



Galloper Wind Farm Project
Environmental Statement – Chapter 30: Cumulative Impact
Assessment
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Galloper Wind Farm Limited

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CONTENTS

	Page
30 CUMULATIVE IMPACT ASSESSMENT	1
30.1 Introduction	1
30.2 Guidance and Consultation	1
30.3 Methodology	13
30.4 Assessment of Impacts – Worst Case Definition	21
30.5 Assessment of Cumulative Impacts during the Construction and Operation Phases	22
30.6 Potential Cumulative Impacts during Decommissioning Phase	59
30.7 Summary	59
30.8 References	65

30 CUMULATIVE IMPACT ASSESSMENT

30.1 Introduction

30.1.1 This Chapter of the Environmental Statement (ES) provides information regarding the potential cumulative impacts that may arise as a result of the Galloper Wind Farm (GWF).

30.1.2 Within each technical Chapter of the ES (**Chapters 8 to 28**) a detailed assessment of the potential cumulative impacts specific to that parameter has been undertaken. It is important to note that the detail within these technical Chapters is more comprehensive than provided within this Chapter. This Chapter draws together the conclusions made on cumulative impacts within the technical Chapters and provides a holistic overview (in summarised tabular form) of these assessments for clarity of interpretation. Further details are also provided specific to the Cumulative Impact Assessment (CIA) with regard to influencing policy and guidance, consultation, methodology and approach.

30.2 Guidance and Consultation

Legislation, policy and guidance

30.2.1 As noted by the recent advice from the Infrastructure Planning Commission (IPC) in relation to the Rochdale Envelope (IPC, 2011), the CIA is fundamental to a robust assessment of the maximum adverse impact.

30.2.2 National Policy Statements (NPS) provide the primary basis on which the IPC is required to make its decisions. In preparing this Chapter the following NPS's are of relevance to the CIA:

- Overarching NPS for Energy (EN-1) (DECC 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC 2011c).

30.2.3 The specific assessment requirements for CIA, as detailed within the NPSs, are repeated in the following paragraphs. The assessment requirements suggested within the NPSs have been applied to this assessment and where appropriate the specific sections of this Chapter that address the issues are indicated. Where any part of the NPS guidance has not been followed within this assessment, it is stated after the NPS text and a justification provided.

- 30.2.4 NPS EN-1 explains that the Planning Act 2008 aims to create a holistic planning regime, so that the cumulative effects of the same project can be considered together (Section 4.9). EN-1 also highlights the importance of a CIA and states that when considering cumulative effects, information should be provided on “*how the effects of the applicant’s proposal would combine and interact with the effects of other development (including projects for which consent has been sought or granted, as well as those already in existence)*”.
- 30.2.5 Parameter specific cumulative issues raised within the NPS “Applicant’s Assessment” sections are detailed in the following paragraphs together with acknowledgement of where the requirement has been addressed, or if not, why it is not of relevance to the GWF ES.
- 30.2.6 EN-1, paragraph 4.19.12 “*Military and civil aviation; any assessment on aviation or other defence interests should also assess the cumulative effects of the project with other relevant projects in relation to aviation and defence*” (see **Section 30.5** and **Chapter 17 Military and Civil Aviation**).
- 30.2.7 EN-1, paragraph 5.7.5 “*Consider and quantify the different types of flooding (whether from natural and human sources and include joint and cumulative effects) and identify flood risk reduction measures, so that assessment are fit for the purpose of the decisions being made*” (see **Section 30.5** and **Chapter 22 Geology, Hydrogeology, Land Quality and Floor Risk**).
- 30.2.8 EN-1, paragraph 5.12.3 “*Socio-economic: cumulative effects – if development consent were to be granted for a number of projects within a region and these were developed in a similar timeframe, there could be some short-term negative effects, for example a potential shortage of construction workers to meet the needs of other industries and major projects in within the region*” (see **Section 30.5** and **Chapter 21 Socio-Economics**).
- 30.2.9 EN-3, paragraph 2.6.89 “*Intertidal habitat; where cumulative effects are predicted as a result of multiple export cable routes in the intertidal zone, it may be appropriate for applicants of various schemes to work together to ensure that the number of cable crossings are minimised and installation and decommissioning phases are coordinated in order to reasonably minimise potential disturbance*” (see **Section 30.5** and **Chapter 12 Marine and Intertidal Ecology**).
- 30.2.10 EN-3, paragraph 2.6.119 “*Subtidal habitat; where cumulative effects are predicted as a result of multiple cable routes in the subtidal zone, it may be appropriate for applicants of various schemes to work together to ensure that the number of cable crossings are minimised and installation and decommissioning phases are coordinated in order to reasonably minimise potential disturbance*” (see **Section 30.5** and **Chapter 12 Marine and Intertidal Ecology**).

- 30.2.11 EN-3, paragraph 2.6.92 “*Marine mammals; the assessment of the effects on marine mammals should include the duration of the potentially disturbing activity including cumulative effects with other plans or projects*” (see **Section 30.5** and **Chapter 14 Marine Mammals**).
- 30.2.12 EN-3, paragraph 2.6.164 “*Shipping and navigation; the navigation risk assessment will necessitate cumulative risks associated with the development and other developments (including other wind farms) in the same area of sea*” (see **Section 30.5** and **Chapter 16 Shipping and Navigation**).
- 30.2.13 EN-3, paragraph 2.6.215 “*Seascape and visual impact assessment; where appropriate, cumulative SVIA should be undertaken in accordance with the guidance on cumulative assessment outlined in EN-1 (DECC, 2010b)*” (see **Section 30.5** and **Chapter 20 Seascape, Landscape and Visual Character**).
- 30.2.14 EN-5, paragraph 2.8.2 “*Seascape and visual impact assessment; cumulative landscape and visual impacts can arise where new overhead lines are required along with other related developments such as substations, wind farms and/or other new sources of power generation*”. (see **Section 30.5** and **Chapter 20 Seascape, Landscape and Visual Character**).
- 30.2.15 The following guidance documents have also been used within the relevant technical Chapters of the ES to inform the CIA:
- Guidance on the Assessment of Effects on the Environment and Cultural Heritage from Marine Renewable Developments. Produced by: The Marine Management Organisation (MMO), Joint Nature Conservation Council (JNCC), Natural England, the Countryside Council for Wales (CCW) and Centre for Environment, Fisheries & Aquaculture Science (Cefas) (MMO *et al.*, In draft, December, 2010);
 - Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Draft for consultation. Cefas. Report reference: ME5403 – Module 15. Issue date: 10th March 2011 (Cefas, 2010); and
 - Guidelines for Ecological Impact Assessment in Britain and Ireland, Marine and Coastal (Institute for Ecology and Environmental Management (IEEM, 2010);
 - Guidelines for Ecological Impact Assessment in the UK: Terrestrial, Freshwater and Coastal Environments (Institute for Ecology and Environmental Management (IEEM, 2006);
 - Developing Guidance on Ornithological Cumulative Impact Assessment for Offshore Wind Farm Developers (Collaborative Offshore Wind Research Into The Environment (COWRIE), 2009);

- Guidelines “Methodology for Assessing the Marine Navigational Safety Risks of Offshore Windfarms”, Version Date: 7th September 2005 (DECC, 2005);
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (COWRIE, 2008);
- The Cumulative Effects of Wind Farms, (SNH, 2005); and
- Guidelines for Landscape and Visual Impact Assessment (IEMA, 2002).
- Discussion Paper on the Assessment of Cumulative Effects for Offshore Wind in UK Waters (The Crown Estate Round 3 Strategic Workstreams 30th July 2011).

Consultation

30.2.16 As part of ongoing consultation, the following key stakeholders were invited to respond to a scoping document produced as part of the Environmental Impact Assessment (EIA) process (Gallop Wind Farm Limited (GWFL), 2010). **Table 30.2** summarises issues relevant to the CIA that were highlighted by the consultees in the IPC Scoping Opinion (IPC, 2010) and from the formal Section 42 and 47 consultation process, as well as any further consultation which has been undertaken specific to the CIA. The table also indicates which sections of the ES address each issue.

Table 30.1 Summary of consultation and issues in relation to CIA

Date	Consultee	Summary of issue	Section where addressed
09.2009	Eastern Joint. And Kent and Essex, Sea Fisheries Committee	Concerned about the cumulative impacts of GWF and other projects on fisheries.	Section 30.5 and Chapter 15 Commercial Fisheries (Section 15.10)
07.2010 and 02/2011	Chamber of Shipping (Scoping Opinion)	Concerned about cumulative impacts between GWF and other project (specifically East Anglia Offshore Wind Farm Zone) in regards to shipping and navigation in the area.	Section 30.3, 30.5 and Chapter 16 Shipping and Navigation (Section 16.10)
01.2010 and 07.2010	JNCC and Natural England (Scoping Opinion)	Ornithological CIA should encompass Round 2.5 projects, but inclusion of Round 3 is still questionable due to lack of suitable data. Subsequent consultation established that Round 2.5 and 3 projects would be excluded from the ornithological CIA based on current timeframes.	Section 30.3, 30.5 and Chapter 11 Offshore Ornithology (Section 11.10)
08.2010	IPC (Scoping Opinion)	Cumulative impacts require assessment both on and offshore, including Galloper, Greater Gabbard and Sizewell Power Station proposals.	Section 30.5
08.2010	IPC (Scoping Opinion)	The GWF CIA should consider National Grid works.	Section 30.5
	Suffolk Coastal District Council (SCDC) (Scoping Opinion)		

Date	Consultee	Summary of issue	Section where addressed
08.2010	IPC (Scoping Opinion)	CIA should consider aggregates with regard to hydrodynamic impacts.	Section 30.5 and Chapter 9 Physical Environment (Section 9.10)
	JNCC (Scoping Opinion)		
08.2010	Norfolk County Council (Scoping Opinion)	CIA of visual impacts should consider a) operational wind farms, b) permitted wind farms in the area and c) development proposals likely to come forward.	Section 30.5 and Chapter 20 Seascape, Landscape and Visual Character (Section 20.11)
08.2010	Norfolk County Council (Scoping Opinion)	GWF to consider cumulative impact on the grid network from any existing or proposed wind farms / turbines in the area.	Section 30.5
08.2010	Norfolk County Council (Scoping Opinion)	CIA for ecological aspects must consider projects in the past, present and foreseeable future. Projects incorporated should not only be other wind farms but also other types of projects.	Section 30.5 and Chapter 23 Terrestrial Ecology (Section 23.10)
08.2010	JNCC and Natural England (Scoping Opinion)	CIA should consider the Greater Gabbard Offshore Wind Farm (GGOWF), other constructed wind farms in the Thames Strategic Area (SA), aggregate activity and Phase I of London Array. Development within Zone 5, and extensions to Thames SA projects to be included only if project timetable slips sufficiently for there to be sufficient information on these proposed developments.	Section 30.5
08.2010	JNCC and Natural	London Array Phase II, Round 2.5 and 3 projects should be included in CIA if sufficient	Section 30.5

Date	Consultee	Summary of issue	Section where addressed
	England (Scoping Opinion)	information on these projects becomes available within GWF project timeframe.	
08.2010	Trinity House (Scoping Opinion)	Concerned about the proximity of the Norfolk (East Anglia) Round 3 Offshore Wind Farm zone and believe that as a result of the Scoping Report being submitted for Project ONE that it should be included within the CIA.	Section 30.5 and Chapter 16 (Section 16.10)
08.2010	English Heritage (Scoping Opinion)	CIA must consider both GWF and GGOWF.	Section 30.5
08.2010	MMO and Cefas (Scoping Opinion)	GWF should consider GGOWF, London Array, Gunfleet Sands I & II, Thanet Offshore Wind Farm, and aggregate dredging in the area. However, note is made that this list is not considered comprehensive.	Section 30.5
08.2010	IPC (Scoping Opinion)	<p>Other major development in the area should be identified beyond the proposal itself including all the associated development. The Commission recommends that this should be identified through consultation with the local planning authorities on the basis of major developments that are:</p> <ul style="list-style-type: none"> • Built and operational; • Under construction; • Permitted application(s), but not yet implemented; • Submitted application(s) not yet determined and if permitted would affect the proposed development in the scoping study; and 	Section 30.5

Date	Consultee	Summary of issue	Section where addressed
		<ul style="list-style-type: none"> Identified in the Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited. 	
07.03.2011	IPC	The proposed list of plans and project to be assessed as part of the cumulative assessment were discussed. The IPC advised the applicant to adopt a precautionary approach where all projects registered with IPC, or relevant planning authority, should be considered based on what is known about these projects and the information that is available at the time of finalising the Environmental Statement (ES).	Section 30.5
19.05.2011	CEMEX UK Marine Ltd	Concern regarding the potential cumulative impact on the Shipwash 507/5 Application Area, located within the GWF export cable corridor. Potential implications for their operations as a result of the GWF cable being situated to the north of the area and the GGWF cables situated to the south.	Section 30.5, Chapter 16 (Section 16.10) and Chapter 18 Other Human Activities (Section 18.10)
19.07.2011	MMO (Section 42)	Concern regarding intensity of (piling) activities of surrounding projects and the production of figures to display areas of (noise) intensity.	Section 30.5
08.2011	MMO (Section 42)	The Galloper site is well within a high intensity sole spawning area and cumulative impacts to sole spawning should be fully considered in the EIA.	Section 30.5 and Chapter 13 Fish and Shellfish Resource (Section 13.10)
08.2011	MMO (Section 42)	Insufficient consideration is provided throughout the PER regarding the cumulative impact of repeated hammer blows necessary to erect each foundation and the knock on effect that this evokes on impact range maps.	Section 30.5 and Chapter 13 (Section 13.10)

