological Conservation; and ODPM Circular 06/2005: Biodiversity and Geological Conservation – Statutory Obligations and their impact within the Planning System

⁶ Ramsar sites are included within the definition of European Sites for the purposes of this report.

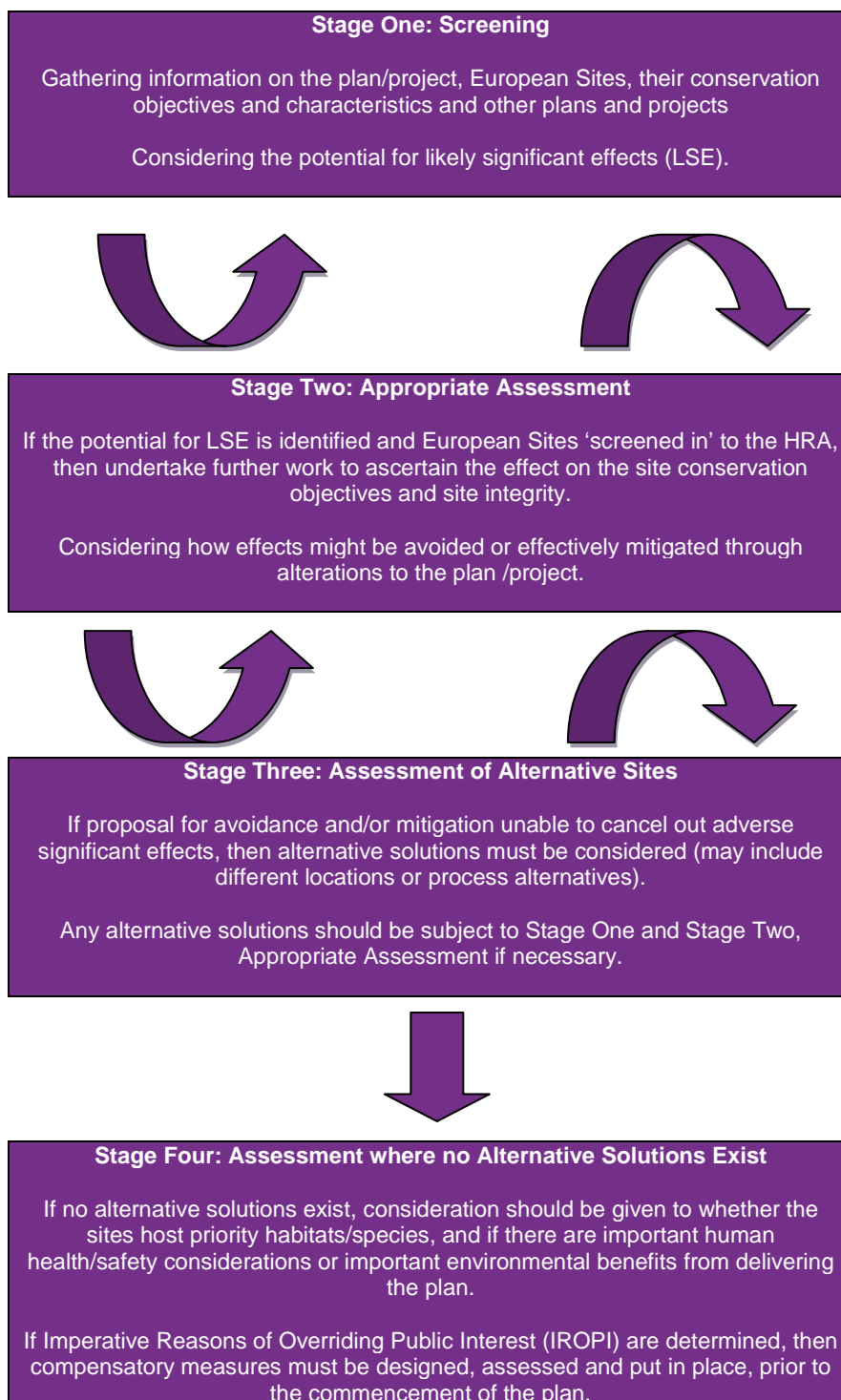
⁷ The term European Site is used throughout all the Site HRA Reports and in the Main HRA Report, and incorporates SACs, SPAs, CSIs and Ramsar sites.

⁸ Regulation 106 applies the requirements and controls in relation to plans under the regulations to National Policy Statements designated under the Planning Act 2008

⁹ <http://www.nuclearpowersiting.decc.gov.uk/nominations/>

process is typically iterative and assessments have been revised on the basis of commentary from the Statutory Consultees.

Table 1: Habitats Regulations Assessment: Summary Overview of Key Stages ¹⁰



¹⁰ Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. European Commission DG Environment (2001) http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm

2 HRA Screening of Bradwell

- 2.1 The nominated site at Bradwell is situated on the Essex coast on the south side of the Blackwater Estuary, approximately 15 km east of the town of Maldon. The nearest built up areas are Bradwell-on-Sea, Tillingham, Southminster and Burnham-on-Crouch. The location of the site is shown in Figure 1.

Screening

- 2.2 The screening process forms the first stage of any HRA and is focused on the 'likely significant effect' (LSE) test. The aim of the LSE test is to determine whether the plan either alone, or in-combination with other plans and projects is likely to result in a significant effect at European Site[s]. This is essentially a risk assessment process that seeks to understand whether there are mechanisms for any identified impacts arising from the plan to adversely affect the European Sites (i.e. a cause-effect pathway)¹¹. The key questions asked are:
- would the effect undermine the conservation objectives for the site?
 - can significant effects be excluded on the basis of objective information?
- 2.3 The tasks undertaken to complete the screening process for Bradwell are described below.

European Site Identification and Characterisation

- 2.4 European Sites within a 20km radius of the nominated site were scoped into the HRA screening process as set out in Table 2 and Figure 2. This area of search reflects guidance recommendations¹², but also takes into account that distance is in itself not a definitive guide to the likelihood or severity of impacts known to arise from developments. For example inaccessibility, or remoteness is typically more relevant, and factors such as the prevailing wind directions, river and groundwater flow direction will all have a bearing on the relative distance at which an impact can occur. It should be noted that an area of land can be covered by more than one European designation.

11 Appropriate Assessment of Plans (Therivel, May 2008)

12 Communities and Local Government (2006) Planning for the Protection of European Sites: Appropriate Assessment – Guidance for Regional Spatial Strategies and Local Development Documents.

Table 2: European Sites within 20km of the nominated Site

	Designation	Distance from nominated site¹³
Essex Estuaries	SAC	Adjacent / within
Mid-Essex Coast Complex	SPA	Adjacent / within
Mid-Essex Coast Complex	Ramsar	Adjacent / within
Dengie (Mid-Essex Coast Phase 1)	SPA	Adjacent / within
Dengie (Mid-Essex Coast Phase 1)	Ramsar	Adjacent / within
Colne Estuary (Mid-Essex Coast Phase 2)	SPA	3.3 km
Colne Estuary (Mid-Essex Coast Phase 2)	Ramsar	3.3 km
Crouch and Roach Estuaries(Mid – Essex Coast Phase 3)	SPA	11.9 km
Crouch and Roach Estuaries (Mid-Essex Coast Phase 4)	Ramsar	11.9 km
Blackwater Estuary (Mid-Essex Coast Phase 4)	SPA	Adjacent / within
Blackwater Estuary (Mid-Essex Coast Phase 5)	Ramsar	Adjacent / within
Foulness (Mid-Essex Coast Phase 5)	SPA	11.5 km
Foulness (Mid-Essex Coast Phase 5)	Ramsar	11.5 km
Abberton Reservoir	SPA	8.0 km
Abberton Reservoir	Ramsar	8.0 km
Outer Thames Estuary	SPA	Within 1km

2.5 The Outer Thames Estuary SPA¹⁴ is also included within this HRA process, using the boundary of the potential SPA set out in the November 2009 consultation. As such, a precautionary approach has been taken for this site during its assessment at both the HRA Screening Assessment and Appropriate Assessment stages.

2.6 **Appendix 1** details the characteristics of the 16 European Sites scoped into the HRA Screening Assessment. The characterisations include an overview of the sites’:

¹³ Distance measured from nearest site boundary.

¹⁴ In November 2009 Natural England, Countryside Council for Wales and the Joint Nature Conservation Committee launched a consultation on 10 new possible marine SACs and two new potential SPAs in English, Welsh and offshore waters around the UK, including the Outer Thames Estuary pSPA (see <http://www.naturalengland.org.uk/ourwork/marine/sacconsultation/default.aspx>). The consultation closed in February 2010. The Outer Thames Estuary SPA was officially classified in August 2010. There were minor changes to the site boundary, but these were not deemed to effect the overall assessment.

- ecological features;
- their qualifying features/ reasons for designation;
- conservation objectives and the condition status of their constituent Sites of Special Scientific Interest (SSSIs) where available;
- environmental conditions necessary to support site integrity; and site vulnerabilities, including any key pressures or trends known to be affecting the sites.

Nominated site Review and Identification of Likely Impacts

- 2.7 The nominated site is to the east of the existing Bradwell nuclear power station (currently being decommissioned), and identifies a large area of approximately 298 ha. This is considered likely to include areas of land for construction and decommissioning as well as the main operational footprint. The nomination documents¹⁵ states that the main operational site is likely to be approximately 30 hectares in size (or 50 ha if indirect cooling infrastructure is also required). The nomination documents have also indicated a likely site size of 47 ha for operation¹⁶. Additional land will also be required for cooling water infrastructure, and possibly also coastal defences and a (construction phase) Marine Off-Loading Facility, beyond the nominated site boundary. Offsite work relating to highway and rail infrastructure may also be a requirement. The nominator was not required to provide details of the proposed development at this stage.
- 2.8 From the nomination documents¹⁷ it is assumed that the nomination is for a nuclear power station development, incorporating:
- at least one nuclear reactor;
 - construction phase areas and facilities, including a Marine Off-Loading Facility;
 - infrastructure and facilities related to the operation of a nuclear power station, including transmission infrastructure;
 - flood defence improvements and coastal defence protection measures;
 - cooling water infrastructure, including intake and outfall structures ;
 - interim radioactive waste storage materials; and
 - highway and rail improvements may also be required.
- 2.9 The full range of potential impacts on environmental conditions and biodiversity arising from the development of new nuclear power stations are outline and discussed in Part II of the HRA Report. Impacts of particular relevance to this site include: direct habitat loss (including from coastal squeeze) and fragmentation and disturbance, and effects

¹⁵ Nomination documents submitted by the developer (the Nuclear Decommissioning Authority), at <http://www.energy-nps-consultation.decc.gov.uk>

¹⁶ Proposed Nuclear Development at Bradwell. Environmental Scoping Report. British Energy (2008)

¹⁷ As proposed through the nominations process

on the marine water environment. These issues are discussed in detail in the HRA Screening Assessment below.