Date	Consultee	Summary of issue	Section where addressed
29.07.2011	JNCC (Section 42)	Recommend the CIA is conducted using a receptor lead approach whereby the potential for CIA with respect to the sensitivity of each receptor is assessed.	Section 30.3
29.07.2011	JNCC (Section 42)	Consideration should be given to any species occurring at a regionally important level (e.g. herring gull). The assessment should distinguish between London Array I and II (e.g. red-throated diver displacement).	Section 30.5 and Chapter 11 (Section 11.10)
29.07.2011	JNCC (Section 42)	Concerned specific reports had not been assessed or taken into account including the post-construction monitoring report from Kentish Flats. As well as interim datasets from East Anglia Offshore Wind Ltd. (EAOW).	Section 30.5 and Chapter 11 (Section 11.10)
29.07.2011	JNCC (Section 42)	Concern that if timescales for GWF proposal slip for any reason that the assessment encompasses all the information available to inform the assessment	Section Table 30.3
29.07.2011	JNCC (Section 42)	Concern over the displacement of birds, especially Red Throated Divers due to construction, boat traffic and associated activities. In terms of red-throated diver, we question the conclusion made that 'no overall significant cumulative impacts would be anticipated on the regional population' this does not appear to be supported by the evidence presented.	Section 30.5 and Chapter 11 (Section 11.10)
29.07.2011	JNCC (Section 42)	Individually Wind Turbine Generators (WTG) may not pose a significant barrier to bird migration, however, it is worth noting that at a cumulative level, developments may cause an impact.	Section 30.5 and Chapter 11 (Section 11.10)

Date	Consultee	Summary of issue	Section where addressed
29.07.2011	JNCC (Section 42)	It is probably most appropriate to consider the potential of a barrier effect on marine mammals arising as a result of this development cumulatively.	Section 30.5 and Chapter 14 (Section 14.10)
29.07.2011	JNCC (Section 42)	<p>Overlap between GWF and London Array Phase II noise is recognised. Further information should be presented in relation to any planned or potential mitigation that could be agreed with the developers of London Array to address this risk.</p> <p>The full cumulative noise assessment should be presented in the final ES.</p> <p>Further information as to how the conclusion has been reached that cumulatively the effects of construction noise are likely to be minor to negligible for the regional population of harbour porpoise.</p>	Section 30.5 and Chapter 14 (Section 14.10)
08.2011	Eastern Inshore Fisheries and Conservation Agency (IFCA) (Section 42)	Appropriate monitoring regime needed for longer term cumulative and in-combination impacts and assessment of these impacts should not be limited to application and construction periods but should be considered as part of ongoing monitoring to be effective.	Section 30.5
08.2011	National Fishermens Federation Organisation (NFFO) (Section 42)	<p>Cumulative effects of other offshore developments in the near vicinity must be taken under consideration, displacement have direct impact on numbers of vessels in the proposed area.</p> <p>Overlap of developments (East Anglia ONE, Kentish Flats Extension and London Array Phase II) will provide further displacement and will lead to a social and economic impact</p>	Section 30.5 and Chapter 15 Commercial Fisheries (Section 15.10)

Date	Consultee	Summary of issue	Section where addressed
		and sever financial loss.	
08.2011	East Anglia Offshore Wind (EAOW) (Section 42)	There is limited info in the PER regarding the cumulative impact of underwater noise and its effects on sensitive species and populations. EAOW intend to commence construction in 2015 followed by a continuous programme of construction for future projects within the zone.	Section 30.5 and Chapter 14 (Section 14.10)
08.2011	RSPB (Section 42)	CIA is incomplete, particularly in regard to the lack of CRA but also in respect of justification for exclusion of specific sites and species from CIA. For example, with respect to sites within the foraging and migratory range of gannet, it is not clear why the Round 2 sites Dudgeon and Docking Shoal, which both contribute to cumulative mortality for gannet, have been excluded.	Section 30.5 and Chapter 11 (Section 11.10)
08.2011	Maritime and Coastguard Agency (MCA) (Section 42)	The cumulative risk needs to encompass all potential developments, at whatever stage of planning concept or operation. Therefore the CIA needs to adopt the Rochdale envelope approach and include the full development area for the East Anglia project.	Section 30.5, Chapter 16 (Section 16.10)
08.2011	Britannia Aggregates Ltd and Volker Dredging Ltd (Section 42)	Cumulative impacts of wind farm developments in regard to the navigational safety aspects of compressed shipping activity should be given consideration as well as the socio-economic impacts of increased shipping times.	Section 30.5, Chapter 16 (Section 16.10)
08.2011	Royal Yachting Association (RYA) (Section 42)	The impact of a smaller navigational passage between the wind farm and East Anglia ONE should the south west corner of East Anglia ONE be developed on commercial and recreational vessels is a significant cumulative impact and should be considered within the	Section 30.5, Chapter 16 (Section 16.10)

Date	Consultee	Summary of issue	Section where addressed
		Navigational Risk Assessment.	
08.2011	Chamber of Shipping (Section 42)	<p>There is a need to consider the cumulative impacts of developments within the East Anglia Round 3 Zone, particularly in the south-west corner of the Zone; such a scenario would impact heavily upon the space available for vessels operating east-west along the proposed northern boundary of Galloper and therefore must be considered as part of a comprehensive Navigational Risk Assessment (NRA).</p> <p>We request that further work (to that detailed in the PER) on re-routing options is undertaken in order to assess the impacts fully.</p>	Section 30.5, Chapter 16 (Section 16.10)

30.3 Methodology

- 30.3.1 Cumulative impacts may occur where impacted receptors (from the project in isolation) also have the potential to be impacted by other existing, consented and or proposed development / activity.
- 30.3.2 Where 'no impact' has been predicted for an impact associated with the proposed GWF project in isolation, it has been considered that there is no potential (through a lack of pathway) for a cumulative impact to manifest.
- 30.3.1 For descriptive ease (based on the nature of impacts of the proposed development), the potential cumulative impacts associated with the proposed GWF development are considered at the following levels:
- Interactions with other wind farms; and
 - Interactions with other regulated activities occurring in the region.
- 30.3.2 The determination of what constitutes relevant projects and or plans has been informed through a receptor lead process, where the extent, duration and type of impact has, where possible, been considered against the characteristics of the receptor. For example, some widely-ranging migratory species that originate from SPAs further north, such as gannet, may pass through the GWF site and encounter a number of other East coast wind farms along the way. Therefore, for gannet species (as an example), additional offshore wind farm projects along the east coast of Britain that are within its foraging range (from the SPA), are considered (for collision risks and barrier effects only) (see **Section 11.10** of **Chapter 11** for detail).
- 30.3.3 The detailed approach to this for each parameter is provided within the individual technical Chapters of this ES.
- 30.3.4 Further to this approach, consideration of relevant projects, plans and activities has been informed by the extensive consultation carried out with stakeholders throughout the project (as detailed in **Table 30.2** and **Chapter 7 Consultation**).
- 30.3.5 GWFL has judged that the projects that should be considered within the scope of this CIA are as follows (see **Figure 30.1** for the geographical representation of the projects).

Offshore

Other wind farm infrastructure

- GGOWF;
- Thanet Offshore Wind Farm;
- London Array Offshore Wind Farm – Phase I and II;
- Gunfleet Sands I, II and III;

- East Anglia ONE;
- Kentish Flats Offshore Wind Farm;
- Kentish Flats Extension Wind Farm; and
- Scroby Sands onshore wind farm (assessed for ornithology only).

Other regulated activities

- Aggregate Extraction Areas 498 (Volker Dredging Ltd and Britannia Aggregates Ltd) and Shipwash 507/5 (CEMEX UK Marine Ltd).

- 30.3.6 Within the Outer Thames Estuary there is potential for there to be up to six other offshore wind farms and associated extensions either in construction or operation during the GWF lifetime (based on information available to date).
- 30.3.7 The greatest cumulative impacts for many offshore receptors will come from these existing or planned wind farms. **Table 30.3** provides information on the planned construction period for these offshore projects and distances from the GWF.
- 30.3.8 It is noted that the East Anglia Offshore Wind Farm Zone will be developed as a number of individual wind farms (or projects), each of which will require the appropriate statutory consents and approvals (EAOW, 2010). At the time of writing (of this ES) the identification of these projects is ongoing (as part of the Zone Appraisal and Planning (ZAP) process) with only one project (East Anglia ONE) identified to date. Therefore, as no project information is available with regard to the detail of this future development, meaningful quantified assessment is not possible at this juncture.
- 30.3.9 The current information available (at the time of writing) for East Anglia ONE is principally contained within the project's Scoping Report (EAOW, 2010 and 2011). Data collection to inform the EIA is being undertaken for East Anglia ONE and much of this is not currently publicly available. Therefore, the level of assessment able to be made with regard to this project is reflective of the limited project information available.
- 30.3.10 Other developments and activities within the region such as Aggregate Extraction Areas 498 and Shipwash 507/5 and commercial fishing activity will also contribute to the cumulative impacts on some receptors. Any additional projects / activities that have been assessed are clearly outlined in the relevant sections.

Table 30.2 Distances (km) of Outer Thames wind farm sites (from GWF) and their status

Project details	Status as at October 2011	Distance from GWF (excluding cable corridor) (km)	Predicted construction period ¹
GWF	EIA Stage	N/A	A 56 month offshore construction window notionally assuming an earliest Q2 or Q3 2015 commencement
GGWF	In construction	0	2009 - 2012
East Anglia ONE	Zonal Assessment and Scoping for East Anglia ONE	25.2 Note; export cable routes from GWF and East Anglia ONE are likely to intersect.	East Anglia ONE to commence at earliest in 2015
London Array I	In construction	24.3	2011 - 2012
London Array II	Consented	15.1	Expected 2014 - 2015
Thanet	Operational	37	Operational
Gunfleet Sands I	Operational	42.6	Operational
Gunfleet Sands II	Operational	40	Operational
Gunfleet Sands III – Demonstration project	Consent submitted	46.4	2011 - 2012
Kentish Flats	Operational	61.6	Operational
Kentish Flats Extension	EIA Stage	61.5	2013 -2014

¹ Construction times supplied via www.4coffshore.com and associated web links to site pages

Project details	Status as at October 2011	Distance from GWF (excluding cable corridor) (km)	Predicted construction period ¹
Scroby Sands	Operational	70	Operational

Onshore

Other wind farm infrastructure

- GGWF substation.

Other regulated activities

- Decommissioning of Sizewell A nuclear power station;
- Sizewell B Nuclear Power Station;
- Sizewell B Dry Fuel Store; and
- Sizewell C proposed nuclear power station development.

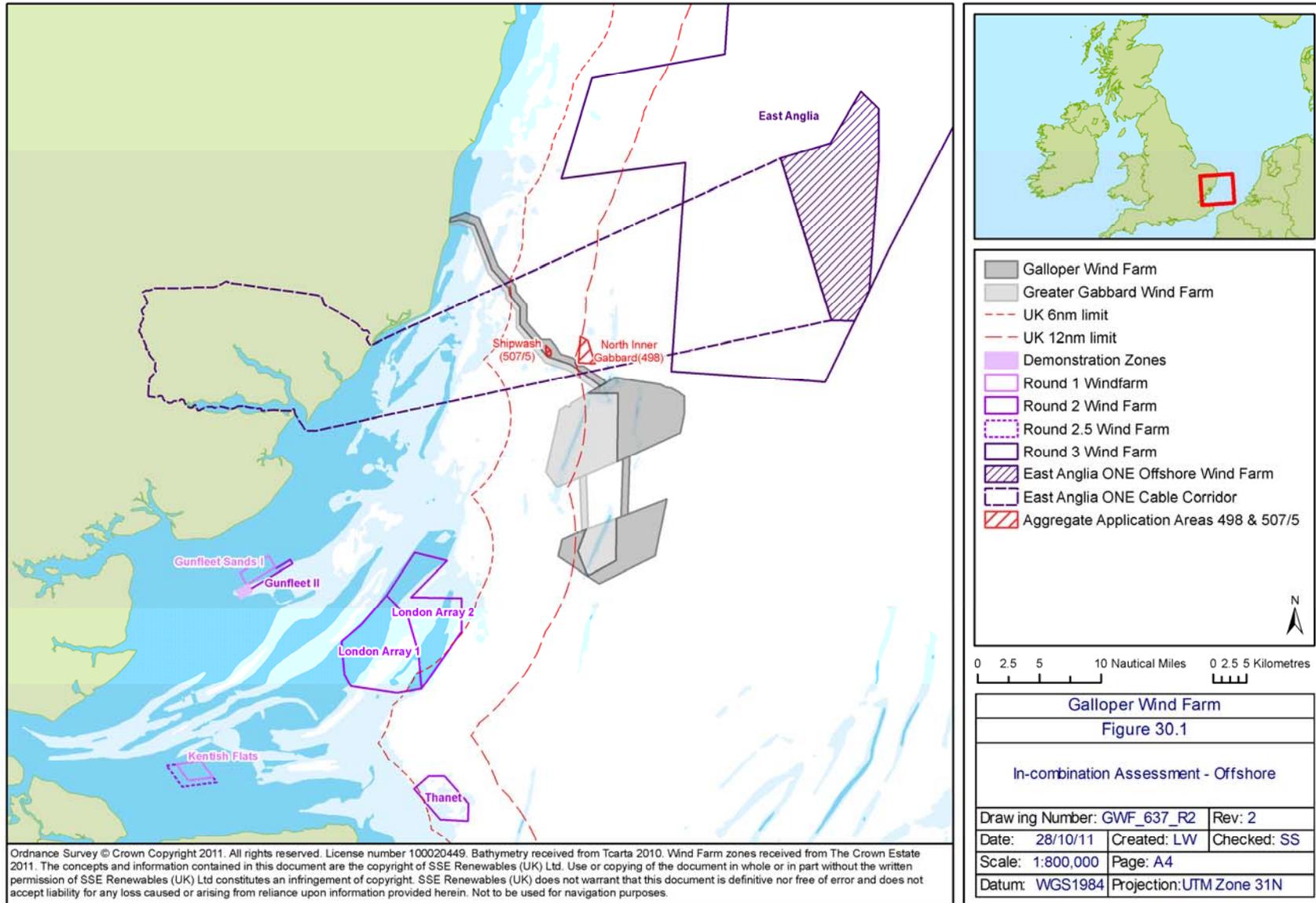
30.3.11 Whilst the Nominated Site Area for Sizewell C is known, further details of this proposed development have not been released. At this point in time it is expected that the earliest construction may begin on Sizewell C would be approximately 2016/2017. There would be a potential for an overlap of construction periods if GWF construction extended into 2017. As details for the proposed Sizewell C development are not available, it has not been possible to quantify the potential for cumulative impacts within the assessment for GWF. However, where a potential impact is anticipated, it is referred to within the assessment tables contained within this Chapter.