Identification and Consideration of Other Plans, Programmes and Projects

- 2.10 It is a requirement of Article 6(3) of the Habitats Directive that HRA examines the potential for plans and projects to have a significant effect either individually or 'in combination' with other plans, programmes and projects (PPPs). The aim is that plans and projects are evaluated within the context of the prevailing environmental conditions and that account is taken of their effects.
- 2.11 Plan level HRA practice has shown that the in-combination assessment is most relevant where plans might otherwise be screened out because their individual contribution is inconsequential. The requirement is that the HRA assessment process should take account of reasonably foreseeable impacts (as opposed to every conceivable effect)¹⁸.
- 2.12 For the purposes of this HRA assessment consideration was given to:
- Local Development Plans delivering planned spatial growth; and
 - Major Development Schemes (including transport plans/ airport expansion) where relevant.
- 2.13 Where relevant, reference was also made to:
- Coastal Habitat Management Plans;
 - Catchment Abstraction Management Strategies;
 - Flood Catchment Management Plans;
 - Minerals and Waste Development Frameworks;
 - Shoreline Management Plans;
 - River Basin Management Plans; and
 - Minerals and Waste Development Frameworks.
- 2.14 A summary of the key plans referred in the in-combination assessment process are provided in **Appendix 2**, and these are further discussed where relevant in section 3.

Screening Assessment

- 2.15 The following sections outline the issues arising from the HRA Screening Assessment (LSE test) presented in **Appendix 3**, for Bradwell. The HRA Screening Assessment indicated that development

¹⁸ Tyldesley, D. (2009). The Habitats Regulations Assessment of Local Development Documents. Revised Draft Guidance for Natural England. Natural England, Sheffield.

at Bradwell has the potential to adversely affect European Sites as a result of:

- **Water Resources and Quality Impacts;**
- **Habitat (and Species) Loss and Fragmentation;**
- **Coastal Squeeze;**
- **Disturbance (Noise, Light and Visual); and**
- **Air quality.**

2.16 Each of these potential impacts is considered in turn below, with reference to the conservation objectives for each site where relevant (provided in Appendix 1)

Water Resources and Quality Impacts

European Sites for which significant effects are likely or uncertain (see below):

- All sites

2.17 Conservation objectives for the European Sites primarily focus on maintaining key habitats such as saltmarsh, mudflats and sandflats in a favourable condition. The quality of fresh and marine water that feeds and supports European Sites is a key determinant in ensuring the integrity of habitats and dependant species. Poor water quality from toxic compounds [that may also bind to sediments] can lead to death of aquatic life and increase the vulnerability of species to disease. Nutrient enrichment in water (eutrophication) can affect the availability of oxygen, changing habitat composition with direct impacts on dependant species.

2.18 The HRA Screening Assessment reviewed the potential for impacts on water resources and quality arising from the construction, operation and decommissioning phases of a new nuclear power station at the nominated site. All of these impacts could lead to a decline in favourable condition of key habitats. Issues include:

- increased/ altered drainage from earthworks and excavations and potential sedimentation changes;
- alteration of flow through abstraction and the return of additional water volumes to the aquatic system;
- changes to water temperature creating 'thermal plumes' as a result of controlled discharges;
- the potential for toxic contamination (for example from anti-fouling agents associated with cooling water systems) from accidental leakage may interact or combine with routine non-radioactive or radioactive discharges that will be subject to discharge consents regulated by the Environment Agency.

- 2.19 Of the 16 European Sites screened, all sites are identified as possessing specific vulnerabilities relating to the water resource.

Essex Estuaries SAC

Mid-Essex Coast SPA/Ramsar complex (particularly the Blackwater Estuary SPA/Ramsar and Dengie SPA/Ramsar sites)

- 2.20 The Essex Estuaries SAC is particularly vulnerable to potential effects on water quality. Construction (and decommissioning) activities such as excavations, earthworks storage and infrastructure installation could lead to events such as pollution incidents or alterations to sediment regimes in turn affecting the favourable condition of primary qualifying habitats of the SAC (predominantly saltmarsh and intertidal mud and sandflat communities). Such habitats can decline as a consequence of increased turbidity, smothering from sediments and through contamination by synthetic and non-synthetic compounds.
- 2.21 Works within the intertidal/marine zone of the SAC such as dredging or tunnelling for cooling water infrastructure are of particular relevance. Operational impacts such as discharge of heated water into the SAC could also alter SAC habitats locally.
- 2.22 The interest features of the Mid-Essex Coast SPA/Ramsar complex (internationally important populations and assemblages of Annex 1 birds, migratory birds and waterfowl as well as nationally important plant and invertebrates¹⁹) are dependant on the mudflat, sandflat and saltmarsh habitats. Contamination is a particular issue for these species either through direct contact or accumulation of toxins through the food chain. In addition eutrophication or smothering could have direct impacts on important plants and invertebrates and could cause a reduction in food sources and prey items which birds of the SPA/Ramsar require, as could abstraction of water where fish and invertebrate food sources may be sucked into the cooling water system.
- 2.23 Bradwell lies directly adjacent to the Essex Estuaries SAC. Within the Mid-Essex Coast SPA/Ramsar complex the sites of most relevance are the Blackwater Estuary SPA/Ramsar²⁰ and the Dengie SPA/Ramsar. Both of these fall immediately adjacent to the nominated site and could be directly impacted. There could also be indirect impacts on the Mid-Essex Coast SPA/Ramsar complex as a whole due to contaminants dispersing over long distances and movement of bird species between designations.

2.24 The Screening Assessment indicates that the potential for significant effects on these European Sites through water

¹⁹ Important bird assemblages are included within both the SPA and Ramsar designations. Important plants and invertebrates are included within the Ramsar designation only.

²⁰ Despite being separate designations, for the purposes of this assessment the SPA and Ramsar sites have been grouped together as they are designated for very similar reasons and cover the same geographical area.

resource and quality pathways should be considered further through Appropriate Assessment

Abberton Reservoir SPA/Ramsar

- 2.25 Similarly there may be indirect impacts on the Abberton Reservoir SPA/Ramsar site (which is closely linked to the Mid-Essex Coast SPA/Ramsar complex) if there are impacts on transitory/migratory birds that are common to both areas. **This issue should be considered further through Appropriate Assessment to determine the nature and extent of the potential significant effects identified.**

Outer Thames Estuary SPA

- 2.26 Part of the Outer Thames Estuary SPA falls within 1km of the nominated site at Bradwell. The SPA contains internationally important numbers of wintering Red-Throated Diver *Gavia stellata*. Changes to water quality could potentially affect the habitats of the prey (for example, fish and invertebrates) that Red-throated Divers feed upon through contamination of sediment, increases in nutrients and changes in turbidity, water temperature and salinity. Toxins could also accumulate through the food chain, which could increase mortality or affect breeding success of this species.
- 2.27 **The Screening Assessment indicates that the potential for significant effects on the Outer Thames SPA through water resource and quality pathways should be considered further through Appropriate Assessment.**

Habitat (and Species) Loss and Fragmentation

European Sites for which significant effects are likely or uncertain (see below):

- Essex Estuaries SAC
- Dengie (Mid-Essex Coast Phase 1) SPA / Ramsar
- Blackwater Estuary (Mid-Essex Coast Phase 4) SPA / Ramsar
- Mid-Essex Coast Complex SPA / Ramsar
- Colne Estuary SPA / Ramsar
- Crouch and Roach Estuaries SPA / Ramsar
- Foulness SPA / Ramsar
- Abberton Reservoir SPA / Ramsar
- Outer Thames Estuary SPA

- 2.28 Habitat loss and fragmentation in relation to European Site integrity can occur naturally (for example tree fall or changing flow patterns in

aquatic systems) or as a result of human intervention. Direct anthropogenic impacts (for example through industrial developments, road building, flood defences) can lead to adverse impacts such as loss of habitats which cannot easily be re-created, removal of habitat connectivity, barriers to species migration and isolation of species which are immobile or unable to disperse easily.

- 2.29 The Screening Assessment noted the potential for direct impacts through habitat loss and fragmentation during the construction phases of development at Bradwell. In particular, direct loss of habitat will occur as a result of the development encroaching onto the margins of adjacent European Sites, and onto the designated foreshore through the construction of upgraded coastal protection, cooling water infrastructure and a marine landing facility. Loss of habitats within the European Sites would go against conservation objectives which seek to maintain key habitats such as saltmarsh, mudflats, sandflats and sandbanks in favourable condition.

Essex Estuaries SAC

- 2.30 These direct impacts are specifically relevant to the Essex Estuaries SAC. This designation is currently exposed to physical habitat loss including direct loss of habitat, and reduction in extent due to changes in hydrology and sediment regimes arising from construction on the coastal fringe. **The impacts of habitat loss and fragmentation on the Essex Estuaries SAC conservation objectives and site integrity should be considered further through Appropriate Assessment.**

Mid-Essex Coast SPA/Ramsar complex (particularly the Blackwater Estuary SPA/Ramsar and Dengie SPA/Ramsar sites).

Abberton Reservoir SPA/Ramsar

Outer Thames Estuary SPA

- 2.31 Loss of habitat is also an impact for the Blackwater Estuary SPA/Ramsar and Dengie SPA/Ramsar interest features (an array of breeding, migratory and overwintering species), and is likely to lead to displacement and disturbance with commensurate impacts on breeding and feeding on these bird species. Little Tern is a qualifying species of interest at Blackwater Estuary and is particularly vulnerable to habitat loss and disturbance. The Ramsar designations also cover saltmarsh habitat and rare plants and invertebrates which would also be directly affected by any habitat loss.
- 2.32 Similarly if development of the nominated site results in loss of buffer habitats or habitats outside of the European Sites that are also of importance to qualifying bird species, impacts could arise. For example Dark-bellied Brent Goose and Golden Plover are key species which

both use habitats outside of the European Sites such as damp grassland and coastal grazing marsh for feeding.