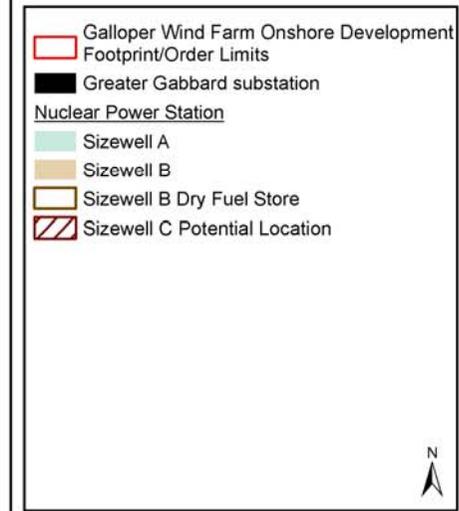
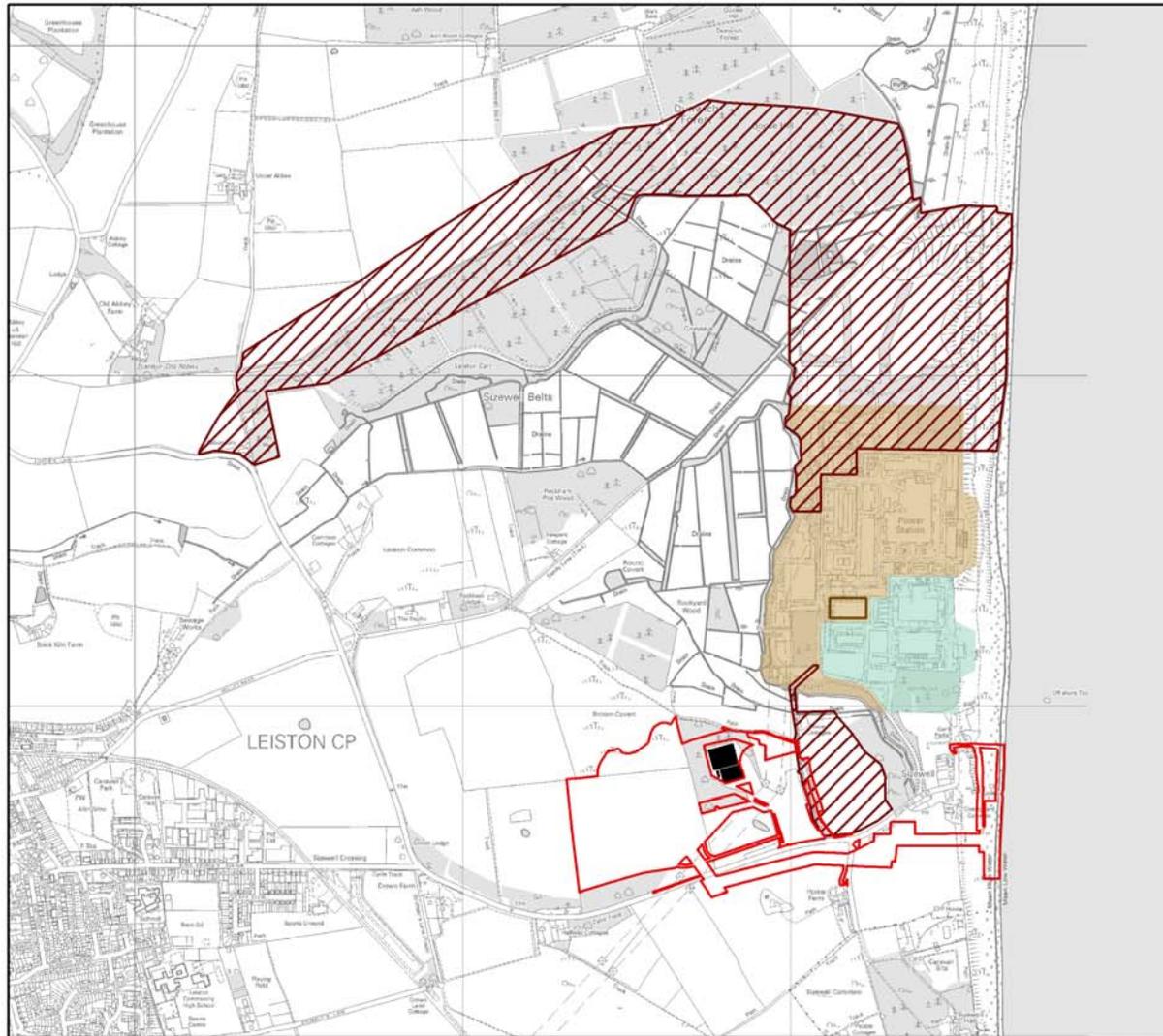
30.3.12 In addition, activities at the Sizewell energy installations (Sizewell A and B nuclear power stations) could contribute to cumulative impacts. **Table 30.4** provides information on the planned construction period for the onshore projects and distances from the GWF.

Table30.4 Distances (km) of onshore wind farm and other activities (from GWF) and their status

Project details	Status as at May 2011	Distance from GWF (excluding cable route) (km)	Predicted activity period
GWF	EIA Stage	N/A	2014 - 2016
GGWF	In construction	0	2009 - 2011

Project details	Status as at May 2011	Distance from GWF (excluding cable route) (km)	Predicted activity period
Sizewell A Decommissioning	Decommissioning underway	0.6	Demolition of buildings programmed to be complete by 2019. Site will not be fully decommissioned until 2100
Sizewell B	Operational	0.8	Operational until at least 2035
Sizewell B Dry Fuel Store	Planning consent received	0.6	Construction expected 2012 - 2013
Sizewell C	Site nominated	1.2	Construction estimated to be 2016/2017 to 2021





Galloper Wind Farm
Figure 30.2

In-combination Assessment - Onshore

Drawing Number: GWF_655_R1		Rev: 1
Date: 28/10/11	Created: LW	Checked: JA
Scale: 1:20,000	Page: A4	
Datum: OSGB36	Projection: British National Grid	

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Approach to CIA

30.3.13 The scope of the CIA (in terms of relevant issues and projects) has been established with consultees during the consultation process.

30.3.14 As discussed in **Chapter 4 EIA Process**, the assessment of cumulative impacts has been carried out in accordance with relevant guidance for each EIA parameter under investigation (where available). However, during Section 42 consultation, the statutory consultees indicated that there would be value in also adopting the approach taken in the Norman *et al.*, (2007) guidance, where relevant, although it will inevitably need to be adapted to the relevant EIA parameter. Therefore, to ensure consistency within the ES an approach which has been adapted from Norman *et al.*, (2007) has been taken with regard to assessing cumulative impacts. With regard to timescale there are four components for consideration:

- Past (historic) changes in the parameter;
- Impacts currently affecting the parameter;
- Impacts that will inevitably occur to the parameter because the factor (project / activity) is now operating or a particular project has recently been constructed but the effects of that factor are not yet manifested in the measurements made to define the baseline conditions; and
- Predicted impacts that would derive from the proposed wind farm, other projects that have been consented or are reasonably foreseeable and other changes in un-consented activities that can be predicted to occur.

30.3.15 The CIA is an iterative process that was continually developed as the EIA was finalised. This Chapter presents a summary of the findings of the studies and assessments informed from each technical Chapter. The overall approach to the CIA included the following activities:

- Desk top identification of other projects and activities for which there is the potential for a cumulative impact with the GWF;
- Summary of the identified projects and available data, confirming those projects and topic impacts for which detailed CIA is supported;
- Evaluation of potential impacts on those receptors identified within the ES to establish whether pathways exist for cumulative impacts with other projects;
- Collection and assessment of the information available to support the CIA;
- Detailed CIA by each relevant parameter (as represented within the ES), where the level of collected information supports this (the assessment will follow the same methodology as that applied to the EIA and presented in the ES); and

- In instances where a quantitative CIA is not possible, qualitative discussion of potential impacts making use of available information has been undertaken.

- 30.3.16 Cumulative impacts associated with the construction, operation and decommissioning of the proposed GWF development have been assessed in accordance with the EIA methodology detailed in **Chapter 4**, where possible. The details provided in **Chapter 5 Project Details** have been used to establish a realistic worst case development scenario for CIA.
- 30.3.17 It should be noted that the ES has assessed all potential cumulative impacts upon the identified receptors. The assessment focuses on the receptors where it has been identified that a cumulative impact will be an issue. The assessment is detailed in **Tables 30.6** and **30.7** and the potentially significant impacts are summarised in **Table 30.8**.
- 30.3.18 Each receptor and potential impact has been identified, and a summary of the potential cumulative impact has been detailed. The cumulative impact has been highlighted using a ranking system (**Table 30.5**) depending on its potential significance (negligible to major adverse/beneficial). Where no impacts are anticipated “*no significant impacts likely*” is stated. For a number of receptors, the assessment of cumulative impacts for a certain activity is not applicable. For example, if no pathway for cumulative impacts exists between a potential impact at GWF (i.e. loss of subtidal habitats) and another activity or project (i.e. GGOWF substation) in this case the GGOWF substation will have no impact upon subtidal habitats due to its location being onshore). In such instances the letters N/A (Not Applicable) have been placed under the relevant heading.

Table 30.5 Ranking system used for the assessment of cumulative impacts.

Colour	Cumulative impact significance
No highlight	No significant impact likely
Green highlight	Likely negligible impact
Yellow highlight	Likely minor impact
Orange highlight	Likely moderate impact
Red highlight	Likely major impact

30.4 Assessment of Impacts – Worst Case Definition

- 30.4.1 The assessment of impacts within each technical Chapter includes the identification of a realistic worst case design scenario relevant to the particular receptor being assessed. Therefore, for the purpose of the CIA, the realistic worst case scenario, taking into consideration the range options

currently being assessed, is in line with that identified for each receptor impact within the relevant technical Chapters.

30.5 Assessment of Cumulative Impacts during the Construction and Operation Phases

- 30.5.1 **Tables 30.6** and **30.7** provide an assessment of the potential cumulative impacts with other wind farms and regulated activities (identified in Section 30.3) during the construction and operation phase of the GWF project, respectively. The potential for cumulative impacts associated with the decommissioning is discussed in Section 30.6.
- 30.5.2 As a result of the nature of the ornithological assessment, the cumulative assessment on birds, including detail on the projects and activities assessed, is summarised in a separate section (Section 30.5.4-30.5.9).

Table 30.6 Potential cumulative impacts of GWF on receptors during the construction phase (with the exception of Chapter 11)

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
Nature Conservation Designations (see Section 8.10). Full details on the assessment of European designated sites is provided in the GWF HRA Report, and should be referred to for further information.									
Impact on the qualifying features and supportive habitats of: Alde-Ore Estuary SPA The Sandlings SPA Outer Thames SPA Flamborough Head and Bempton Cliffs SPA Minismere to Walberswick SPA Orfordness to Shingle Street Special Area of Conservation (SAC) Alde, Ore and Butley Estuaries SAC Minsmere to Walberswick Heaths and Marshes SAC Margate and Long Sands dSAC	The GGOWF will be operational by 2012 so there is no route for cumulative impacts from simultaneous construction activity.	All other wind farms that have the potential to be in construction at the same time as GWF (namely, London Array Phase II and East Anglia ONE) are situated too far away from GWF for potential interaction of construction related activities to occur. Therefore, no pathway for cumulative impacts from simultaneous construction activity exists with these projects.				Potential for cumulative impacts on designations from dredging activities and installation of foundations at GWF is highly unlikely given the temporary nature of the works and the localised nature of the activity.	The GGOWF will be operational by 2012 so there is no route for cumulative impacts from simultaneous construction activity. In addition the impacts associated with the onshore construction works will be of a localised nature.	No cumulative impacts are anticipated on the European designated sites assessed, this is primarily as a result of the location of the proposed Sizewell projects (being out with the GWF site) and there being little or no overlap in the construction timetables. In addition the impacts associated with the onshore construction works will be temporary and localised.	
	No likely significant impact						No likely significant impact	No likely significant impact	
Impact on statutory and non statutory sites of relevance to the onshore development	N/A						The GGOWF will be operational by 2012 so there is no route for cumulative impacts from simultaneous construction activity. In addition the impacts associated with the onshore construction works will be of a localised nature.	No cumulative impacts are anticipated the sites assessed, this is primarily as a result of the location of the proposed Sizewell projects (being out with the GWF site), and there being little or no overlap in the construction timetables. In addition the impacts associated with the onshore construction works will be of a localised nature.	