- 2.33 There may also be indirect impacts on the Mid-Essex Coast SPA/Ramsar complex as a whole as well as Abberton Reservoir SPA/Ramsar site due to the movement of bird species between these designated sites.
- 2.34 Loss of habitat along the coastal fringe could also lead to removal of supporting habitat (and prey species), which the Red-throated Divers of the Outer Thames Estuary SPA rely on for feeding. This species occurs mainly offshore and is dependent on sandbank habitats. There is uncertainty at this stage whether any sandbanks will be affected by habitat loss/fragmentation and therefore, in line with the precautionary principle, further information should be gathered as part of the Appropriate Assessment scoping stage.
- 2.35 **The impacts of habitat loss and fragmentation on the aforementioned European Sites conservation objectives and site integrity should be considered further through Appropriate Assessment**

Coastal Squeeze

European Sites for which significant effects are likely or uncertain (see below):

- Essex Estuaries SAC
 - Dengie (Mid-Essex Coast Phase 1) SPA / Ramsar
 - Blackwater Estuary (Mid-Essex Coast Phase 4) SPA / Ramsar
 - Mid-Essex Coast Complex SPA / Ramsar
 - Colne Estuary SPA / Ramsar
 - Crouch and Roach Estuaries SPA / Ramsar
 - Foulness SPA / Ramsar
 - Abberton Reservoir SPA / Ramsar
- 2.36 Coastal squeeze impacts are closely related to habitat loss and fragmentation, and relate specifically to situations where the coastal margin is squeezed by the fixed landward boundary. Coastal squeeze typically arises through the development of flood defences/ reinforcement of coastal margins. It can prevent natural movement of coastal species and habitats 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.
- 2.37 The HRA Screening Assessment identified that development at Bradwell, particularly proposals for upgraded coastal protection and a

marine landing facility would encroach directly on the margins of the Essex Estuaries SAC and the Blackwater Estuary SPA/Ramsar and the Dengie Estuary SPA/Ramsar sites. All these designations are currently under threat from the effects of coastal squeeze which has been identified as a significant problem in the area. Not only could this lead to direct effects on the designations themselves, it could also add to the problem in the wider context of the Mid-Essex SPA/Ramsar complex as a whole.

- 2.38 As noted in relation to the issues of habitat loss and fragmentation vulnerabilities exist where impacts which will remove or change the sensitive, designated intertidal habitats that are constituent parts of the Essex Estuaries SAC integrity. This would go against key conservation objectives for maintaining habitats within the European Sites in favourable condition and would have knock on effects on the important bird assemblages and important plants and invertebrates of the SPA/Ramsar designations which depend on these habitats.
- 2.39 The impacts of coastal squeeze should be considered alongside habitat loss and fragmentation through further Appropriate Assessment.**

Disturbance (Noise, Light and Visual)

European Sites for which no significant effects are likely (see Appendix 3):

- Essex Estuaries SAC

European Sites for which significant effects are likely or uncertain (see below):

- Dengie (Mid-Essex Coast Phase 1) SPA / Ramsar
- Blackwater Estuary (Mid-Essex Coast Phase 4) SPA / Ramsar
- Mid-Essex Coast Complex SPA / Ramsar
- Colne Estuary SPA / Ramsar
- Crouch and Roach Estuaries SPA / Ramsar
- Foulness SPA / Ramsar
- Abberton Reservoir SPA / Ramsar
- Outer Thames Estuary SPA

- 2.42 Disturbance to habitats and species can arise from a number of sources. While recreational activities are frequently implicated in disturbance events, sources are multifarious and can include traffic, construction activity and intermittent sounds (for example alarms/sirens). The impacts on bird species of disturbance events are particularly significant and tend to occur on a continuum where the most disturbing activities are those that are irregular, unpredictable

loud noise events and movement or vibration of a long duration. Less disturbing are regular, frequent, quiet and predictable patterns of sound or vibration with limited vibration²¹.

Mid-Essex Coast SPA/Ramsar complex (particularly the Blackwater Estuary SPA/Ramsar and Dengie SPA/Ramsar sites)

Abberton Reservoir SPA/Ramsar

Outer Thames Estuary SPA

- 2.43 Overwintering birds (which are one of the main qualifying features of the Mid-Essex Estuaries SPA/Ramsar complex) expend unnecessary energy and have reduced feeding times as a result of responding to disturbance events. Displacement between feeding sites can also place pressures on available resources, placing additional pressures on supporting habitats.²² As well as noise disturbance (particularly during construction and decommissioning) there could be an increase in light pollution during the winter months due to shorter daylight hours which could lead to disturbance impacts on overwintering birds. The net effect of these disturbance events is a direct negative impact on species survival. Effects on breeding birds can be equally as detrimental leading to nest abandonment and failures. Little Tern are a key breeding species of Blackwater Estuary and are extremely vulnerable to disturbance.
- 2.44 The HRA Screening Assessment identified disturbance as being of potential relevance for the Blackwater Estuary and Dengie SPA/Ramsar sites. Noise disturbance during construction and decommissioning is of particular concern (especially disturbance associated with construction of cooling water infrastructure, the marine landing platform and upgraded coastal protection directly within the SPA/Ramsar sites) During the construction/decommissioning phases of the development, increased disturbance is likely from a range of sources (lighting, noise and vibration) and may divert birds from their chosen roosting, feeding and breeding sites. These disturbance sources and effects may be equally relevant off-site through the construction of improved road/ rail access.
- 2.45 Similarly if development of the nominated site results in disturbance of buffer habitats or habitats outside of the designations that are also of importance to qualifying bird species, impacts could arise. For example Dark-bellied Brent Geese and Golden Plover are key species which both use habitats outside of the designated sites such as damp grassland and coastal grazing marsh for feeding.
- 2.46 There may also be indirect impacts on the Mid-Essex Coast SPA/Ramsar complex as a whole as well as Abberton Reservoir

21 Scott Wilson (Nov 2008) EcoTowns: Sustainability Appraisal and Habitats Regulations Assessment.

22 Gill, Sutherland and Norris (1998) The consequences of human disturbance for estuarine birds. RSPB Conservation Review 12. 67-72.

SPA/Ramsar site due to the movement of bird species between designated sites.

- 2.47 Red-throated Divers of the Outer Thames Estuary SPA are also highly sensitive to disturbance by noise and visual presence during the winter, which can lead to displacement from feeding grounds. Such a response affects energy budgets and food intake rates and can affect chances of survival. Noise and visual disturbance associated with construction, operation and decommissioning activities at Bradwell could therefore result in adverse effects on the SPA if populations of Red-throated Diver occur nearby.
- 2.48 Given the extended construction phase of the development and identified sensitivities of the designated species to disturbance events, the potential for adverse effects should be considered further through Appropriate Assessment.**

Air Quality Impacts

European Sites for which no significant effects are likely (see Appendix 3):

- Mid-Essex Coast Complex SPA / Ramsar
- Colne Estuary SPA / Ramsar
- Crouch and Roach Estuaries SPA / Ramsar
- Foulness SPA / Ramsar
- Abberton Reservoir SPA / Ramsar

European Sites for which significant effects are uncertain (see below):

- Essex Estuaries SAC
- Dengie (Mid-Essex Coast Phase 1) SPA / Ramsar
- Blackwater Estuary (Mid-Essex Coast Phase 4) SPA / Ramsar
- Outer Thames Estuary SPA

- 2.49 The effects of changing and poor air quality at European Sites vary according to the pollutant type, (acid deposition, ammonia, nitrogen oxides, ozone and sulphur dioxide) and the nature of the receiving environment. The key pollutants that are of concern for terrestrial habitats are sulphur dioxide (SO₂), ammonia (NH₃) and nitrogen oxides (NO_x) and elevated levels of sulphur dioxide and nitrogen in particular would be expected throughout the construction and decommissioning phases of the nuclear power station. Deposition of nitrogen can lead to soil enrichment and sulphur dioxide to acidification; altering the species composition, with impacts on associated species.
- 2.50 Background air quality in the UK has improved progressively and is expected to continue to improve significantly over the next 15 years with tightening emissions standards and moves towards 'cleaner'

energy generation. Pollution levels for all key pollutants in the (rural) area around Bradwell are typically low²³.

- 2.51 The HRA Screening Assessment noted the potential for impacts on air quality at a local level arising development of the nominated site. These impacts are considered to arise in particular from the construction/ development and decommissioning processes (for example fugitive dust and airborne particulates). Increased traffic generation is also of concern during development phases, and major roads within 200 metres have the potential to increase nitrogen and carbon emissions impacts from vehicles²⁴.
- 2.52 The HRA Screening Assessment also noted the potential for radioactive releases to the atmosphere, but that regulatory sources indicate aerial (radioactive) emissions to be low and cause little (human) and biodiversity radiation exposure²⁵.

Essex Estuaries SAC

Blackwater Estuary SPA/Ramsar site

Dengie SPA/Ramsar site

Outer Thames Estuary SPA

- 2.53 The HRA Screening Assessment of sites that may be affected by potential changes to local air quality identified four designations; Essex Estuaries SAC, Blackwater Estuary SPA/Ramsar, Dengie SPA/Ramsar and the Outer Thames Estuary SPA. All these sites are in close proximity to the nominated site and could be adversely affected by increases in air pollution.
- 2.54 Given the role of air quality in maintaining the overall site integrity of European Sites, and the development proposed through other plans (for example Local Development Frameworks) it is considered relevant to gather further air quality data to confirm a 'no significant effect' finding and ensure that supporting environmental conditions will not be adversely affected by development at Bradwell. This approach supports the analysis provided in the main HRA report.
- 2.55 In line with the precautionary principle further information should be gathered as part of the Appropriate Assessment scoping stage to address potential uncertainties identified in relation to air quality issues.**

23 AEA Energy (2007) Air Pollution in the UK.

24 Department for Transport (2003) Transport Analysis Guidance, the Local Air Quality Sub-Objective TAG Unit 3.3.3.

25 Environment Agency (2005) Measuring Environmental Performance, Sector Report for the Nuclear Industry.

Conclusions and Recommendations of Screening Assessment

- 2.56 In line with the screening requirement of the Habitats Directive and Regulations, an assessment was undertaken to determine the likely significant-effects of the development at Bradwell on the fifteen European Sites that lie within 20km of the nominated site. The Screening Assessment was informed by:
- The information gathered on the European Sites – **Appendix 1**;
 - Consideration, where necessary, of other plans and programmes that have spatial/ contextual relevance – **Appendix 2**
 - The summary analysis of potential environmental impacts generated by the development activities arising from Bradwell;
 - Government guidance²⁶ which indicates that HRA for plans is typically broader and more strategic than project level HRA and that it be undertaken at a level that is proportionate to the available detail of the plan.
- 2.57 The Screening Assessment identified a number of key impacts arising from the proposed development and the potential for likely significant effects on all of the European Sites scoped into the screening process. These findings are summarised in Table 3 below. The potential for ‘in-combination’ effects with other plans and projects was also identified.