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
	N/A							No likely significant impact	No likely significant impact
Impact on the landscape associated with the Suffolk Coasts and Heaths Area of Outstanding Natural Beauty (AONB) (associated with offshore development)	During the construction phase the primary potential effects as a result of the offshore aspects of the development will be associated with the increased activity of construction vessels travelling to the offshore site from local ports, the presence of jack-up barges and the progressive construction of the WTGs. The presence of the construction vessels and the associated marine and intertidal activity is considered to be relatively insignificant due to the existing baseline of significant marine activity in the study area; therefore there is no pathway for cumulative impacts on landscape designations to occur.							N/A	N/A
	No likely significant impact							N/A	N/A
Impact on remaining statutory and non statutory sites of relevance to the offshore development	No impacts have been identified for the remainder of these sites; as a result there is no pathway for cumulative impacts on statutory and non statutory designated sites of relevance to the offshore development.							N/A	N/A
	No likely significant impact							N/A	N/A
OSPAR Habitats and Species	No significant impacts have been identified for OSPAR Habitats and Species, therefore no significant cumulative impacts are anticipated for any of the species and habitats identified.							N/A	N/A
	No likely significant impact							N/A	N/A
Physical Environment (see Section 9.10 for further detail)									
Effects on the existing tidal, wave and sedimentary regimes including increased suspended sediment in the water column	The GGOWF will be operational by 2012 so there is no route for cumulative impacts from simultaneous construction activity.	Effects on wave and tidal regimes from the GWF and other wind farm developments have been predicted to be localised (near field and within the wind farm site) in nature. Therefore, no potential for cumulative effects to arise exists. All other wind farms that have the potential to be in construction at the same time as GWF (namely, London Array Phase II and East Anglia ONE) are situated too far away from GWF for potential interaction of construction related sediment plumes to occur. Therefore, no pathway for cumulative impacts from simultaneous construction activity exists with these projects.				Potential for sediment plumes overlapping from dredging activities and installation of foundations at GWF is highly unlikely given the temporary nature of the works and localised extent of any plumes from GWF activity. Furthermore, baseline suspended sediment concentrations are relatively high and there are a lack of sensitive receptors in proximity to these projects. Therefore		N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
							significant cumulative effects with aggregate dredging would be considered unlikely.		
	No likely significant impact	No likely significant impact					No likely significant impact	N/A	N/A
Marine Water and Sediment Quality (see Section 10.10 for further detail)									
Deterioration in water and / or sediment quality due to accidental spillage of construction materials	No significant impacts on marine water and sediment quality have been identified that have the potential to extend sufficient distance to result in potential cumulative impacts with other wind farm development (both those undergoing construction and those in operation).						Construction activity within the cable corridor will result in small scale and localised effects on suspended sediment concentrations and therefore even if activities occurred simultaneously, or concurrently, construction at GWF is unlikely to act cumulatively with aggregate extraction to impact upon marine water and sediment quality. In addition, there is no evidence to show that contaminant concentrations at the site are at levels which have the potential to significantly effect the marine environment Significant cumulative impacts are not anticipated*	N/A	N/A
	No likely significant impact						No likely significant impact *GWFL are in negotiations with Cemex and The Crown Estate and no further	N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
							information is available at the time of writing (October 2011) in regard to the plans for aggregate extraction at Area 507/5		
Marine and Intertidal Ecology (see Section 12.10 for further detail)									
Loss of subtidal habitat	The GGOWF ES predicted a loss of up to 0.33km ² (approximately 0.23%) of seabed within the GGOWF project boundary (147km ²). When this is added to the predicted losses of the GWF project (0.37km ² or 0.17% based on project boundary of 222km ²), the total loss over both sites will be 0.7km ² , of a total of 369km ² covered by the two sites (approximately 0.19% of the combined area). Given the ubiquity of the benthic communities across the southern North Sea significant cumulative impacts are not anticipated.	Habitats and species identified at GWF are widespread throughout the Thames Estuary and wider southern North Sea and show a degree of similarity with those recorded at other wind farm sites in the region. The majority of these habitats and species have a low sensitivity and high recoverability. <i>Sabellaria spinulosa</i> is of higher sensitivity however this species was not found in dense aggregations and is also not limited to specific areas. The total percentage loss of subtidal habitat as a result of GWF is very low, and is likely to be in line with losses experienced / predicted at other wind farm sites. Subsequently the magnitude of the potential impact is likely to be low and the overall impact is not anticipated to be significant.					Species present are in general considered to be ubiquitous and of low sensitivity, in line with the GWF surveys (with the exception of <i>S. spinulosa</i> which has not been found in dense aggregations, limiting the sensitivity of this species). The low magnitude and sensitivity will result in a cumulative impact which is not anticipated to be significant.	N/A	Sizewell Power Station has localised thermal plumes associated with the outlet pipes. Their impact footprint would not overlap with that of the GWF cable works and therefore, potential for cumulative impact is considered unlikely. The species and habitats identified at the GWF landfall site are of low sensitivity, this is likely to be similar at the Sizewell site. There is potential for expansion of Sizewell C and like GWF, the impacts will be localised and unlikely to interact with subtidal habitats impacted by the GWF.
	Likely negligible impact	No likely significant impact					No likely significant impact	N/A	No likely significant impact
Physical disturbance from construction vessels and cable installation	The impact will be highly localised and temporary. The habitats in the area have a low sensitivity and high recoverability. Any sensitive habitat (i.e.	Habitats and species identified at GWF are widespread throughout the Outer Thames Estuary and are similar to those found at other regional offshore wind farm sites. The majority of these habitats and species have a low sensitivity and high recoverability. <i>S. spinulosa</i> reef is of higher sensitivity however this species was not found in dense aggregations and is also not limited to specific areas. The impact will be highly localised and temporary. It is not considered that there is the potential for significant cumulative impact given the negligible impact from GWF.						N/A	The species and habitats identified at the GWF landfall site are of low sensitivity and high recoverability, this is likely to be similar at the Sizewell site. There is potential for expansion of

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
	<i>S. spinulosa</i> reef) would be avoided by micro-siting and best practice implemented for installation activities.								Sizewell C, however coastal works, like GWF, are likely to be localised and unlikely to interact with the habitats impacted by GWF.
	Likely negligible impact	No likely significant impact						N/A	No likely significant impact
Indirect impacts due to increases suspended sediment	Evidence provided in Chapter 9 indicates that indirect construction impacts from suspended sediment increases would be localised to the immediate vicinity of the project. These would be minor in relation to background conditions, temporary and limited to the areas of cable installation. Potential pathways for indirect impacts between the GWF project and other activities are unlikely to exist. In addition, were any pathways to develop (such as through overlapping activity with aggregate dredging) the habitats and species present have a low sensitivity and high recoverability, which would mean that any cumulative impact would be unlikely to be of significance. Impacts will be temporary, small scale and localised for GWF and this will be the case with other projects. Given the distance between GWF and many of these projects there will be no spatial overlap between increased concentrations of suspended sediments. There will however be a potential additive impact across the region, but given the magnitudes of impact involved and the low sensitivity of most habitats and species within the regional benthic community, the cumulative impact would be negligible.							N/A	Impacts associated with the intertidal environment will be temporary, small scale and localised, in addition the work at Sizewell is not anticipated to have any significant effect on suspended sediment levels.
	Likely (regional) negligible impact							N/A	No likely significant impact
Fish and Shellfish Resources (see Section 13.10 for further detail)									
Potential for cumulative underwater noise impacts to affect fish, especially in relation to spawning activities or spawning grounds, is dependent on two or more projects undertaking pile driving simultaneously or two or more projects undertaking pile driving activities over consecutive spawning periods, as detailed below.									
Underwater noise (concurrent impact)	The final monopiles were installed in 2010, therefore no route for concurrent cumulative impacts.	No overlap in timing of piling. Kentish Flats Extension construction to take place from 2013 to 2014, GWF piling to commence 2015.	There is potential for concurrent overlap and disturbance as a result of piling associated with East Anglia ONE in relation to Downs herring spawning ground. However, assuming mitigation (as detailed in Chapter 13) is	Thanet is operational, therefore no route for cumulative impacts from simultaneous construction.	There is the potential for a minor cumulative impact to occur through overlap in the extent of the noise impact zones. However, assuming mitigation (as detailed in Section 13) is implemented there would be no residual impact.	No overlap in timing of piling. Gunfleet Sands Extension construction to take place from 2011 to 2012, GWF piling to commence 2015.	Underwater noise arising from vessel traffic associated with regional aggregate extraction is not considered to have potential to cumulatively impact fish and shellfish at a regional level.	N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
			implemented there would be no residual impact.						
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A
Underwater noise (consecutive impact)	The final monopiles were installed in 2010 and were subject to timing restrictions, therefore no route for consecutive cumulative impacts.	Potential consecutive impacts to the inshore Thames sole spawning grounds could occur over the period 2011 to 2018 as a result of the Gunfleet Sands (2 WTGs) and Kentish Flats Extension (10-17 WTGs), the two phases of the London Array (subject to a sole spawning restriction) and GWF. Sole are considered to be relatively insensitive to noise and while their overall sensitivity has been assessed as medium the actual extent of behavioural impacts are generally localised. The potential for the different wind farm projects to continually disrupt the same spawning areas is therefore unlikely, especially given the size of the sole spawning area available in the Thames Estuary and license conditions associated with some of the other inshore developments precluding piling during the sole spawning season. Assuming mitigation (as detailed in Chapter 13) is implemented there would be no residual impact.					Underwater noise arising from vessel traffic associated with regional aggregate extraction is not considered to have potential to cumulatively impact fish and shellfish at a regional level.	N/A	N/A
	No likely significant impacts	No likely significant impact					No significant impacts likely	N/A	N/A
Disturbance to fish and shellfish as a result of other human activities	N/A					The proportion of the total herring spawning habitat within the East English Channel potentially impacted by aggregate extraction is extremely small, with less than one third of a percent of the potential herring spawning habitat in the East English Channel impacted. In addition the direct impacts to herring spawning are limited at some licensed areas by restrictions and areas of very high spawning potential are located	N/A	Sizewell nuclear facility has a number of existing marine components (namely the intake and outlet cooling water pipes). Intake structures of power stations are known to entrain and kill fish species. Regulators would require stringent screening and fish impingement and entrainment mitigation devices to be employed including the use of acoustic deterrents and fish return systems in accordance with the best available techniques.	