26 “Planning for the Protection of European Sites: Appropriate Assessment - Guidance For Regional Spatial Strategies and Local Development Documents”,
<http://www.communities.gov.uk/archived/publications/planningandbuilding/planning2>

Table 3: Summary of Likely Significant Effect Screening Assessment

European Sites within 20 km of nominated site at Bradwell	Water Resources and Quality	Habitat Loss and Fragmentation	Coastal Squeeze	Disturbance (Noise, Light, Visual)	Air Quality
Essex Estuaries SAC	✓	✓	✓	✗	?
Mid-Essex Coast SPA/Ramsar complex ²⁷	?	?	?	?	✗
Dengie SPA/Ramsar (Mid-Essex Coast Phase 1)	✓	✓	✓	✓	?
Colne Estuary SPA/Ramsar (Mid-Essex Coast Phase 2)	?	?	?	?	✗
Crouch and Roach Estuaries SPA/Ramsar (Mid-Essex Coast Phase 3)	?	?	?	?	✗
Blackwater Estuary SPA/Ramsar (Mid-Essex Coast Phase 4)	✓	✓	✓	✓	?
Foulness SPA/Ramsar (Mid-Essex Coast Phase 5)	?	?	?	?	✗
Abberton Reservoir SPA/Ramsar	?	?	?	?	✗
Outer Thames Estuary SPA	✓	?	✗	?	?

Key		
Likely Significant Effect	✓	further Appropriate Assessment required
No Likely Significant Effect	✗	no further Appropriate Assessment required
Significant Effect Uncertain	?	precautionary approach taken and further Appropriate Assessment required

2.58 It is recommended that the HRA proceeds to the next stage of 'Appropriate Assessment' in relation to the nine European Sites where the potential for likely significant effects (✓) or significant effect uncertain (?) has been identified. The next stage of the HRA process is outlined in section 3 of this report.

²⁷ Some impacts should be considered in the context of the Mid-Essex Coast SPA/Ramsar complex as a whole as well as its component parts.

3 HRA Appropriate Assessment of Bradwell

Scoping and Additional Information Gathering

- 3.1 To support the Appropriate Assessment (AA) phase, additional information was gathered on the European Sites and environmental conditions, in line with the specific issues identified by the Screening Assessment. This additional information included air quality data and trends, available from the UK Air Pollution Information System (APIS) and the Essex Air Quality Consortium, water quality and abstraction data produced by the Environment Agency (EA) and information on water bird trends from the WeBs (Wetland Bird Survey) website.

Assessing the Impacts (in-combination) Appropriate Assessment

- 3.2 The HRA Screening Assessment considered whether the impacts arising from the nominated site at Bradwell have the potential to significantly affect the European Sites scoped into the assessment process.
- 3.3 The following sections summarise the further analysis undertaken to determine whether such effects are likely to have an adverse effect on European Site integrity, either alone or in-combination with other plans and projects. This was done by making an assessment against the conservation objectives for each European Site. These are detailed in Appendix 1 and summarised below:

Essex Estuaries SAC

- 3.4 Subject to natural change, maintain the following habitats in favourable condition:
- Estuaries (which include intertidal mudflat and sandflat communities, rock communities subtidal mud communities subtidal muddy sand communities and subtidal mixed sediment communities)
 - Mudflats and sandflats not covered by seawater at low tide
 - Salicornia and other annuals colonising mud and sand.
 - Atlantic salt meadows
 - Mediterranean and thermo-atlantic halophilous scrubs
 - Sandbanks which are slightly covered by water all the time.

Mid-Essex Estuaries SPA/Ramsar complex (which includes Blackwater Estuary SPA/Ramsar, Colne Estuary SPA/Ramsar, Crouch and Roach Estuaries SPA/Ramsar, Foulness SPA/Ramsar and Dengie SPA/Ramsar)

- 3.5 Subject to natural change maintain habitats for internationally important populations of regularly occurring migratory bird species in favourable condition.
- 3.6 Subject to natural change, maintain habitats for internationally important assemblages of waterfowl in favourable condition.
- 3.7 Subject to natural change maintain habitats for internationally important populations of the regularly occurring Annex 1 bird species in favourable condition.

Abberton Reservoir SPA/Ramsar

- 3.8 Subject to natural change, maintain habitats for the internationally important populations of the regularly occurring Annex 1 bird species in favourable condition.
- 3.9 Subject to natural change maintain habitats for internationally important populations of regularly occurring migratory bird species in favourable condition.
- 3.10 Subject to natural change maintain habitats for internationally important assemblages of waterfowl in favourable condition.

Outer Thames Estuary SPA

- 3.11 Subject to natural change, maintain in favourable condition the internationally important populations of the regularly occurring Annex I Species the Red-throated Diver – and its supporting habitats and species. Relevant habitats include shallow coastal waters and areas in the vicinity of sub-tidal sandbanks.

Water Resources and Quality

Essex Estuaries SAC

Mid-Essex Coast SPA/Ramsar Complex (in particular Blackwater Estuary SPA/Ramsar and Dengie SPA/Ramsar)

Abberton Reservoir SPA/Ramsar

Outer Thames Estuary SPA

- 3.12 The Blackwater Estuary is immediately adjacent to the nominated site at Bradwell. Current Environment Agency data²⁸ indicates that, the

28 Environment Agency: River Basin Management Plan: Anglian River Basin District.
<http://wfdconsultation.environment-agency.gov.uk/wfdcms/en/anglian/Intro.aspx>

ecological and chemical status of the estuary is 'moderate' and 'good' respectively. By 2015, the Environment Agency predicts that both the ecological and chemical status will be maintained. The assessments for the coastal water quality, downstream from Bradwell mirror those for the estuarine environment, with a prediction that both the ecological and chemical status of the water will remain unchanged. The ecological status of the rivers around Bradwell is assessed to be of 'moderate' ecological quality – the chemical condition of these rivers is classified as 'not requiring assessment'. Groundwater chemical quality around Bradwell is assessed by the Environment Agency as being 'poor (deteriorating)'.

- 3.13 Radioactive discharges are subject to authorised limits monitored by the Environment Agency. Potential exposures are kept under constant review and discharges are carefully controlled to ensure that doses are maintained within required limits. Of the non-radioactive discharges, nitrate contributions are considered to be the most significant (research cited by the Environment Agency in the nuclear sector report). In particular it is noted that there can be measurable localised impacts on sea nutrient levels in the vicinity of discharge outlets which discharge from urban areas, industry and agriculture.
- 3.14 Environmental condition data from the Environment Agency indicates that water quality of the Essex Estuaries has improved greatly in recent years although urban and agricultural diffuse outputs are increasingly being highlighted as sources of contamination (particularly nutrients). Macroalgal proliferation has been highlighted as a particular problem within the Blackwater Estuary²⁹.
- 3.15 Despite being further away from Bradwell the remaining designations within the Mid-Essex SPA/Ramsar complex (Colne Estuary, Crouch and Roach Estuaries and Foulness) may also be affected by changes to water quality. Further information regarding coastal processes (for example currents and drift patterns) which could disperse any contaminants from Bradwell into the wider estuarine environment is needed to determine whether there will be an adverse impact on the integrity of these designations.
- 3.16 The catchment³⁰ which feeds the Essex Estuaries has been split into north and south Essex and then further into 'Water Resource Management Units' (WRMUs). The nearest to Bradwell is WRM1 in the north Essex catchment. Rivers within this unit (based on resource availability at times of low flow) fall within the following categories:

UKTG – Water Framework Directive Website: <http://www.wfduk.org/>
Environmental Agency –

<http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=e>

²⁹ Essex Estuaries European Marine Site. Marine Biological Association Occasional publication No 17.

³⁰ The Combined Essex Catchment Abstraction Management Strategy (EA 2007).

<http://www.environment-agency.gov.uk/research/planning/33570.aspx>

- 1) Over-abstracted – existing abstraction is causing unacceptable damage to the environment at low flows. Water may still be available at high flows with appropriate restrictions.
 - 2) Over-licenced – current abstraction is such that no water is available at low flows. If existing licences were used to their full allocation they could cause unacceptable environmental damage at low flows. Water may be available at high flows with appropriate restrictions.
 - 3) No water available – no water is available for further licensing at low flows. Water may be available at high flows with appropriate restrictions.
- 3.17 The nomination report for Bradwell states that direct cooling is the preferred option³¹, and that water would be taken directly from the Blackwater Estuary (the River Blackwater is over-abstracted) which is within the Essex Estuaries SAC and the Blackwater Estuary and Dengie SPA/Ramsar sites. There may also be requirements for off-site potable water resources and wastewater discharges. It will therefore be a requirement for any new developments at Bradwell to provide water supply strategies to the Environment Agency and IPC to show how impacts (from abstractions or discharges) on European Sites will be avoided.
- 3.18 In relation to the Outer Thames SPA, assessments made by the Environment Agency in 2004 under the Water Framework Directive (WFD) and updated in the River Basin Management Plans in 2009 indicate the transitional (including estuarine) and coastal waters within the area are at risk of failing to reach the environmental standards that are required under the WFD³² and organic source pollution in particular is identified as a potential future risk. The WFD will however be addressing coastal water quality issues and discharges will be controlled under this to meet 'Good Ecological Status' as specified under the Directive.
- 3.19 The sheltered coastal areas and transitional water types of the SPA are at most risk from impacts related to water resources and quality (the more exposed offshore areas of the SPA are less at risk, as there is greater dilution and dispersion of contaminants).
- 3.20 Under the Habitat Regulations it is also a requirement that competent authorities review all authorisations, consents, licences and permissions on European designated sites. This is known as the Review of Consents (RoC) process. Any existing abstraction and discharge licences at Bradwell will therefore undergo review. Activities which could have an adverse impact will not be renewed unless it can be shown that there will not be an adverse effect on European Sites.

31 Subject to detailed technical and environmental impact studies to determine design and impact; and that if there are environmental limits to direct cooling, a suitable indirect cooling system would be developed.

³² <http://www.environment-agency.gov.uk/research/planning/33292.aspx>

Similarly any new permissions will only be granted if applications show that there will not be an adverse impact on site integrity.

- 3.21 With regards to birds, impacts (such as loss of food sources as well as accumulations of toxins within the food chain) should be considered in the wider context (Mid-Essex Coast SPA/Ramsar complex as a whole and Abberton Reservoir) as well as at the more local level due to movement of bird species between designations. Project level assessment (with detailed information on bird movement patterns in relation to breeding, feeding and roosting) is needed in order to fully determine impacts. Similarly project level assessment is needed to fully determine impacts on the Red-throated Divers of the Outer Thames SPA as this species and its supporting habitats and prey species are vulnerable to impacts on water quality.

Effects in Combination with Other Plans and Projects

- 3.22 Aspects of the following plans and projects could lead to 'in combination' effects on European Sites with regards to water resources and quality (see Appendix 2):
- Essex County Council Minerals and Waste Development Framework (under review) – mineral extraction could lead to impacts on water flows which can be far reaching including disturbance to groundwater flow, changes to run off patterns, water table or groundwater sites.
 - Essex County Council Local Transport Plan – Potential impacts such as increased surface water run-off.
 - Local Development Frameworks/Core Strategies – development within the following districts could lead to impacts such as reduction in water quality as a result of increased housing and increased abstraction requirements:
 - Maldon District Core Strategy (under consultation)
 - Chelmsford Borough Council Core Strategy.
 - Thurrock LDF Core Strategy (in preparation).
 - Rochford District Council Core Strategy (in preparation)
 - Colchester Borough Core Strategy
 - Tendring District Council LDF (in preparation)
 - Decommissioning of Bradwell Nuclear Power Station – Potential impacts from turbid water entering surface water and drainage ditches, risks of spills entering the surface water system and groundwater contamination/change in ground water levels; however these are being dealt with through an Environmental Management Plan³³.
 - Bradwell Wind Farm – Possible cumulative impacts from short term localised water quality effects due to water table level and turbine excavations.

33 Bradwell Reactor Site. Environmental Management Plan 2008/2009. ES/EMP/003. Magnox South March (2009).

- Eco-Towns Programme (Draft PPS). North East Elsenham – Possible ‘in combination’ effects as a result of increased abstraction.
- No specific plans or programmes were noted which address the Outer Thames SPA. However, the following current and proposed economic activities could have cumulative effects in the future; aggregate extraction, oil and gas, renewables, cables, fisheries, shipping (including dredging of channels), recreation and land-based sources of pollution.
- Development of a new nuclear power station at Sizewell may result in in-combination effects, if new nuclear power stations are built at both Bradwell and Sizewell. An assessment of these potential effects is included in the Habitats Regulations Assessment Main Report.

3.23 The following plans and projects are considered likely to have an overall positive impact as protection and management of European Sites is a priority or key consideration.

- The Combined Essex Catchment Abstraction Management Strategy – Under the Habitat Regulations the Environment Agency have to assess the effects of existing abstraction licences any new licence applications to make sure they are not impacting on European Sites.
- The River Basin Management Plan. Anglian River Basin District – key aims of the plan include addressing point sources of pollution, securing sustainable amounts of water and improving wildlife habitats.
- Crouch and Roach Flood Management Strategy and Blackwater and Colne Flood Management Strategy- one of the key aims of these strategies is to avoid pollution of controlled water from release of landfill material or other sources of contamination.
- North and South Essex Flood Catchment Management Plans (Drafts) - plans that will look to assess how flood risks might change and be managed over the next 50 – 100 years. The plan considers flooding associated with rivers (tidal flood risks are to be dealt with under Shoreline Management Plans). Objectives include maintaining and improving water quality standards, and to protect and improve water resources as well protecting and improving designated areas of nature conservation interest.
- Raising of Abberton Reservoir – The raising of Abberton Reservoir is proposed to cover an existing predicted shortfall in water supply in the Essex supply area. The raising of the reservoir is expected to have an overall positive effect by providing substantial wetland habitat.

3.24 A precautionary approach requires that at the strategic level potential adverse effects on site integrity be assumed for the Essex Estuaries SAC and the Blackwater Estuary and Dengie SPA/Ramsar sites as well in the wider context (Mid-Essex Coast SPA/Ramsar complex as a whole and Abberton Reservoir). In

addition, adverse effects on site integrity should be assumed for the Outer Thames Estuary SPA in relation to water quality and resources.

- 3.25 Although potential locations³⁴ have been identified for cooling water infrastructure, it is not possible without further information (such as more specific discharge and abstraction requirements, coastal processes, bird movements and mitigation measures) to conclude that impacts (including 'in-combination' effects) will not lead to a decline in favourable condition of the habitats present and the important species which they support.**
- 3.26 The potential for mitigation measures to address the potential adverse effects identified is considered further in the avoidance and mitigation section of this report.**

Habitat (and Species) Loss and Fragmentation/ Coastal Squeeze

Essex Estuaries SAC

Mid-Essex Coast SPA/Ramsar Complex (in particular Blackwater Estuary SPA/Ramsar, Dengie SPA/Ramsar and Colne Estuary SPA/Ramsar)

Abberton Reservoir SPA/Ramsar

Outer Thames Estuary SPA

- 3.27 The Essex Estuaries Coastal Habitat Management Plan (CHaMP)³⁵ produced by the Environment Agency indicates that the estuarine complex is changing progressively. A main factor contributing to this change is the presence of man-made features which have constrained the ability of inter-tidal habitats (notably saltmarsh) to move landward in response to sea level rise. Analysis and modelling predicts that over the next 50 years profound changes could occur in the distribution and extent of coastal habitat with changes including significant loss of saltmarsh communities. Bradwell is situated adjacent to habitats within the Essex Estuaries SAC as well as the Blackwater Estuary SPA/Ramsar and the Dengie SPA/Ramsar sites. Habitats in close proximity to Bradwell include sand and gravel, mud and saltmarsh.**
- 3.28 The Site of Special Scientific Interest (SSSI) units³⁶ underpinning the parts of the Essex Estuaries SAC are the Blackwater Estuary SSSI and Dengie SSSI. 47% of the Blackwater Estuary SSSI is in favourable condition whilst 53% is in decline. Within the Dengie SSSI 62.8% is favourable condition whilst 37% is declining. Any loss or damage of habitat through development could contribute to further decline in**

34 Proposed Nuclear Development at Bradwell. Environmental Scoping Report. British Energy (2008)

35 The Essex Estuaries Coastal Habitat Management Plan: Executive Summary (October 2002).

<http://www.eclife.naturalengland.org.uk/champs/pilots.asp>

36 Appendix 1. European Site Characterisations

favourable condition of the SSSIs and would therefore also have an adverse impact on the Essex Estuaries SAC.

- 3.29 Loss of any sandbank habitat within the Outer Thames Estuary SPA could result in significant effects on Red-throated Divers which rely on this habitat for feeding. Sandbanks are dynamic systems and are therefore constantly changing. However, their associated communities are vulnerable to activities such as dredging, disposal of dredged material, aggregate extraction, fishing, oil and gas exploration and development.
- 3.30 In addition, any disturbance which interferes with the hydrological regime in the vicinity of sandbanks can be detrimental as maintenance of this habitat is dependent on current direction and speed. Adjacent coastal development and construction of sea defences can potentially change hydrological regimes.
- 3.31 The site nomination report³⁷ for Bradwell states that existing coastal defences are of 18th century origin and the viability of such structures in the area is well established, although current structures have a residual life. There would be no need or intention to extend flood defences and coastal protection measures across the existing shore and that new coastal protection measures could be built on or immediately behind the existing line of coastal defence. It is then stated that such a layout would avoid any wider impact of the development on neighbouring shores.
- 3.32 Despite this upgraded coastal protection could still contribute to the effects of coastal squeeze as well as constraining opportunities for adapting to rising sea levels as a result of climate change (such as managed realignment).
- 3.33 As the extent of direct loss of habitats within the Essex Estuaries SAC the Blackwater Estuary and Dengie SPA/Ramsar sites and the Outer Thames Estuary SPA (from the construction of cooling water infrastructure, upgraded coastal protection, and a marine landing facility) is unknown, adverse effects on these European Sites both locally and in the wider context of the Mid-Essex SPA/Ramsar complex (particularly any effects on birds if habitats which they rely on are lost) cannot be ruled out without further project level information (such as site design showing full extent of habitat loss). Further information on coastal process and hydrodynamics is also needed. It is possible that these changes may act cumulatively or accelerate changes identified by the CHaMP in relation to primary designation features.
- 3.34 Habitat loss (both direct and as a result of coastal squeeze) has been ruled out for the Crouch and Roach Estuaries SPA/Ramsar and

37 <http://www.nuclearpowersiting.decc.gov.uk/nomination/bradwell/>

Foulness SPA/Ramsar due to their distance (11.9km and 11.5 km respectively) from the nominated site at Bradwell.

- 3.35 With regards to the Colne Estuary SPA/Ramsar site (which is situated approximately 3.3km away) there is uncertainty as to the possible effects of coastal squeeze and it is considered that further information on coastal processes is needed to determine if there will be an adverse effect on site integrity.
- 3.36 There could be indirect impacts on the bird species through habitat loss/coastal squeeze due to movement of birds between designations. More site specific detail (and possibly further information on bird movement patterns in relation to breeding, feeding and roosting) is needed in order to fully determine impacts. Further assessment should consider the impacts on the Mid-Essex Coast SPA/Ramsar complex as a whole as well as in the local context. Abberton Reservoir SPA/Ramsar also needs to be considered in any further assessment.