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
							to the south of the aggregates extraction sites.		
	No likely significant impacts						No significant impacts likely	N/A	No significant impacts likely
Marine Mammals (see Section 14.10 for further detail)									
Impacts associated with construction noise (concurrent and consecutive noise impacts) and geophysical surveys	The GGOWF will be operational by 2012, therefore, no route for cumulative impacts from concurrent construction activity. Consecutive impacts are not expected as there will be at least a three year gap between piling / surveys at GGOWF and these activities occurring at GWF.	Although the construction schedules for the Kentish Flats Extension Project and GWF potentially overlap, the distance between the two sites (inclusive of Kentish Flats I) would prevent significant concurrent and / or consecutive impacts occurring.	There is potential for construction related disturbance / displacement impacts to occur concurrently or consecutively. East Anglia ONE is located at a distance is approximately equal to the maximum impact range for behavioural impacts at GWF, it is therefore considered that there is limited potential for two simultaneous pile driving operations at these sites to have overlapping spatial impact footprints. There is potential for cumulative impacts to occur as a	Thanet completed construction in 2010, therefore no route for cumulative impacts from concurrent construction. Consecutive impacts are not anticipated as there will be a four year gap between piling operations.	There is the potential for multiple discrete disturbance / displacement effects to occur simultaneously or in rapid succession. This may lead to a short-term restriction on habitat range and/or barrier effects.	There would be no overlap of construction activity with the GWF and the Gunfleet Sands Wind Farm. In addition, the distance between the two sites would prevent significant concurrent and / or consecutive impacts occurring	Underwater noise from aggregate extraction at Area 498 and 507/5 is unlikely to cumulatively impact marine mammals within the region	N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
			result of consecutive construction noise.						
	No likely significant impact	No likely significant impact	Likely minor adverse to negligible impact	No likely significant impact	Likely minor adverse to negligible impact	No likely significant impact	No likely significant impact	N/A	N/A
Collision risk (from shipping and commercial fisheries)	Shipping and commercial fisheries are not assessed cumulatively for all receptors, but are relevant to marine mammals as a result in the increase in vessel movements associated with the construction of GWF. However, given the low level of marine mammal activity within the wider study area, and as the number of vessels associated with GWF is small in comparison to the existing level of vessel activity within the region, no likely significant effects are anticipated.								
Displacement and habitat loss associated with aggregate activity	N/A						The value / sensitivity of all marine mammal species in relation to displacement and habitat loss associated with dredging activity in the Thames estuary is considered negligible. Given the limited spatial extent of aggregate activity and the temporary duration of the displacement by construction activity on GWF the combined impact magnitude of displacement on marine mammals is likely to be negligible.	N/A	N/A
	N/A						Likely negligible impact	N/A	N/A
Commercial Fisheries (see Section 15.10 for further detail)									
Loss of access to fishing grounds	The GGOWF will be operational by 2012, therefore, no route for cumulative impacts from simultaneous construction activity.	The only potential for cumulative impacts between GWF, EA ONE, Kentish Flats Extension and London Array II	The only potential for cumulative impacts between GWF, EA ONE, Kentish Flats	Thanet is operational, and therefore no cumulative construction related impacts are anticipated	The only potential for cumulative impacts between GWF and London Array II relate to the European trawl fleet and the	Gunfleet Sands I and II are operational, and III is in planning. (in addition it is located over 45km from the	Aggregates activity may overlap- with cable export corridor and local fishing vessel activity. Access to these locations is only	N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities		
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity	
		relate to the European trawl fleet and the Lowestoft passive gear sector. Due to the overlap of activities there is the potential for cumulative impacts on the fishing fleets.	Extension and London Array II relate to the European trawl fleet and the Lowestoft passive gear sector. Due to the overlap of activities there is the potential for cumulative impacts on the fishing fleets.		Lowestoft passive gear sector. These activities overlap with GWF and have the potential to be impacted cumulatively.	GWF site and close inshore with limited foreign fishing activity) therefore potential cumulative impacts are not anticipated.	restricted during active dredging operations and vessel monitoring data indicates that the current license areas do not affect the distribution of fishing activity			
	No likely significant impact	Likely minor adverse to negligible impact	Likely minor adverse to negligible impact	No likely significant impact	Likely minor adverse to negligible impact	No likely significant impact	Likely negligible impact	N/A	N/A	
Potential effect on fishing vessel safety	The other offshore wind farms in the Thames Estuary are of a scale and at a sufficient distance from the GWF site that it is considered there would not be a significant cumulative impact on shipping and navigation and therefore fishing vessel safety.							N/A	N/A	N/A
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A	N/A	
Impacts associated with oil and gas exploration	Oil and gas exploration has not been included in the activities assessed in this table, however it is relevant to the cumulative commercial fisheries assessment. There are no current active licence blocks located within or in close proximity to the GWF project and there are no active or abandoned well sites within the GWF site, as such there would not be any significant cumulative impacts between these designations and the proposed GWF development in regard to commercial fisheries. No likely significant impact is anticipated.									
Impacts associated with Marine Conservation Zones	Marine Conservation Zones have not been included in the activities assessed in this table, however they are relevant to the cumulative commercial fisheries assessment.. Site NG1B located along the proposed GWF site cable export corridor, is not fished by Dutch vessels not all areas of the proposed MCZ zone fall within the French and Belgian fishing grounds. However, there will be some cumulative loss of fishing grounds as a result of the MCZ and GWF. The cumulative impact is anticipated to be of minor adverse significance.									
Shipping and Navigation (see Section 16.10)										
Re-routing of shipping and navigation	The GGOWF site has been considered intrinsically within the analysis of impacts on shipping and navigation, therefore is not assessed cumulatively.	Kentish Flats is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant cumulative impact on shipping and	Re-routing associated with the proposed GWF project will not result in the introduction of new shipping routes in the proximity of East Anglia ONE.	Thanet is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant cumulative impact on	London Array is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant cumulative impact on shipping and navigation	Gunfleet Sands is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant cumulative impact on	Aggregate extraction will not result in re-routing of shipping, therefore there is no pathway for cumulative impacts.	N/A	N/A	

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
		navigation	Therefore there is no impact pathway.	shipping and navigation		shipping and navigation			
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A
Potential for increased collision risk	The GGOWF site has been considered intrinsically within the analysis of impacts on shipping and navigation, therefore is not assessed cumulatively.	Kentish Flats is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant cumulative impact on shipping and navigation	The potential for increased ship to ship collisions may be increased by compressing the shipping route, however, all traffic would be travelling in the same direction (as a result of the Sunk TSS), which would serve to reduce the potential for collisions and therefore there is no impact pathway.	Thanet is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant cumulative impact on shipping and navigation	London Array is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant cumulative impact on shipping and navigation	Gunfleet Sands is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant cumulative impact on shipping and navigation	The temporary nature of the export cable installation works and the 500m safety zones will reduce the collision risk during construction. The increase in operational vessels is not a significant increase in the total number of vessels in the area and therefore no additional risk is anticipated.	N/A	N/A
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A
Military and Civil Aviation (see Section 17.10)									
Effects on radar and aviation interests	The outputs of CAA, MOD and NATS consultation to date and technical modelling exercises (see Section 17.7 and Technical Appendix 17.A) indicate that there will be no cumulative impacts on radar and aviation interests, primarily as a result of the distance of projects and regulated activities from military and civil aviation and radar installations and activity areas.						N/A	N/A	N/A
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
Other Human Activities (see Section 18.10)									
Effects on other activities	As a result of the localised and relatively short term nature of the construction activities, impacts resulting from other developments/activities and the GWF cumulatively will be no greater than those impacts from other developments/activities alone.							N/A	N/A
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A
Archaeology (see Section 19.10 for further detail)									
Onshore – Disturbance to archaeological resource	N/A.						N/A	GGOWF will be operational by 2012 and construction activities will not overlap.	No impacts identified upon archaeology for the proposed Sizewell B Dry Fuel Store (British Energy, 2010) or Sizewell A Decommissioning (British nuclear Group, 2005). Given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible.
	N/A						No likely significant impact	No likely significant impact	No likely significant impact
Offshore – Effects on archaeological resource	The majority of these wind farms have already been subject to archaeological assessments. With regard to known archaeological sites and geophysical anomalies, the principle means of mitigation is avoidance; therefore the cumulative impact would be anticipated to be negligible. With regard to indirect impacts, project specific studies indicate little change in sedimentation and scour from wind farm construction (see Chapter 9); subsequently the cumulative impact is likely to be negligible. With regard to setting and perception, the pre-existing industrial character of the area suggests that the cumulative impact upon local visual and character perceptions of GWF alongside other offshore developments and activities will be negligible						Protocols are in place within the aggregates industry to mitigate for the impact on potential archaeological receptors; consequently, the in combination impact with GWF would be negligible.	N/A	N/A
	Likely negligible impact						Likely negligible impact	N/A	N/A
Offshore – Effects on archaeological resource	<i>Potential effects with other activities not detailed in this table, comprising commercial fishing, shipping and ports and subsea cables are of relevance to the cumulative archaeological assessment. Mitigation measures which will be required during any of these activities and this will reduce the pathway for cumulative impacts to occur, in addition the ports of relevance to GWF are located a significant distance from the proposed site. Full archaeological assessments will have been undertaken for all activities described. As a result there is no likely significant impact on the archaeological resource when considering these additional activities.</i>								
Landscape and Seascape Visual Assessment (see Section 20.11 for further detail)									

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
Onshore landscape and visual effects	N/A	N/A	N/A	N/A	N/A	N/A	N/A	The construction of the GWF substation will be in the same locality as the operational GGOWF substation. By locating these developments alongside each other the aim is to minimise the combined visual envelope of the two developments and reduce the proliferation of visual noise within this part of the AONB. Within the landscape and visual assessment GGOWF has been captured as part of the existing visual baseline and no additional cumulative impact is predicted.	Sizewell B Dry Fuel Store and the decommissioning of Sizewell A are not reported to have any landscape and visual impacts Should the GWF onshore construction works extend beyond 2017 there is the potential for a cumulative impact upon landscape and visual receptors during construction. Given the absence of any details of the Sizewell C proposals it is not possible to undertake a quantitative assessment of this potential cumulative impact during construction at this stage.
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	Potential significant impact
Seascape effects	During the construction phase the primary potential effects as a result of the offshore aspects of the development will be associated with the increased activity of construction vessels travelling to the offshore site from local ports, the presence of jack-up barges and the progressive construction of the wind WTGs. The presence of the construction vessels and the associated marine and intertidal activity is considered to be relatively insignificant due to the existing baseline of significant marine activity in the study area, therefore there is no pathway for cumulative impacts to occur.							N/A	N/A
	Likely negligible impact	No likely significant impact	Likely negligible impact	Likely negligible impact	Likely negligible impact	Likely negligible impact	No likely significant impact	N/A	N/A
Socio Economics (see Section 21.10 for further detail)									
Direct employment	The large number of offshore wind farms proposed in this region will require a supply chain of survey vessels and construction vessels (plus experienced crews), as well as other onshore and offshore construction workers. It is estimated that the cumulative direct workforce numbers would increase to in excess of 1% of the Suffolk Coastal District						N/A	GGOWF will be operational by 2012 and construction	No significant socio-economic impacts are reported for the Sizewell

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities		
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity	
	workforce and potentially in excess of 1% of the East of England workforce. This represents an increase in the overall magnitude of the effect (increasing from a low to medium magnitude effect).								activities will not overlap.	B Dry Fuel Store and Sizewell A decommissioning projects. Given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible
	Potential minor beneficial impact	Potential minor beneficial impact	Potential minor beneficial impact	Potential minor beneficial impact	Potential minor beneficial impact	Potential minor beneficial impact	No likely significant impact	No likely significant impact	No likely significant impact	
Indirect employment	The large number of offshore wind farms proposed in this region will require a supply chain of survey vessels and construction vessels (plus experienced crews), as well as other onshore and offshore construction workers. It is estimated that the cumulative indirect workforce numbers would also increase in excess of 1% for the region. This represents an increase in the overall magnitude of the effect (increasing from negligible to a low magnitude effect).							N/A	GGOWF will be operational by 2012 and construction activities will not overlap.	No significant socio-economic impacts are reported for the Sizewell B Dry Fuel Store and Sizewell A decommissioning projects. Given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible.
	Potential minor beneficial impact	Potential minor beneficial impact	Potential minor beneficial impact	Potential minor beneficial impact	Potential minor beneficial impact	Potential minor beneficial impact	No likely significant impact	No likely significant impact	No likely significant impact	
Geology, Hydrogeology, Land Quality and Flood Risk (see Section 22.10 for further detail)										
Impacts on geology, hydrology and land quality	No significant cumulative impacts are anticipated for any other offshore projects / activities.								GGOWF will be operational by 2012 and construction activities will not overlap.	Potential impacts reported for the Sizewell B Dry Fuel Store are considered to be localised to the footprint of the Sizewell B Dry Fuel Store and are not felt to overlap with the GWF development footprint. No impacts are reported

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
									for the Sizewell A decommissioning. Given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible.
								No likely significant impact	No likely significant impact
Terrestrial Ecology (see Section 23.10 for further detail)									
Impacts on terrestrial ecology	No significant cumulative impacts are anticipated for any other offshore projects / activities.							GGOWF will be operational by 2012 and construction activities will not overlap.	No terrestrial ecology impacts are reported for the Sizewell B Dry Fuel Store and Sizewell A Decommissioning, therefore no cumulative impacts are anticipated. There are expected to be habitat losses associated with the construction of Sizewell C, should GWF construction extend beyond 2017 there is the potential for a cumulative impact. However, given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible.
								No likely significant impact	No likely significant impact
Land-use, Tourism & Recreation (see Section 24.9 for further detail)									
Onshore land use, tourism and recreation	The GGOWF will be operational by 2012, therefore, no route for cumulative impacts from simultaneous construction activity.	Recreational activity in the region is localised and is also relatively limited in the wider Thames offshore area, therefore no cumulative impacts are anticipated.					GGOWF will be operational by 2012 and construction activities will not overlap.	No land use, tourism and recreation impacts are reported for the Sizewell B Dry Fuel Store and Sizewell A Decommissioning, therefore no cumulative	

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
									impacts are anticipated. Given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible.
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact
Traffic and Transport (see Section 25.9 for further detail)									
Driver delay at priority junctions, pedestrian severance and reduced pedestrian amenity	The GGOWF will be operational by 2012, therefore, no route for cumulative impacts from simultaneous construction activity.	N/A	N/A	N/A	N/A	N/A	N/A	GGOWF will be operational by 2012 and construction activities will not overlap.	There is the potential for the Sizewell B Dry Fuel Store construction phase and Sizewell A decommissioning phases to overlap with GWF. It is extremely unlikely that peak traffic periods for these developments will overlap; however should this occur I would represent a potentially significant cumulative impact. A construction traffic management plan will be agreed with the Highways Authority to ensure that these peak periods do not overlap. Given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible.
	No likely significant impact	N/A	N/A	N/A	N/A	N/A	N/A	No likely significant impacts	Potential moderate adverse impact
Noise (see Section 26.10 for further detail)									

Receptor and potential impact	Offshore: other wind farms/ other regulated activities							Onshore: wind farms/ other regulated activities	
	GGOWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and Shipwash 507/5	GGOWF Substation	Sizewell nuclear power station activity
Construction noise onshore	N/A	N/A	N/A	N/A	N/A	N/A	N/A	GGOWF will be operational by 2012 and construction activities will not overlap.	No significant noise impacts associated with the Dry Fuel Store are reported to be negligible and are not expected to result in cumulative impacts. Noise associated with Sizewell A demolition works is expected to be complete before the start of the GWF construction. Given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible.
	No likely significant impact	N/A	N/A	N/A	N/A	N/A	N/A	No likely significant effect	No likely significant effect
Air Quality (see Section 27.10 for further detail)									
Impacts on air quality onshore	No cumulative impacts with other offshore projects / activities are anticipated.							GGOWF will be operational by 2012 and construction activities will not overlap.	No significant air quality impacts have been identified for either the Dry Fuel Store or Sizewell A decommissioning projects. Given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible..
								No likely significant impact	No likely significant impact

Table 30.7 Potential cumulative impacts of GWF on receptors during the operational phase ((with the exception of Chapter 11)