Effects in Combination with Other Plans and Projects

- 3.37 Aspects of the following plans and projects could lead to 'in combination' effects on European Sites with regards to Habitat (and species) Loss and Fragmentation/ Coastal Squeeze (See Appendix 2):
- Essex County Council Minerals and Waste Development Framework (under review) – mineral extraction could lead to habitat loss.
 - Essex County Council Local Transport Plan – Potential impacts from land take and habitat loss or deterioration.
 - Maldon District Core Strategy (under consultation) – policies relating to urban development and flood defence could lead to 'in-combination' effects.
 - Chelmsford Borough Core Strategy - policies relating to locations for industry/development identified in close proximity to European Sites could lead to 'in-combination' effects.
 - Colchester Borough Core Strategy – Possible impacts on habitats where housing is located close to European Sites.
 - Tendring District Council Local Development Framework – currently in preparation. Documents not yet available however policies may result in 'in combination' effects.
 - Renewable Energy Strategy for Essex – Promotion of offshore and onshore windfarms could lead to in-combination effects through development along the coast.
 - Decommissioning of Bradwell Nuclear Power Station – Possible impacts from demolition of buildings and foundations, construction

work and other general activity on site, however these are being dealt with through an Environmental Management Plan³⁸

- No specific plans or programmes were noted which address the Outer Thames SPA however the following current and proposed economic activities could have cumulative effects in the future; aggregate extraction, oil and gas, renewables, cables, fisheries, shipping (including dredging of channels), recreation and land-based sources of pollution.
- Development of a new nuclear power station at Sizewell may result in in-combination effects, if new nuclear power stations are built at both Bradwell and Sizewell. An assessment of these potential effects is included in the Habitats Regulations Assessment Main Report.

3.38 The following plans and projects are considered likely to have an overall positive impact as protection and management of European Sites is a priority or key consideration:

- The River Basin Management Plan. Anglian River Basin District – a key aim of the plan is to reduce the impact of transport and built environments and to improve wildlife habitats.
- Essex Estuaries Coastal Habitat Management Plan (CHaMP) – this plan offers a long term strategic view on the balance of losses and gains to habitats and species of European interest likely to result from sea level rise and the flood and coastal defence response to it. Included within the plan are recommendations to Shoreline Management Plans (see below) to ensure flood and coastal defence options address the requirements of the Habitat Regulations. Options for habitat creation are also presented. European Sites are a priority however options for coastal habitat management could lead to 'in-combination' effects.
- East Anglian Strategies – Shoreline Management Plans (in preparation) – provides a large-scale assessment of the risks associated with coastal evolution and presents a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner. The relevant Shoreline Management Plan (Harwich to Canvey Island) is currently in preparation. Whilst it is expected that European Sites will be a priority there is still the potential for 'in-combination' effects depending on policies that are adopted in the vicinity of Bradwell. This document should be reviewed at project level HRA, once published, as coastal management policies will be defined for the Essex estuaries area. This will have implications for the development at Bradwell with regards to which coastal defence measures are most appropriate in order to avoid adverse effects on the integrity of European Sites.

³⁸ Bradwell Reactor Site. Environmental Management Plan 2008/2009. ES/EMP/003. Magnox South March (2009).

- Crouch and Roach Flood Management Strategy and Blackwater and Colne Flood Management Strategy- key aims of the strategies is to enhance salt marsh generation, ensure compliance with the Habitats Regulations and to maintain and enhance environmentally designated sites, habitats and species. In addition they seek to provide a flood management strategy that supports the long term objectives of providing effective flood management. Whilst environmental considerations are a priority options for flood defence could lead to 'in-combination' effects.
- North and South Essex Flood Catchment Management Plans (Drafts) - plans that will look to assess how flood risks might change and be managed over the next 50 – 100 years. The plan considers flooding associated with rivers (tidal flood risks are to be dealt with under Shoreline Management Plans). Objectives include to manage flood risk to the built and rural environment, to reduce vulnerability to the effects of climate change and to protect and improve water resources as well protecting and improving designated areas of nature conservation interest. Whilst environmental considerations are a priority, options for managing flood risk such as upgraded coastal defences could still have impacts on designated sites and therefore there may be 'in-combination' effects.
- Raising of Abberton Reservoir – The raising of the reservoir is expected to have an overall positive effect by providing substantial wetland habitat.

3.39 At this strategic stage, where detailed development proposals that include the extent of additional land take for construction are unknown a precautionary approach requires that potential adverse effects (including 'in combination' effects) on site integrity be assumed through habitat loss and coastal squeeze on the Essex Estuaries SAC, the Blackwater Estuary SPA/Ramsar site, the Dengie SPA/Ramsar site, the Colne Estuary SPA/Ramsar site and the Outer Thames Estuary SPA until greater site specific detail (including information such as site design, technology, extent of habitat loss, coastal processes and mitigation measures) is known. It is not possible to conclude without this information that impacts will not lead to a decline in favourable condition of the habitats present and the important species which they support.

3.40 There is also uncertainty regarding impacts of habitat loss on birds of the Mid-Essex Coast SPA/Ramsar complex and Abberton Reservoir SPA/Ramsar.

3.41 The potential for mitigation measures to effectively address the impacts identified is considered further in the avoidance and mitigation section of this report.

Disturbance (Noise, Light, Visual)

Mid-Essex Coast SPA/Ramsar complex (In particular Blackwater Estuary SPA/Ramsar and Dengie SPA/Ramsar sites)

Abberton Reservoir

Outer Thames Estuary SPA

- 3.42 The Mid-Essex Coast SPA/Ramsar complex and Abberton Reservoir SPA/Ramsar site in combination support an extremely high number of internationally important bird assemblages. Within the Mid-Essex SPA/Ramsar complex the Blackwater Estuary and Dengie components fall immediately adjacent to Bradwell and are considered to be of most relevance. Key bird species using habitats within these designations are particularly vulnerable to disturbance from close human proximity and the Screening Assessment noted the potential for construction and decommissioning phases specifically to create disturbance events, particularly through noise but also through increases in light pollution. These impacts are relevant all year round as both important populations of breeding and overwintering birds use the designated sites.
- 3.43 These disturbance events could be more far reaching than just the local area due to movement of bird species between designations within the Mid-Essex Coast SPA/Ramsar complex and Abberton Reservoir. Further site specific information is needed (and more detailed information on bird movement patterns in relation to breeding, feeding and roosting) in order to determine how far reaching any impacts might be and whether they are likely to be of significance.
- 3.44 The Outer Thames Estuary SPA falls within 1km of the site at Bradwell and supports internationally important populations of the Red-throated Diver over winter. This species is particularly sensitive to noise and visual disturbance, which can displace birds from their feeding grounds and affect chances of survival.
- 3.45 Red-throated Divers are not regarded as threatened within the EU. However, the conservation status is regarded as unfavourable because of declines in the European breeding population between 1970 and 1990. The population is now considered stable but depleted. Despite this, any impacts as a result of disturbance could contribute to the unfavourable status of the birds, and in turn impact on the integrity of the SPA. Further site-specific information is needed (including more detailed information on Red-throated Diver movement patterns) in order to determine whether there are likely to be any impacts of significance.

Effects in Combination with Other Plans and Projects

3.46 Aspects of the following plans and programmes could lead to 'in combination' effects on European Sites with regards to disturbance (see Appendix 2):

- Essex County Council Minerals and Waste Development Framework (under review) – Potential impacts through human disturbance, for example through increased noise, vibration and light and vehicular use.
- Essex County Council Local Transport Plan – Potential impacts from noise associated with transport.
- Maldon District Core Strategy (under consultation) – policies for development along the Crouch Valley Branch line could lead to impacts on European Sites due to increased disturbance; marina proposals could lead to increased recreational activity as could policies to provide additional footpaths, cycleways, bridleways and other recreational facilities in the countryside.
- Chelmsford Borough Core Strategy – high density housing proposed for Woodham Ferrers town centre (in close proximity to European Sites) could result in increased recreational pressure.
- Thurrock LDF Core Strategy (in preparation) – increased populations associated with new dwellings within the authority could contribute to an increase in recreational disturbance.
- Rochford District Council Local Development Framework (in preparation) – Whilst policies are likely to protect sites from development in the coastal zone, extensions to residential areas and employment areas in the district could mean increased recreational use of the area.
- Colchester Borough Core Strategy – the increased number of visitors to European Sites due to increases in housing or tourism facilities near these sites may result in non-physical and physical disturbance.
- Tendring District Council LDF (in preparation) – Documents are not yet available however 'in combination' effects relating to disturbance could arise through increased housing, industry and tourism.
- Renewable Energy Strategy for Essex – Promotion of offshore and onshore windfarms could lead to 'in combination' effects regarding disturbance.
- Decommissioning of Bradwell Nuclear Power Station – Possible impacts from demolition of buildings and foundations, construction work and other general activity on site, however these are being dealt with through an Environmental Management Plan³⁹
- Bradwell Wind Farm – Possible cumulative impacts from short term localised water quality effects due to disturbance from turbine excavations. Possible disturbance to bird populations once turbines are in operation.

³⁹ Bradwell Reactor Site. Environmental Management Plan 2008/2009. ES/EMP/003. Magnox South March (2009).

- No specific plans or programmes were noted which address the Outer Thames SPA however the following current and proposed economic activities could have cumulative effects in the future; aggregate extraction, oil and gas, renewables, cables, fisheries, shipping (including dredging of channels), recreation and land-based sources of pollution.
- Development of a new nuclear power station at Sizewell may result in in-combination effects, if new nuclear power stations are built at both Bradwell and Sizewell. An assessment of these potential effects is included in the Habitats Regulations Assessment Main Report.

3.47 A precautionary approach requires that at the strategic level potential adverse effects (including ‘in combination’ effects) on site integrity be assumed for the Blackwater Estuary and Dengie SPA/Ramsar sites as well as in the wider context (Mid-Essex Coast SPA/Ramsar complex as a whole and Abberton Reservoir) in relation to disturbance impacts. In addition potential adverse effects on site integrity should be assumed for the Outer Thames Estuary SPA. It is not possible without further information (such as more specific information on likely levels of noise disturbance, bird movements and mitigation measures) to conclude that there will not be adverse effects on the important bird species of European Sites.

3.48 The potential for mitigation measures to effectively address the potential adverse effects identified is considered further in the avoidance and mitigation section of this report.

Air Quality

Essex Estuaries SAC

Mid-Essex Coast SPA/Ramsar (Blackwater Estuary SPA/Ramsar and Dengie SPA/Ramsar only)

3.49 Information obtained from Maldon District Council⁴⁰ indicates that air quality in the Maldon District is generally good with no risk of air quality objectives being exceeded. The Environment Act 1995 gives local authorities the responsibility to periodically review and assess local air quality, and where air quality objectives are unlikely to be achieved, to designate air quality management areas. To this end Maldon District Council has developed an action plan aimed at reducing air pollution and carries out monthly monitoring of nitrogen dioxide at nine sites within the district area; however none are near (or deemed to be required near) Bradwell. According to the Maldon District Council website, other pollutants (for example particulate matter (PM10) carbon

40 Maldon District Council

http://www.maldon.gov.uk/LivingHere/EnvironmentalHealth/Pollution/air_quality_monitoring.htm

monoxide, lead, ozone, sulphur dioxide and volatile organic compounds) are not currently significant in the district.

- 3.50 Information provided by the Air Pollution Information System⁴¹ (APIS) indicates that air quality in the area is good with pollution levels for all key pollutants being low. For habitats within the European Sites such as saltmarsh, there is currently no exceedance of critical loads. Similarly no vulnerabilities have been identified for the bird species of the European Sites. The main sources of air pollution in the Maldon District are busy and congested roads⁴².
- 3.51 Despite this saltmarsh habitats are thought to act as significant sinks for pollution (including airborne pollution) and pollutants could lead to habitat degradation. In addition pollutants accumulate in the saltmarsh system for relatively long periods of time however cyclical patterns of erosion and accretion may lead to the release and re-deposition of pollutants. It is therefore not possible to conclude without further information that impacts from air quality will not have an adverse impact on the above European Sites and important bird, plant and invertebrate species.
- 3.52 The Environment Agency assesses that, non-radioactive aerial emissions (sulphur dioxide, nitrogen oxides and volatile organic compounds) from nuclear power stations are extremely low compared with other regulated industries and the Agency does not consider them to be an environmental priority. The Environment Agency's most recent available assessment of radioactive aerial emissions for regulated nuclear power stations and specifically for current generation at Bradwell indicates that all fall within authorised limits⁴³.
- 3.53 Air quality issues around Bradwell are considered to be potentially most significant during construction and decommissioning phases (for example through increased dust and vehicle emissions).
- 3.54 Air Quality impacts on the Outer Thames SPA were screened into the appropriate assessment due to the close proximity of the SPA to the nominated site. However, after further consideration, adverse effects on site integrity have been ruled out. This is because the SPA covers a huge area (393734.18 ha), and it is considered unlikely that localised air quality impacts would contribute to any deterioration in site integrity. In addition, the SPA does not have any specified vulnerabilities relating to air quality.

41 Air Pollution Information System <http://apis.ac.uk/>

42 Essex Air Quality Consortium http://www.essexcc.gov.uk/microsites/airessex/air_maldon.html

43 Measuring Environmental Performance: Sector Report for the Nuclear Industry (Environment Agency, Nov 2005). http://maps.environment-agency.gov.uk/wiyby/queryController?topic=pollution&ep=2ndtierquery&lang=_e&layerGroups=1&x=321000.0&y=145900.0&extraClause=AUTHORISATION_ID~'AF7282'&extraClause=YEAR~2006&textonly=off&latestValue=&latestField=

Effects in Combination with Other Plans and Projects

3.55 A number of plans were assessed for 'in-combination' effects relating to air quality and although potential impacts were identified they are unlikely to be at a level that will affect the adverse integrity of designated sites 'in combination' with the proposed development. The most relevant plans are listed below:

- Essex County Council Minerals and Waste Development Framework (under review) – Potential impacts from emissions (particularly dust) both through minerals extraction and aggregate recycling facilities.
- Essex County Council Local Transport Plan – potential impacts from increased emissions and increase in air pollution although the plan promotes sustainable measures for transport and better air quality.
- Decommissioning of Bradwell Reactor Site – Possible impacts from demolition of buildings and foundations, construction work and other general activity on site, however these are being dealt with through an Environmental Management Plan⁴⁴

3.56 A precautionary approach requires that at the strategic level potential adverse effects on site integrity be assumed for the Essex Estuaries SAC, Blackwater Estuary and Dengie SPA/Ramsar sites in relation to air quality impacts due to the proximity of these designated sites to Bradwell. It is not possible without further site specific to conclude that impacts will not lead to a decline in favourable condition of the habitats present and the important species which they support.

3.57 The potential for mitigation measures to effectively address the potential adverse effects identified is considered further in the avoidance and mitigation section of this report.

Avoidance and Mitigation Measures

3.58 Avoidance and mitigation measures can apply both at a strategic policy level in the form of policy amendments/caveats, and in more detail at project level, where they are specific measures applicable to the identified issues at individual sites. This HRA is being undertaken at a strategic level where there are development uncertainties regarding the nature, scale and final footprint of the development within the nominated site. These uncertainties limit the capacity of the HRA to reasonably predict the effects on a European Site⁴⁵.

⁴⁴ Bradwell Reactor Site. Environmental Management Plan 2008/2009. ES/EMP/003. Magnox South March (2009).

⁴⁵ The key principles and any assumptions made in this plan level HRA of the Nuclear NPA and nominated sites are outlined in Part II of the HRA report.

- 3.59 At this strategic stage, the HRA for Bradwell can make recommendations for avoidance and mitigation measures in relation to Bradwell to inform the strategic siting assessment process, and therefore the overall development of the Nuclear NPS. These recommendations may also subsequently provide guidance to the IPC and potential future developers to ensure that any future development at Bradwell takes into account the findings of this strategic level assessment in the more detailed project level HRA.
- 3.60 The HRA recommendations for avoidance and mitigation measures in relation to Bradwell are discussed below and summarised in Table 4. Part II of the [main] HRA report also summarises the measures identified in this report alongside those proposed by [other] individual site HRAs.
- 3.61 This HRA is part of an ongoing assessment process that would continue with detailed, project level HRA to be undertaken by the IPC as competent authority (informed by the developer's assessment in an HRA Report), and informed by detailed information regarding the development plans at Bradwell, including consideration of the impact on local defined habitats not covered by the HRA plan process. The project level HRA, in line with the recommendations made in this strategic assessment may (as a result of project specific findings) consider alternative approaches to the development including changes to the nature, scale, technology applied or locational boundaries of the nominated site in order to avoid adverse effects on the integrity of the European Sites considered.
- 3.62 Detailed information on site development and further baseline information regarding important habitats and species will be gathered at the project level and site investigation stage. Indeed, the current site promoter has already defined further investigations (many of which will be underway) in their EIA Scoping Report⁴⁶, which will help to inform appropriate mitigation and avoidance measures in any detailed project level HRA:
- Geology, Hydrogeology, Hydrology and Soils;
 - Hydrodynamics and Coastal Geomorphology;
 - Flood Risk Assessment;
 - Marine Sediment and Water Quality;
 - Breeding birds, wintering birds, intertidal and inshore marine birds
 - Botanical interest;
 - Invertebrates;
 - Fisheries and other marine ecology;
 - Traffic and transport;
 - Noise, vibration and air quality; and
 - Local Community, Human activity and recreation.

46 Proposed Nuclear Development at Bradwell. Environmental Scoping Report. British Energy (2008)

- 3.63 As part of the overall mitigation package an ecological mitigation and management plan (or similar document) should be produced which incorporates all detailed mitigation measures, good site environmental practices (such as pollution control) and any ongoing monitoring measures that may be required after mitigation has been implemented.
- 3.64 There should also be strategies put in place to deal with any 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.

Water Resources and Quality

- 3.65 Avoiding adverse effects on surface, ground and estuarine waters is the responsibility of the developer, but is subject to stringent management and regulatory frameworks by Water Companies (resource planning) and the Environment Agency (abstraction licensing and discharge regulation) including requirements under the Water Framework Directive.
- 3.66 Thermal, radioactive and non-radioactive discharges should go beyond complying with existing standards, with radioactive discharges required to be As Low As Reasonably Achievable (ALARA)⁴⁷ and that all other discharge levels are required to be an improvement on existing standards. All discharges which lead to adverse effects on the integrity of European Sites should not be permitted. In addition to thermal effects from direct cooling, there are potential water quality issues, in particular nutrient enrichment from anti-fouling agents, which may be associated with the cooling water process.
- 3.67 The IPC, as guided by the Nuclear NPS, can direct requirements for the efficiency of water use and the protection of water quality, to ensure adverse effects on the European Sites were avoided. This may include requiring that management measures relating to supply and discharge (including potential effects on European Sites) are in place prior to the implementation of the nominated site proposals, and that decisions relating to best available technology for discharges take specific account of the sensitivities of the individual receiving environments. Adverse effects could be mitigated at the site level through suitable discharge standards, design measures, including use of Sustainable Drainage Systems (SuDS), and the selection of appropriate construction methods.

⁴⁷ ALARA is not a dose limit; it is a practice that has as its objective the attainment of dose levels as far below applicable limits as possible.

Habitat (and Species) Loss and Fragmentation/Coastal Squeeze

- 3.68 The Nuclear NPS should seek to prioritise, through the guidance it provides to the IPC, the avoidance of direct habitat impacts that may lead to habitat loss or fragmentation.
- 3.69 In relation to the identified issues at Bradwell this would mean avoiding or minimising losses of habitats and species through careful site layout and design (for example, using tunnelling techniques for cooling water infrastructure to minimise impacts on habitats at the surface). It would also include sensitively designed sea defences (for example, soft engineering for any upgraded coastal protection or use of permeable material for the marine landing facility). Connectivity of important wildlife corridors around the nominated site should be maintained and opportunities for habitat creation, restoration and enhancement should be sought where possible and incorporated into the overall mitigation package.

Disturbance (Noise, Light, Visual)

- 3.70 Disturbance events in relation to bird species are most significant when they are irregular/ sudden and unpredictable. Noise, light and visual impacts can be managed at a site level through phasing and timing that takes account of breeding and feeding cycles; this information is expected to be gathered through further investigation at the project level. The precise detail and the nature of the measures required would need to be agreed with Natural England prior to the commencement of development. These measures would form part of the wider site management plan that developers would be required to agree and implement prior to commencement.
- 3.71 Avoiding adverse effects on fish/invertebrate species which are food sources for birds is in part influenced by the efficiencies achieved within the industrial process and the nature of the technologies proposed by developments (extent of cooling water requirements). Fish protection measures could be incorporated within cooling water intake/system design. There is, therefore, a role for the Nuclear NPS to direct requirements for technologies and operating practices that take account of identified fish populations in the estuarine environment around Bradwell.

Air Quality

- 3.72 As air quality impacts have been identified for three designated sites (Essex Estuaries SAC, Dengie SPA/Ramsar site and Blackwater Estuary SPA/Ramsar site), it is appropriate that the Nuclear NPS takes account of potential air quality impacts through its direction to the IPC.

Requirements should include sustainable transport plans including, for example: the use of non-road transport where possible; the phasing of development; and robust monitoring at sites by operators (and the Environment Agency as appropriate) to track changes throughout the lifecycle of proposed operations. In particular, the monitoring should account for the potential for cumulative impacts where the phasing between the existing power station and the new build overlaps.