Receptor and potential impact	Offshore: other wind farms/ regulated activities							Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
<p>Nature Conservation Designations (see Section 8.10 for further detail). Full details on the assessment of European designated sites is provided in the GWF HRA Report, and should be referred to for further information.</p>									
Impact on the qualifying features and supportive habitat of Alde-Ore Estuary SPA	<p>Through the GWF HRA process it is concluded that there will be no adverse impacts on the Conservation Objectives of the Alde-Ore Estuary SPA, due to the GWF construction and operation, either alone or in-combination with other projects. This means that the integrity of the SPA will not be adversely affected, and that favourable conservation status can be restored over the long-term, despite any impacts associated with the GWF development.</p> <p>Further details on the assessment undertaken on European designated sites is provided in the GWF HRA Report and also Chapter 11 Offshore Ornithology (and associated technical appendices)</p> <p>No likely significant impact</p>								
Impact on the qualifying features and supportive habitat of: The Sandlings SPA Outer Thames SPA Flamborough Head and Bempton Cliffs SPA Minismere to Walberswick SPA Orfordness to Shingle Street SAC Alde, Ore and Butley Estuaries SAC Minsmere to Walberswick Heaths and Marshes SAC Margate and Long Sands dSAC Alde-Ore Estuary SPA (all other impacts associated with lesser black-backed gull)	<p>A thorough assessment of the potential cumulative impacts upon European designated sites is presented in the GWF HRA Report and summarised in Chapter 8, it is considered that there is unlikely to be any significant effects on these sites during operation.</p> <p>Further details on the assessment undertaken on European designated sites is provided in the GWF HRA Report and also Chapter 11 Offshore Ornithology (and associated technical appendices)</p> <p>No likely significant impact</p>								

Receptor and potential impact	Offshore: other wind farms/ regulated activities						Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station
Impact on statutory and non statutory sites of relevance to the onshore development	N/A						No significant impacts are anticipated on designated sites of relevance to the onshore development. IN regard to the landscape designation of the AONB, significant cumulative landscape impacts associated with development at Sizewell and GGOWF are not anticipated.	
	N/A						No likely significant impact	
Impact on the landscape associated with the Suffolk Heritage Coast and Suffolk Coasts and Heaths AONB (associated with offshore development)	The proposed GWF will not significantly add to the existing cumulative effects generated by the consented and existing operational offshore wind farms in the study area. The overall cumulative effect of the proposed GWF over and above that caused by the existing and consented wind farms of the study area is considered, therefore, to be no more than low to negligible.	Due to the distance from the coastal receptors identified, the cumulative effects of GWF and Kentish Flats have not been considered in the cumulative assessment.	Lies 45km from the coastline and is within the GWF study area. However, only those wind farm projects which are within 30 to 35km of a coastal receptor are considered as part of the cumulative assessment. Beyond these distances cumulative effects will be negligible.	The proposed GWF will not significantly add to the existing cumulative effects generated by the consented and existing operational offshore wind farms in the study area. The overall cumulative effect of the proposed GWF over and above that caused by the existing and consented wind farms of the study area is considered, therefore, to be no more than low to negligible.		No significant cumulative impacts associated with GWF and aggregate extraction activities are anticipated.	N/A	N/A
	Likely negligible impact	No likely significant impact	Likely negligible impact	Likely negligible impact		No likely significant impact	N/A	N/A
Impact on remaining statutory and non statutory sites of relevance to the offshore development OSPAR Habitats and Species	No significant impacts have been identified for the remainder of statutory and non statutory designated sites/species/habitats which might be affected by the operational phase of GWF, as a result there is no pathway for cumulative impacts on statutory and non statutory designated sites of relevance to the offshore development.						N/A	
	No likely significant impact						No likely significant impact	No likely significant impact

Receptor and potential impact	Offshore: other wind farms/ regulated activities						Onshore: other wind farms/ regulated activities		
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
Physical Environment (see Section 9.10 for further detail)									
Effects upon the existing hydrodynamic, wave and sedimentary regimes	The presence of the GWF would have insignificant effects on the physical environment both locally and over a wider area. The same conclusion has been reached for the GGOWF; therefore no cumulative effects as a result of interactions are anticipated.		Evidence from sensitivity testing with regard to GWF and GGOWF indicated no potential for cumulative effects on wave and tidal currents at a localised level. Given the lack of effect on wave and tidal regimes there is no pathway for far-field effects. Therefore, no cumulative effects would be anticipated between the GWF development and any of the other wind farm developments (which are at substantial distance from GWF) in the wider region.			There is potential for aggregate extraction to affect hydrodynamics but this is difficult to assess as will vary depending on volumes being extracted at any particular time. GWF will have insignificant effects on the physical environment and the potential effects associated with aggregate extraction will small-scale and localised. Therefore no significant cumulative effects are anticipated.		N/A	N/A
	No likely significant impact		No likely significant impact			No likely significant impact		N/A	N/A
Potential effects on the coast	Wave and tidal current effects are considered to be limited to the vicinity of the turbine foundations, with no significant interactions between foundation structures, and no cumulative effects. The local changes to the physical environment will therefore not cause any change to the wave and tidal current processes along the south-east England coastline (Suffolk being the closest approximately 25km away) and the GWF will have no measurable influence on the general bedload and suspended sediment transport regime at the coast.								
Sediment and Water Quality (see Section 10.10)									
Deterioration in water and / or sediment quality due to accidental spillage of contaminants during wind farm maintenance operations.	With the application of the project Environmental Management and Monitoring Plan (EMMP) and adherence to relevant guidance no significant impacts are anticipated at GWF, and it is safe to assume that the same management and control measures will be applied during the operation of GGOWF.		No significant impacts on marine water and sediment quality have been identified that have the potential to extend sufficient distance to result in potential cumulative impacts with other wind farm development.			N/A		N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ regulated activities						Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station
	No likely significant impact		No likely significant impact			N/A	N/A	N/A
Impact on marine water and sediment quality	No significant impacts on marine water and sediment quality have been identified that have the potential to extend sufficient distance to result in potential cumulative impacts with other wind farm development.					There is potential for scour effects at GWF and aggregate extraction to cumulatively impact upon marine water and sediment quality. However the impact as a result of potential scour is anticipated to be of negligible significance as a result of relatively localised and small scale effects on suspended sediment concentrations. Therefore there is no pathway for cumulative impacts to occur.	N/A	N/A
	No likely significant impact					No likely significant impact	N/A	N/A
Marine and Intertidal Ecology (see Section 12.10 for further detail)								
Indirect impacts through change in current regime	Habitats and species identified at GWF are widespread throughout the Outer Thames Estuary and are similar to those found at other sites. The majority of these habitats and species have a low sensitivity and high recoverability. <i>S. spinulosa</i> is of higher sensitivity however this species was not found in dense aggregations and is also not limited to specific areas. Indirect operational impacts would be localised to the immediate vicinity of the project. Potential pathways for indirect operational impacts between the GWF project and other activities do not exist. Scour impacts are localised and will only occur in some of the sediment types.						N/A	N/A
	No likely significant impact						N/A	N/A
Direct impacts on benthos due to maintenance activities	Impacts will be temporary, sporadic and highly localised to within the footprint of the works, best practice will further minimise any impacts. At this juncture it is not possible to predict the scale of maintenance works required for GWF or indeed other sites, however given that these will be highly localised and temporary it is unlikely that the cumulative impact across sites at the regional scale will be significant.						N/A	N/A
	No likely significant impact						N/A	N/A
Direct impact on subtidal benthos due to habitat alteration	For GWF it is considered that this impact will be negligible and there will not be a true 'reef' created due to the distances between WTGs. Across wind farms the same will hold true, the area of habitat change within the wider region will be negligible and there will not be a significant cumulative impact.					N/A	N/A	N/A
	No likely significant impact					N/A	N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ regulated activities						Onshore: other wind farms/ regulated activities		
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
Indirect impact on subtidal benthos due to alteration to existing human activity	It is not possible at this juncture to determine what level of decrease in fishing activity may occur and what the subsequent indirect impact on the benthos will be, especially considering concurrent decreases in fishing capacity and potential for quota changes. However, given the area of the wind farms compared to the wider available area for fishing and the widespread nature of the communities across the region, it is unlikely that there would be a significant cumulative impact due any reduction in fishing effort.						N/A	N/A	N/A
	No likely significant impact						N/A	N/A	N/A
Natural Fish and Shellfish Resource (see Section 13.10 for further detail)									
EMF	Based on the information available, it is clear that fish species may respond to EMF. However, the magnitude and extent of the EMF effects are anticipated be localised (within 20m of cables) and therefore no cumulative impacts would occur.	Given the distance between the two projects no pathway for cumulative impact exists.	Potential for cumulative EMF may occur in the immediate vicinity of the crossing point between the two sets of export cables. Given the discrete nature of the potential impact it is considered unlikely to have a significant impact on wide ranging receptors.	Given the distance between the two projects no pathway for cumulative impact exists.	Given the distance between the two projects no pathway for cumulative impact exists.	Given the distance between the two developments no pathway for cumulative impact exists.	N/A	N/A	N/A
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A	N/A
Marine Mammals (see Section 14.10 for further detail)									
Collision risk (from shipping and commercial fisheries)	<i>Shipping and commercial fisheries are not assessed cumulatively for all receptors, but are relevant for collision risk to marine mammals as a result in the increase in vessel movements associated with the construction of GWF. However, there is a low level of marine mammal activity within the wider study area, and the number of vessels associated with GWF is small in comparison to the existing level of vessel activity within the region. In addition, impacts on the intensity and distribution of commercial fishing activity within areas frequented by marine mammals in the outer Thames Estuary may lead to a reduction in prey resource and/or an increase in interactions between fishing nets and vessels and marine mammals. Given the low level of marine mammal activity within the wider study area, and the fact that fisheries will not be excluded from the wind farm site during operation (with the exception of a 50m safety zone around the turbines) these interactions are unlikely to occur. No likely significant effects are anticipated.</i>								
Commercial Fisheries (see Section 15.9 for further detail)									
Loss of access to	The other offshore wind farms of relevance to the cumulative assessment on loss of access to fishing grounds comprise:						Intermittent nature of	N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ regulated activities							Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
fishing grounds	GGOWF, East Anglia ONE and London Array (for other sites there is no pathway for cumulative impacts as a result of their location). In respect to these three projects, there will be a cumulative loss of grounds to the European trawl sector, in particular the Belgian and Dutch.						dredging activities, small spatial extent and ability of static gears to be used in GWF and along cable corridor unlikely to lead to significant cumulative impacts.		
	Likely minor adverse (associated with GWF, GGOWF, East Anglia ONE and London Array)						No likely significant impact	N/A	N/A
Impacts associated with oil and gas exploration	Oil and gas exploration has not been included in the activities assessed in this table, however it is relevant to the cumulative commercial fisheries assessment. There are no current active licence blocks located within or in close proximity to the GWF project and there are no active or abandoned well sites within the GWF site, as such there would not be any significant cumulative impacts between these designations and the proposed GWF development in regard to commercial fisheries. No likely significant impact is anticipated.								
Impacts associated with Marine Conservation Zones	Marine Conservation Zones have not been included in the activities assessed in this table, however they are relevant to the cumulative commercial fisheries assessment.. Site NG1B located along the proposed GWF site cable export corridor, is not fished by Dutch vessels not all areas of the proposed MCZ zone fall within the French and Belgian fishing grounds. There will be some cumulative loss of fishing grounds as a result of the MCZ and GWF. The cumulative impact is anticipated to be of minor adverse significance.								
Shipping and Navigation (see Section 16.10)									
Impacts on shipping and navigation	GGOWF is considered intrinsically within the shipping and navigation analysis and is therefore not assessed cumulatively.	Is of the scale, and at a sufficient distance that it is not considered to create any cumulative impacts.	Both wind farms will lead to north-south shipping being displaced, however there is sea room available (approx. 13nm) between the two projects.	Other wind farms in the Thames Estuary are of the scale and at a sufficient distance from the GWF that they are unlikely to have potential to cause any cumulative impact. Furthermore, the shipping impact of GWF affects different traffic receptors and therefore, reduces the potential pathway for impact to occur.			Further consultation required to determine the scale of potential overlap.	N/A	N/A
	N/A	No likely significant impact	No likely significant impact	No likely significant impact			No likely significant impact but further consultation required	N/A	N/A
Re-routing of shipping and navigation	The GGOWF site has been considered intrinsically within the analysis of impacts on shipping and navigation, therefore is not assessed cumulatively.	Kentish Flats is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a	Re-routing associated with the proposed GWF project will not result in the introduction of new shipping	Thanet is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a	London Array is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant cumulative impact on shipping and	Gunfleet Sands is of a scale and at a sufficient distance from the proposed GWF site that it is not considered there will be a significant	Aggregate extraction will not result in re-routing of shipping, therefore there is no pathway for cumulative impacts.	N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ regulated activities							Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
		significant cumulative impact on shipping and navigation	routes in the proximity of East Anglia ONE. Therefore there is no impact pathway.	significant cumulative impact on shipping and navigation	navigation	cumulative impact on shipping and navigation			
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A
Military and Civil Aviation (see Section 17.10)									
Effects on radar and aviation interests	The outputs of CAA, MOD and NATS consultation to date and technical modelling exercises (see Section 17.7 and Technical Appendix 17.A) indicate that there will be no cumulative impacts on radar and aviation interests, primarily as a result of the distance of projects and regulated activities from military and civil aviation and radar installations and activity areas. As a result the cumulative impacts of GWF and other projects will be no greater than the impacts associated with those projects in isolation.						N/A	N/A	N/A
	No likely significant impact						N/A	N/A	N/A
Other Human Activities (see Section 18.10)									
Effects on aggregate activity	In regard to Shipwash 507/5 aggregate area, there is the risk of an aggregate vessel interacting with the installed cables of GWF and GGOWF. There is a low likelihood of such an event occurring and GGOWF and GWF export cable infrastructure could not both interact with any dragging machinery in the same event. The cumulative impact is not anticipated to be any greater than when considering GWF in isolation.	No pathway for cumulative impacts due to the location of Kentish Flats, in addition no concerns have been raised.	Volker Dredging Ltd and Britannia Aggregates Ltd have commented that it is imperative that the existing shipping route between GWF and East Anglia One Offshore Wind Farm remains open as closure would result in increase in steaming times. Potential	No pathway for cumulative impacts due to the location of Kentish Flats, in addition no concerns have been raised.	No pathway for cumulative impacts due to the location of Kentish Flats, in addition no concerns have been raised.	No pathway for cumulative impacts due to the location of Kentish Flats, in addition no concerns have been raised.	N/A	N/A	N/A

Receptor and potential impact	Offshore: other wind farms/ regulated activities							Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
			impacts are assessed within Chapter 16 as being of minor adverse significance.						
	Likely minor adverse impact	No likely significant impact	Likely minor adverse impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A	N/A
Effects on all other human activities	Impacts resulting from other developments / activities and the GWF cumulatively will be no greater than those impacts from other developments/activities alone.								
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact
Archaeology (see Section 19.10 for further detail)									
Effects on archaeological resource	Impacts during the operational phase will be restricted to discrete localised events, such as scour and temporary maintenance works. The only potential for overlap in impact footprint would be from maintenance works associated with any potential crossing point between the GWF and East Anglia ONE export cables. For all impacts, established industry mitigation measures (as detailed in Section 19.6) would be considered by GWFL, which would serve to reduce the significance of impacts and therefore, reduce the potential for cumulative impacts with other projects.							N/A	N/A
	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	No likely significant impact	N/A	N/A
Landscape and Seascape Visual Assessment (see Section 20.11 for further detail)									
Onshore landscape and visual effects	N/A	N/A	N/A	N/A	N/A	N/A	N/A	GWF substation will be in the same locality as the operational GGOWF substation. By locating these developments alongside each other the aim is to minimise the combined visual envelope of the two developments and reduce the proliferation of visual noise within this part of the AONB. Within the landscape	Sizewell A and B represent existing visual noise within the AONB and have been captured as part of the visual baseline within the assessment of operational impact within Chapter 20 and there are not considered to be any further cumulative impacts. The adverse landscape and

Receptor and potential impact	Offshore: other wind farms/ regulated activities							Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
								and visual assessment GGOWF has been captured as part of the existing visual baseline and there are not considered to be any further cumulative impacts.	visual effects of Sizewell C are likely to be much greater than those caused by GWF, due to the greater area of land cover, scale of development and timescale of Sizewell C. The combined projects will extend the areas of landscape influenced by development over a wider area of the AONB. There are likely to be cumulative adverse landscape and visual impacts. However, given the lack of information available for Sizewell C it is not possible to quantify this.
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No likely significant impact	Likely significant impact
Seascape effects	The proposed GWF will not significantly add to the existing cumulative effects generated by the consented and existing operational offshore and onshore wind farms in the study area. GWF will add to the existing spread of turbines seen on the horizon line, but will rarely alter the degree or extent of existing visual exposure.						No cumulative seascape effects are anticipated as a result of aggregate activity and the operational GWF.	N/A	N/A
	Likely negligible impact						No likely significant impact	N/A	N/A
Socio Economics (see Section 21.10 for further detail)									

Receptor and potential impact	Offshore: other wind farms/ regulated activities							Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
Direct employment	The large number of offshore wind farms proposed in this region will require a supply chain of operations and maintenance equipment and staff.						N/A	The GWF and GGOWF substation are effectively unmanned and operated remotely from Lowestoft.	The GWF and GGOWF substations are effectively unmanned and operated remotely from Lowestoft.
	Likely negligible impact						N/A	No likely significant impact	No likely significant impact
Indirect employment	The large number of offshore wind farms proposed in this region will require a supply chain of operations and maintenance equipment and staff.						N/A	The GWF and GGOWF substations are effectively unmanned and operated remotely from Lowestoft.	The GWF and GGOWF substations are effectively unmanned and operated remotely from Lowestoft.
	Likely negligible impact						N/A	No likely significant impact	No likely significant impact
Geology, Hydrogeology, Land Quality and Flood Risk (see Section 22.10 for further detail)									
Impacts on geology, hydrology and land quality	No cumulative impacts are anticipated for any other projects / activities during the operation phase.								
Terrestrial Ecology (see Section 23.10 for further detail)									
Impacts on terrestrial ecology	No cumulative impacts are anticipated for any other offshore projects / activities during the operation phase.							No operational impacts have been identified for GWF in regards to terrestrial ecology.	No operational impacts have been identified for GWF in regards to terrestrial ecology.
								No likely significant impact	No likely significant impact
Land-use, Tourism and Recreation (see Section 24.10 for further detail)									
Land use, tourism and recreation	No cumulative impacts are anticipated for any other offshore projects / activities during the operation phase.							No land use, tourism or recreation impacts were identified for GGOWF substation	No land use, tourism or recreation impacts were identified for the Sizewell B Dry Fuel Store or for

Receptor and potential impact	Offshore: other wind farms/ regulated activities							Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
									<p>Sizewell A Decommissioning. Given the lack of information available for Sizewell C it is not possible to assess potential cumulative impacts.</p>
								No likely significant impact	No likely significant impact
Traffic and Transport (see Section 25.10 for further detail)									
Impacts on traffic and access	No cumulative impacts are anticipated for any other offshore projects / activities during the operation phase.							No operational impacts have been identified for GWF in regards to traffic and transport.	No operational impacts have been identified for GWF in regards to traffic and transport.
								No likely significant impact	No likely significant impact
Noise (see Section 26.10 for further detail)									
Operational noise at onshore substation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<p>The proximity of the two substations will lead to a cumulative increase in operational noise at the nearest receptors. The operational noise limits set by SCDC for both substation will ensure that a cumulative impact is not experienced</p>	<p>Operational noise associated with the Sizewell B was captured as part of the baseline environment and any cumulative impacts are effectively captured as part of the operational impact assessment for GWF. Given the lack of information</p>

Receptor and potential impact	Offshore: other wind farms/ regulated activities							Onshore: other wind farms/ regulated activities	
	Greater Gabbard OWF	Kentish Flats OWF (including Kentish Flats Extension)	East Anglia ONE	Thanet OWF	London Array OWF (Phase I and II)	Gunfleet Sands OWF (I, II and III)	Aggregate extraction in Area 498 and 252	Greater Gabbard OWF Sub Station	Sizewell nuclear power station activity
									available for Sizewell C it is not possible to assess potential cumulative impacts.
	Likely negligible impact	N/A	N/A	N/A	N/A	N/A	N/A	Likely negligible impact	No likely significant impact
Air Quality (see Section 27.10 for further detail)									
Impacts on air quality onshore	No cumulative impacts with other projects / activities are anticipated during the operation phase.								

Cumulative ornithology summary

- 30.5.4 Following consultation with the JNCC and Natural England, the cumulative assessment for the ornithology receptor has been based on each species' foraging range, rather than limiting the scope to the Thames Strategic Area. As a result the summary of impacts is not in line with the approach within **Table 30.6** and **30.7** and has been summarised below and within **Table 30.8**.
- 30.5.5 Depending on foraging range, all or some of the following Round 1, 2 and 2.5 proposed, consented or operational offshore wind farms within the Thames Strategic Area were considered relevant to the CIA for the species of principal concern:
- GGOWF;
 - London Array (phases I and II);
 - Gunfleet Sands I, II and III;
 - Kentish Flats (including extension); and
 - Thanet.
- 30.5.6 In addition, the following projects were considered for relevant species:
- East Anglia ONE: available data is limited to the scoping report, although preliminary collision risk results for lesser black-backed gull were made available by the developer;
 - Projects within the Greater Wash Strategic Area and east coast of Britain (see **Chapter 11**) which are within the foraging range and migratory route for gannet, and also along the migratory flyway for other species such as skuas. Assessment using these sites will be limited to collision risk only.
- 30.5.7 Although not within the Thames Strategic Area, Scroby Sands was considered as it partly overlaps with the Outer Thames SPA boundary, and is within foraging range of more wide-ranging species. However, as a small site some 50km+ north of the GWF, its impacts are expected to be negligible and therefore does not require inclusion in the CIA.
- 30.5.8 The main effects for birds of the construction, operation and decommissioning of the proposed GWF lie in the indirect loss of habitat through disturbance, displacement and/or disruption of flight-lines within an area around turbines, and the risk of collision mortality. The development of other wind farms in the region may act cumulatively on any of these aspects.
- 30.5.9 Cumulative direct loss of habitat due to placement of turbine foundations and other infrastructure is not considered this CIA as it is likely to be very small in relation to the availability of habitat in the Thames Strategic Area and thus of **negligible significance** for all species at a regional scale.

30.5.10 Other activities in the area that may have a direct or indirect impact on birds include the following types of project, identified in the Thames Strategic area by JNCC/Natural England (2010):

- Oil and gas exploration and production;
- Gas interconnectors;
- Pipelines for carbon dioxide for storage;
- Cables;
- Commercial fisheries;
- Shipping (including dredging of channels); and
- Recreation.

Table 30.8 Cumulative ornithology summary

Species	Summary of cumulative assessment	Impact
Construction		
Cumulative direct disturbance effects (other wind farms)		
Great skua Arctic skua Common gull Fulmar Gannet Lesser black-backed gull Herring gull Great black-backed gull Kittiwake Common guillemot Razorbill Red-throated diver	It is considered unlikely that any significant effects will result to any species particularly if activities take place at a lower intensity in winter months (due to adverse conditions), when the majority of divers are present. At worst, a cumulative minor adverse impact is predicted on all populations at a regional level	Likely minor adverse impact
Cumulative indirect disturbance impacts (other wind farms)		
Great skua Arctic skua	Indirect disturbance impacts may occur through the effect of specific construction activities, e.g. on prey or on habitats, however no potential for significant residual cumulative disturbance impacts on receptors during construction have been identified. Any impacts on bird behaviour are expected to be short-term only	Negligible to minor adverse

Species	Summary of cumulative assessment	Impact
Common gull Fulmar Gannet Lesser black-backed gull Herring gull Great black-backed gull Kittiwake Common guillemot Razorbill Red-throated diver	with limited potential for spatial overlap of impacts caused by GWF construction. The significance of the impact on the majority of species was assessed as being negligible or minor adverse in other relevant ESs.	
Operation		
Cumulative disturbance due to maintenance activities (other wind farms)		
Great skua Arctic skua Common gull Fulmar Gannet Lesser black-backed gull	Although disturbance events associated with this activity will be localised, a series of discrete disturbance events could take place on individuals of the same population. Of the key species considered, red-throated diver are the most sensitive to disturbance from increased human activity and are likely to be present in the majority of other Outer Thames wind farm areas and potentially within East Anglia ONE. However, any such effects are considered likely to be tolerable as the species is wide-ranging during winter months across the North Sea, with highest numbers recorded passing through briefly on migration in the GWF survey area, with the GWF site containing suboptimal habitat and representing a relatively unimportant for the species in the Greater Thames.	No likely significant impact

Species	Summary of cumulative assessment	Impact
Herring gull Great black-backed gull Kittiwake Common guillemot Razorbill Red-throated diver		
Cumulative displacement and avoidance of wind turbines (other wind farms)		
Relevant regional populations: Red-throated diver Great Skua Lesser black-backed gull Great black-backed gull Razorbill	<p>For red-throated diver whilst cumulative disturbance effects on the regional population are likely, especially with regard to the adjacent GGOWF, no overall significant cumulative impacts would be anticipated on the regional population.</p> <p>Great black-backed gull and lesser black-backed gull are of low sensitivity to displacement as they are wide ranging and tolerant of man-made structures. Therefore, whilst potential cumulative effects are acknowledged, especially with regard to the adjacent GGOWF project, it is not anticipated that these would have a significant impact on the regional populations.</p> <p>Great skua were only recorded briefly therefore disturbance is unlikely to arise</p>	No likely significant impact
Cumulative barrier effects		
Ornithology	There is a lack of evidence in the scientific literature as to whether seabird movement is affected by the presence of	Negligible

Species	Summary of cumulative assessment	Impact
receptors	<p>wind farms, with any impacts being subtle and difficult to measure on individuals' fitness or reproductive success. Examples are detailed below</p> <p>For a species such as great skua, although barrier effects are considered to be moderate for the GWF in isolation the proximity and layout of other wind farms in the Thames Strategic Area suggests that there is unlikely to be cumulative barrier effects as a result of the GWF.</p> <p>Given the relatively low densities of the red-throated diver recorded within GWF in comparison to other Thames sites, it is not expected that the GWF would have a significant cumulative effect of a barrier to movement as it lies outside of the species' preferred habitat range and distribution in the Outer Thames Estuary.</p> <p>For lesser black-backed gull it is a possibility that due to the large number of flights during the breeding season, small incremental reductions in a breeding pair's and therefore juvenile gulls' fitness may build up. Based on the relative WTG layouts of the two sites however, the GWF would likely account for a negligible increase in flight length, since birds heading to and from the colony would already take evasive action due to the presence of GGOWF turbines.</p> <p>For gannet the wide ranging behaviour of this species means that relatively large deviations should not be associated with any significant cost in energetic terms.</p>	<p>impact to no likely significant impact</p>
Cumulative collision risk (other wind farms)		
Lesser black-backed gull	<p>The most sensitive species to the proposed GWF development is considered to be lesser black-backed gull, because of its high numbers throughout the year, its Very High conservation status and proximity to the Alde-Ore Estuary SPA, which is currently in unfavourable condition. At a national level, a cumulative loss of 408-517 birds would result in an increase in the mortality rate of the breeding population of 1.8-2.3%, assuming a background mortality of 10%.</p>	<p>Likely minor adverse</p>
<p>Common gull</p> <p>Lesser black-backed gull</p> <p>Herring gull</p> <p>Great black-backed gull</p> <p>Kittiwake</p>	<p>No cumulative impacts are predicted above the levels of significance presented for GWF alone.</p>	<p>No likely significant impact</p>