Table 4: Summary of Avoidance and Mitigation Recommendations

Potential Effects	Avoidance and Mitigation Measures – Recommendations for the IPC
Water Resources and Quality	
<ul style="list-style-type: none"> • Water Quality 	<ul style="list-style-type: none"> • Direct requirements for the protection of water quality. This may include requiring that decisions relating to best available technology (BAT) take specific account of the sensitivities of the individual receiving environments. • Thermal, radioactive and non-radioactive discharges should go beyond complying with existing standards, with radioactive discharges required to be ALARA and all other discharge levels required to be an improvement on existing standards. • Design water cooling culverts to avoid effects on the existing thermal regime of the Blackwater Estuary/Outer Thames Estuary SPA. • Protection measures should be incorporated into water intake systems so as to avoid depleting important food sources for birds such as fish/invertebrates • Layout and siting of potential sources of pollution to avoid and minimise potential impacts on sensitive areas.
<ul style="list-style-type: none"> • Water Quantity 	<ul style="list-style-type: none"> • Direct requirements for the efficiency of water use • Ensure that volume of cooling water returned to the Blackwater Estuary is within capacity of immediate receiving environment and does not adversely affect sediment flow. • Direct the selection of appropriate construction methods
<ul style="list-style-type: none"> • Surface and Groundwater Flow 	<ul style="list-style-type: none"> • Require suitable design is adopted to avoid or mitigate potential impacts on groundwater. • Require suitable design, including use of Sustainable Drainage Systems (SuDs). • Direct the selection of appropriate construction methods
Habitat Loss and Fragmentation/ Coastal Squeeze	

Potential Effects	Avoidance and Mitigation Measures – Recommendations for the IPC
<ul style="list-style-type: none"> • Direct habitat loss 	<ul style="list-style-type: none"> • Require site layout/ design to avoid or mitigate habitat losses within the Essex Estuaries SAC, the Blackwater Estuary SPA/Ramsar and the Dengie SPA/Ramsar sites and the Outer Thames Estuary SPA. • Require environmentally sensitive designs for all coastal defence structures and marine landing facilities. • Strategic coastal management documents such as the CHaMP and Shoreline Management Plan (when available in 2010) should be considered to help determine the best form of flood defence and upgraded coastal protection. • Soft engineering, managed realignment and foreshore recharge should be considered as possible flood defence techniques. • Use tunnelling techniques for cooling water infrastructure to minimise impacts on habitats at the surface • Protective buffer zones around sensitive areas. • Reinstatement to original condition areas affected by construction works. • Include measures within ecological mitigation and management plan
<ul style="list-style-type: none"> • Loss of Surrounding Habitat (construction of associated infrastructure) 	<ul style="list-style-type: none"> • Maintain connectivity of wildlife corridors around the nominated site, in particular connections between European Sites. • Include measures within ecological mitigation and management plan
<ul style="list-style-type: none"> • Barriers to migration 	<ul style="list-style-type: none"> • Screening of works areas, include height restrictions where necessary to limit disturbance and impacts on migratory paths • Ensure that cooling water culverts apply modern tunnelling techniques and discharge to reduce the impacts of thermal plumes on fish • Maintain connectivity of wildlife corridors around the nominated site and in particular maintain links between European Sites. • Protection measures should be incorporated into water intake systems so as to avoid depleting important food sources for birds such as fish/invertebrates
Disturbance (Noise, Light, Visual)	
<ul style="list-style-type: none"> • Recreational activities 	<ul style="list-style-type: none"> • Make workforce aware of sensitivities in relation to birds. • Increased management of access/visitors at vulnerable sites
<ul style="list-style-type: none"> • Construction and 	<ul style="list-style-type: none"> • Minimise need for encroachment of

Potential Effects	Avoidance and Mitigation Measures – Recommendations for the IPC
Decommissioning	<p>construction into sensitive areas through site design.</p> <ul style="list-style-type: none"> • Minimise disturbance, for example through timing of works, visual/noise/light screening. • Locate particularly noisy activities away from sensitive areas • Use machinery with lower noise outputs. • Require noise, light and visual impacts to be managed at a site level through phasing and timing that takes account of breeding, roosting and feeding cycles. • Make workforce aware of sensitivities in relation to birds.
<ul style="list-style-type: none"> • Indirect effects (construction of associated infrastructure) 	<ul style="list-style-type: none"> • Include measures within ecological mitigation and management plan • Minimise need for encroachment of construction into sensitive areas through site design. • Minimise disturbance, for example through timing of works, visual/noise/light screening. • Locate particularly noisy activities away from sensitive areas • Use machinery with lower noise outputs. • Require noise, light and visual impacts to be managed at a site level through phasing and timing that takes account of breeding, roosting and feeding cycles. • Require the incorporation of fish protection measures within cooling water intake/system design. • Make workforce aware of sensitivities in relation to birds.
Air Quality	
<ul style="list-style-type: none"> • Construction, Operation and Decommissioning 	<ul style="list-style-type: none"> • Require sustainable transport plans including, for example: the use of non-road transport where possible; the phasing of development; and robust monitoring by operators at sites to track changes throughout the lifecycle of proposed operations. • Promote the use of carbon-efficient forms of transport and construction during the power station lifecycle. • Support opportunities to offset emissions as appropriate. • Ensure that monitoring by operators accounts for the potential for cumulative impacts where the phasing between the existing power station and the new build overlaps

Potential Effects	Avoidance and Mitigation Measures – Recommendations for the IPC
	<ul style="list-style-type: none"> Dust generating activities should be placed away from sensitive locations and in zones which give maximum protection from wind.

Summary of HRA Findings and Recommendations

3.73 The HRA Screening Assessment identified the likely significant effects on sixteen European Sites as a result of impacts that may arise from the development of a nuclear power station at the nominated site at Bradwell. These effects were assessed further through the AA stage of the HRA which considered: European Site data, available environmental condition data, and the potential effects of other plans and projects ‘in-combination’, in coming to a conclusion on the likelihood that the development of the nominated site will have an adverse effect on European Site integrity.

3.74 Based on HRA experience, professional judgement, and the consultation advice received from the Statutory Consultees, it is reasonable to conclude that the suggested measures may be sufficient to avoid and/ or mitigate the adverse effects on the integrity of European Sites identified. However, the effectiveness of the measures proposed can only be ascertained with certainty through HRA at a project level, where the specific details of developments and primary data sources will be available

3.75 Taking into account the strategic nature of the plan and the information available, AA at this strategic level cannot rule out potential adverse effects on Dengie SPA/Ramsar site, Blackwater Estuary SPA/Ramsar Site Colne Estuary SPA/Ramsar site, and the Essex Estuaries SAC, through impacts on water resources and quality, air quality, habitat and species loss and fragmentation/ coastal squeeze and disturbance (see Table 5). In the wider context, adverse effects can also not be ruled out on the Mid-Essex SPA/Ramsar as a whole (for water quality impacts and impacts on birds) and the Abberton Reservoir (for impacts on birds only). With regards to the Outer Thames Estuary SPA, adverse effects on site integrity cannot be ruled out for water resources and quality, habitat and species loss and fragmentation and disturbance pathways.

Table 5: Summary of Appropriate Assessment

Potential Effects Arising from Development	European Sites at which adverse effects cannot be ruled out
Water resources and quality	<ul style="list-style-type: none"> Mid-Essex Coast SPA/Ramsar as a whole Dengie SPA/Ramsar Blackwater Estuary SPA/Ramsar Abberton Reservoir SPA/Ramsar

	<ul style="list-style-type: none"> • Essex Estuaries SAC • Outer Thames Estuary SPA
Habitat (and species) loss and fragmentation/ coastal squeeze	<ul style="list-style-type: none"> • Mid-Essex Coast SPA/Ramsar as whole • Dengie SPA/Ramsar • Blackwater Estuary SPA/Ramsar • Colne Estuary SPA/Ramsar • Abberton Reservoir • Essex Estuaries SAC • Outer Thames Estuary SPA
Disturbance (noise, light, visual)	<ul style="list-style-type: none"> • Mid-Essex Coast SPA/Ramsar as a whole • Dengie SPA/Ramsar • Blackwater Estuary SPA/Ramsar • Abberton Reservoir SPA/Ramsar • Essex Estuaries SAC • Outer Thames Estuary SPA
Air quality	<ul style="list-style-type: none"> • Essex Estuaries SAC • Dengie SPA/Ramsar • Blackwater Estuary SPA/Ramsar

3.76 To address the uncertainties inherent in a strategic level HRA, the AA has proposed a suite of avoidance and mitigation measures to be considered as part of the project level HRA (Table 4). At this stage, it is assessed that the effective implementation of these strategic mitigation measures may help to address the identified adverse effects on European Site integrity, but that more detailed project level HRA is required in order to draw conclusions on their efficacy

3.77 Further assessment supported by detailed data at project level is therefore required to determine whether nuclear power development at the nominated site at Bradwell could be undertaken without adversely affecting the integrity of the identified European Sites.

3.78 Only at the project level HRA can a conclusion of ‘no adverse effect on site integrity’ be made with any confidence.

Glossary

AA	Appropriate Assessment
AoS	Appraisal of Sustainability
APIS	UK Air Pollution Information System
DECC	Department for Energy and Climate Change
CAMS	Catchment Abstraction Management Strategy
CCW	Countryside Council for Wales
CHaMPs	Coastal Habitat Management Plans
cSAC	Candidate Special Area of Conservation
EA	Environment Agency
EIA	Environmental Impact Assessment
HRA	Habitats Regulations Assessment
ICZM	Integrated Coastal Zone Management
IPC	Infrastructure Planning Commission
LA	Local Authority
LDF	Local Development Framework
LSE	Likely Significant Effect
LTP	Local Transport Plan
MDC	Maldon District Council
NE	Natural England
NH ₃	Ammonia
N2K	Natura 2000 sites
NO _x	Nitrogen Oxide
NPS	National Policy Statement
PPP	Plans, Programmes and Projects
pSPA	Potential Special Protection Area
Ramsar	Wetland Sites designated by the Ramsar Convention
RoC	Review of Consents
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SO ₂	Sulphur Dioxide
SPA	Special Protection Area

SSA	Strategic Siting Assessment
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
WeBs	Wetland Bird Survey
WRMU	Water Resource Management Unit

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