Species	Summary of cumulative assessment	Impact
<p><i>For the following species collision mortality calculations were extended to cover a wider area along the east coast of Britain, due to the species' extensive foraging ranges.</i></p>		
Gannet	<p>An annual mortality of around 430 birds would result in an additional mortality of 0.7% of the national population and 2.4% of the east coast population. With a currently favourable breeding population within the UK, it is therefore considered that the effects of additional mortality are likely to be a Minor adverse impact on the national breeding population and a Moderate but tolerable adverse impact on the east coast breeding population.</p>	<p>Likely minor adverse (national breeding population)</p> <p>Moderate but tolerable on the east coast breeding population</p>
Arctic skua	<p>When considering a cumulative mortality of 15 Arctic skua deaths per annum, this would equate to a 2% increase in baseline mortality on the UK breeding population. It is not clear what proportion this equates to when comparing with the migratory population. However, with the Norwegian population being an estimated 9,000 to 14,000 pairs, it is likely that larger numbers will migrate through the North Sea during passage, and that at worst a Minor adverse cumulative impact on the national breeding population is predicted.</p>	<p>Likely minor adverse</p>
Great skua	<p>A combined mortality of on average 53 collisions per year means that there would be a 2% increase in baseline mortality, which would result in a Low magnitude on a High overall sensitivity species, and at worst a Minor adverse impact on the national breeding population.</p>	<p>Likely minor adverse</p>
<p>Interactions with non-wind farm activities</p>		
Oil and gas installations	<p>There are no current active licence blocks located within or in close proximity to the GWF project and there are no active or abandoned well sites within the GWF site. The nearest active licence block is located over 70km to the north east of GWF</p>	<p>No likely significant impact</p>

Species	Summary of cumulative assessment	Impact
Gas interconnectors and CO2 pipelines	Vessels could potentially disturb and displace red-throated divers belonging to the Outer Thames SPA or other more sensitive species such as razorbills. Vessel activity is likely to be infrequent and any impacts would be confined to the winter period only, when numbers of these species are highest.	No likely significant impact
Cables	A number of operational telecommunication cables pass through the southern North Sea, however effects on birds and associated habitat are considered to be localised and short-term	No likely significant impact
Shipping (including dredging of channels)	Existing populations of all species are habituated to some extent to the other commercial vessel movements in the area, and so any effects of shipping are incorporated into the GWF baseline survey data. It is expected that any increase in cumulative displacement effects from other human activities would only be potentially significant when there was a concentration of activity in a single year within the main foraging areas for a species.	Likely minor adverse
Commercial fisheries	An increase in vessel activity as a result of displacement from GWF could result in an increase in disturbance and displacement of red –throated divers, however Chapter 15 considered that a reduction in activity in the wider area is more likely. Some species as gulls and gannets are likely to easily follow fishing vessels away from the turbine areas, and so a positive impact may result from a lowering of potential collision risk, since a food source (discards) is removed from the area.	No likely significant impact
Recreation	At the current level of activity, the risk is low that recreational activities will impact on the seabird assemblage, particularly in the offshore waters of the GWF site.	No likely significant impact

30.6 Potential Cumulative Impacts during Decommissioning Phase

- 30.6.1 At present specific details on the decommissioning of GWF are not available, however a full Decommissioning Plan for the project will be drawn up and agreed with DECC before construction commences (see **Chapter 5**).
- 30.6.2 The decommissioning proposal at GGOWF includes the removal of the foundations at or just below the seabed, cables left in situ and complete removal of turbines / generating equipment (GGOWL, 2007), and at this stage it is reasonable to assume that the GWF decommissioning proposal will include similar plans. Although cumulative impacts at GWF during the decommissioning phase are anticipated to be similar in nature to those identified during the construction phase of GWF, the activities outlined above are likely to cause less disruption than the activities associated with the construction phase and as a result the potential impacts will be of lower significance.
- 30.6.3 At present, the typical design life for offshore wind turbines is approximately 25 years, therefore it could be concluded that any offshore wind farms on a parallel development timeframe to GWF (London Array Phase II, Kentish Flats Extension, East Anglia ONE) may also overlap during the decommissioning phase. However, the lease term for the projects is likely to be longer than the design life of the turbines (for example, GGOWF has a 50 year lease term (GGOWL, 2007)) as such it is possible that the wind farm developers might seek approval from the relevant Regulatory Authority at the appropriate juncture, to delay the decommissioning work in favour of re-powering the project. Subsequently, it is not possible to predict, in any further detail, specific cumulative impacts which may occur during the decommissioning of GWF due to the uncertainties of both the decommissioning programme for GWF and the other wind farms. The other projects and activities that may result in cumulative impacts alongside the decommissioning of the proposed GWF are not known at this time. However, in line with the assessments made throughout the ES it is anticipated that should there be any overlap in decommissioning timescales, then the potential impacts would be less significant than those predicted during construction as a result of the reduced level of disturbance.

30.7 Summary

- 30.7.1 This Chapter has provided an assessment of potential interactions between impacts arising from GWF, other wind farm developments and regulated activities occurring in the region.
- 30.7.2 Given the scale of the project and its position relative to adjacent wind farm developments in the region, notably its proximity to GGOWF, there is scope for cumulative impacts to occur. The potential cumulative impacts of GWF are not considered to be significant. **Table 30.8** summarises those areas where there is potential for cumulative impacts and also provides context for the impacts described.

- 30.7.3 In regard to the ornithological cumulative assessment, **Table 30.8** summarises the findings detailed in **Chapter 11** (and associated appendices). Impacts are anticipated to be tolerable and / or not significant. **Chapter 11** should be referred to for the full cumulative assessment and findings related to those species of principle concern.

Table 30.8 Summary of potential significant cumulative impacts

Receptor	Impact	Other project / activity	Impact Significance	Context
Construction phase				
Marine and intertidal ecology	Loss of subtidal habitat	GGOWF	Likely negligible impact	The significance of impacts would be no greater than those predicted at project level and are not anticipated to be significant.
	Physical disturbance from construction vessels and cable installation	GGOWF	Likely negligible impact	The significance of impacts would be no greater than those predicted at project level and are not anticipated to be significant, and will be minimised by the application of mitigation measures.
	Indirect impacts due to increases suspended sediment	Relevant offshore wind farm projects and aggregate dredging activity	Likely (regional) negligible impact	This impact relates to an additive impact across the outer Thames region, however it is not anticipated to be significant and the impacts will be no greater than those predicted at project level.
Marine Mammals	Impacts associated with construction noise (concurrent and consecutive noise impacts) and geophysical surveys	East Anglia ONE London Array I and II	Likely negligible to minor adverse	If mitigation measures are put in place at project level, these will act to minimise the significance of this impact. The significance of the cumulative impacts highlighted would also be no greater than those predicted at project level.
	Displacement and habitat loss associated with aggregate activity	Aggregate dredging activity (Area 498 and Shipwash 507/5)	Likely negligible impact	Given the limited spatial extent of aggregate activity and the temporary duration of the displacement by construction activity on GWF the combined impact magnitude is likely to be negligible. Mitigation will also minimise the significance of the impact. The significance of the cumulative impacts highlighted would also be no greater than those predicted at project level.
Commercial	Loss of access to fishing	London Array Phase I and II, Kentish Flats and	Likely negligible	The impacts are primarily for foreign mobile fleets which are nomadic in their nature and have a wide fishing range. In addition, the impact

fisheries	grounds	East Anglia ONE, aggregate dredging activity	to minor adverse	associated with construction will be short term and will only affect a small percentage of their total fishing grounds.
	Loss of fishing grounds associated with Marine Conservation Zones	Site MCZ1B	Likely minor adverse significance	The impact associated with construction will be short term and will only affect a small percentage of their total fishing grounds.
Archaeology	Offshore – Effects on archaeological resource	All relevant offshore wind farm projects and aggregate activity	Likely negligible impact	Archaeological assessments and mitigation across the projects will serve to minimise this impact and the significance of the cumulative impacts highlighted would also be no greater than those predicted at project level.
Socio-economics	Direct employment	Other wind farm developments in the region	Likely minor beneficial	The large number of offshore wind farms proposed in this region will require a supply chain of survey vessels and construction vessels (plus experienced crews), as well as other onshore and offshore construction workers. It is estimated that the cumulative direct and indirect workforce numbers would also increase in excess of 1% for the region. This represents an increase in the overall magnitude of the effect (increasing from negligible to a low magnitude effect).
	Indirect employment	Other wind farm developments in the region	Likely minor beneficial	
Landscape, seascape and visual character	Increased visual noise within a designated landscape and on local viewpoints associated with the onshore development	Sizewell C	Potential significant impact	Within the landscape and visual assessment GGOWF, Sizewell A and B have been captured as part of the existing visual baseline. Should GWF construction extend beyond 2017 there is the potential for a cumulative landscape impact with the activities associated with Sizewell C construction. However, given the lack of information no quantitative assessment is possible at this stage.
	Seascape effects	East Anglia ONE, Thanet, London Array, Gunfleet Sands	Likely negligible impact	Impact is not anticipated to be significant as a result of the level of marine activity in the area and the short term nature of the construction works.
Traffic and transport	Driver delay at priority junctions, pedestrian severance and reduced pedestrian amenity	Sizewell A decommissioning, Sizewell B Dry Fuel Store and Sizewell C	Potential moderate impact	There is the potential for the Sizewell B Dry Fuel Store construction phase and Sizewell A decommissioning phases to overlap with GWF construction. It is extremely unlikely that peak traffic periods for these developments

				<p>will overlap; however should this occur I would represent a potentially significant cumulative impact. A construction traffic management plan will be agreed with the Highways Authority to ensure that these peak periods do not overlap.</p> <p>Given the lack of information a quantitative assessment of the potential cumulative effects with Sizewell C is not possible.</p>
Operational phase				
Nature conservation designations	Impact on the landscape associated with the Suffolk Heritage Coast and Suffolk Coasts and Heaths AONB (associated with offshore development)	GGOWF, East Anglia ONE, Thanet, London Array	Likely negligible impact	The cumulative impact is not anticipated to be significant (low to negligible) and significance of the cumulative impacts highlighted would also be no greater than those predicted at project level.
Commercial fisheries	Loss of access to fishing grounds	East Anglia ONE, London Array, GGOWF	Likely minor adverse	Primarily affecting foreign beam trawlers which have a wide range and the area will only cover a small proportion of their fishing grounds. 50m safety zones will also mean that vessels will, theoretically, still be able to fish within the wind farm site.
	Loss of fishing grounds associated with Marine Conservation Zones	Site MCZ1B	Likely minor adverse significance	Cumulative impact will only affect a small percentage of their total fishing grounds, 50m safety zones will also mean that vessels will, theoretically, still be able to fish within the wind farm site.
Other human activities	Effects on aggregate activity	GGOWF and East Anglia ONE	Likely minor adverse significance	GWFL are in negotiations with Cemex and The Crown Estate and no further information is available at the time of writing (October 2011) in regard to the plans for aggregate extraction at Area 507/5. Significant impacts are not considered likely and will also be no greater than those predicted at project level.
Landscape, seascape and visual character	Increased visual noise within a designated landscape and on local viewpoints associated	GGOWF substation and Sizewell A, B and C	Likely significant impact	GGOWF substation, Sizewell A and B represent existing visual noise within the AONB and have been captured as part of the visual baseline within the assessment of operational impact within Chapter 20 and are not felt to result in any further cumulative impacts.

	with the onshore development			<p>The adverse landscape and visual effects of Sizewell C are likely to be much greater than those caused by GWF, due to the greater area of land cover, scale of development and timescale of Sizewell C.</p> <p>The combined projects will extend the areas of landscape influenced by development over a wider area of the AONB, and there are likely to be cumulative adverse landscape and visual impacts. These are likely to be greatest if the area to the east of Sandy Lane is developed, but much less if only the area to the north of Sizewell B is developed. However, given the lack of information available for Sizewell C a quantification of this cumulative effect has not been possible.</p>
	Seascape effects	All relevant offshore wind farm projects	Likely negligible impact	Cumulatively GWF will rarely alter the degree or extent of existing visual exposure. The significance of the cumulative impacts highlighted would also be no greater than those predicted at project level.
Socio Economics	Direct and indirect employment	All relevant offshore wind farm projects	Likely negligible (beneficial) impact	The large number of offshore wind farms proposed in this region will require a supply chain of operations and maintenance equipment and staff resulting in a beneficial impact
Noise	Operational noise at onshore substation	Greater Gabbard OWF substation	Likely negligible impact	The operational noise limits set by SCDC for both substation will ensure that a significant cumulative impact is not experienced.

30.8 References

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