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GREATER GABBARD OFFSHORE WINDS LTD



Greater Gabbard Offshore Wind Farm Project Environmental Impact Assessment Scoping Report

February 2004

Prepared by



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1 Background Information

1.1 The Proposed Development

The proposed development is an offshore wind farm known as "Greater Gabbard Offshore Wind Farm". The development is one of the 15 successful projects to be granted development rights by The Crown Estate in the recently concluded Round 2 tender.

The Greater Gabbard Offshore Wind Farm Project is located approximately 26km from the Suffolk coast, within the Thames Estuary Strategic Environmental Assessment Area. The site straddles the limit of UK Territorial Waters. The project comprises two arrays of wind turbines and ancillary equipment primarily located on or adjacent to the sand banks known as the Inner Gabbard and The Galloper.

The total capacity of the Greater Gabbard project is 500MW, with 300MW on and adjacent to the Inner Gabbard (within UK Territorial Waters) and 200MW on The Galloper (outside UK Territorial Waters).

In addition to the offshore wind farm infrastructure, ancillary onshore works and works in the inter-tidal zone, are required to connect the wind farm to the electricity transmission network.

This Environmental Impact Assessment Scoping Report has been compiled by PMSS Environmental Ltd, with assistance from the following organisations :

- Ecology Consulting
- Centre for Marine and Coastal Studies
- Posford Haskoning
- Denton Wilde Sapte
- Airtricity
- Fluor

1.2 The Developer

The developer of the project is Greater Gabbard Offshore Winds Ltd, details as below :

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Company Registered No NI 045828
Contact Person and Details Mr Chris Hill, Project Manager

Greater Gabbard Offshore Winds Limited is a company formed specifically to develop, finance, construct and operate the offshore wind farm, and is jointly owned between Airtricity Holdings Limited and Fluor International Limited.

A copy of the Fluor's Environmental Policy is presented in Appendix C. This has been adopted as the environmental policy of Greater Gabbard Offshore Winds Ltd.

1.3 Need for the Development

The need for the development of renewable energy generation in the UK, including offshore wind energy, arises from the requirement to generate electricity, reduce emissions of greenhouse and acid rain gases, and to move towards a more sustainable future. Wind energy is a means of generating electricity that does not produce emissions of greenhouse or acid rain gases, does not produce toxic waste products, and is not dependent on finite reserves of fossil fuels. It is inherently sustainable, and this is explicitly recognised in the Government's approach to the deployment of the technology.

Successive UK Governments have made progressively more determined efforts to curb emissions of harmful gases through a reduction in dependence on fossil fuels. This has occurred, in part, as a response to the following:

- Acid rain has been identified as contributing towards environmental damage to forests, moor lands, lakes and rivers throughout Europe
- Greenhouse gas emissions have been identified as a major contributor to global warming and climate change

The UK Government White Paper "This Common Inheritance" (1990) described global warming as:

"one of the biggest environmental challenges now facing the world"

In 1996, a Department of the Environment Newsletter recorded the Inter Governmental Panel on Climate Change (IPCC) as indicating that current trends in emissions of greenhouse gases:

"...may lead to a warming of the globe by 2°C by 2100 representing an average rate of warming greater than has been seen at any time in the last 10,000 years... Climate change is likely to have wide ranging and mostly adverse impacts on human health with significant loss of life."

In March 1999 the Government published a consultation paper: "New and Renewable Energy: Prospects for the 21st Century". The objective of the consultation exercise was to encourage contributions towards the Government's review of its renewable energy policy in order to identify what would be necessary to achieve 10% of the UK's electricity supply from renewable energy sources by 2010.

In March 2000, the Government launched its draft UK Climate Change Programme. The introduction to the document confirmed the Government's view that:

"Climate change is one of the most serious environmental threats facing the world today. The draft climate change programme sets out a far-reaching strategy for tackling climate change in the UK. It aims to ensure that the UK moves towards a more sustainable economy. It puts in place policies that give clear signals about the changes that need to be made and it outlines a variety of measures that will deliver cuts in greenhouse gas emissions..."

In October 2000, the DTI published its Preliminary Consultation Paper on the Renewables Obligation. In addition to confirming the Government's intention to secure the production of 5% of the UK's electricity supplies from renewables by 2003 and 10% by 2010, the document sets out the detailed proposals for a new Renewables Obligation, to replace the NFFO, to be placed on all electricity suppliers in October 2001 through the Utilities Act 2000.

At the recent inauguration of the UK's first commercial scale offshore wind farm in November 2003, The Prime Minister Rt Hon Tony Blair said :

“...but while North Hoyle is proof of significant progress in developing renewable energies we must take care to remember that it is just one of the very first steps along the way to achieving our goal. It's got to be followed by many more like it.”

Most recently, the Government announced its plan to extend the Renewables Obligation from the stated goal of generating 10% of UK electricity by 2010 from renewable sources, to 15% by 2015. This announcement, in conjunction with other Government initiatives, is clear evidence of the Government's proactive approach to renewable energy generation.

1.4 Regulatory and Policy Background

1.4.1 Offshore Wind Farm Consents Process

There are currently two possible consents routes available :

a) Electricity Act / FEPA

b) Transport and Works Act

(a) Electricity Act / FEPA (Food and Environmental Protection Act)

Under the Electricity Act / FEPA route the principal consents/licences required are:

- Electricity Act 1989 – Section 36
- Food and Environment Protection Act 1985 – Section 5, and
- Coast Protection Act 1949 – Section 34

Other consents likely to be required depending on development proposals are :

- Town and Country Planning Act 1990 – Section 57 or 90 (e.g. for onshore substations)
- Electricity Act 1989 – Section 37 (for onshore overhead lines)

(b) Transport and Works Act

Alternatively, under Section 3 (1)(b) of the TWA, the Secretary of State for Trade and Industry, can make an Order relating to the carrying out of works which interfere with rights of navigation in waters within or adjacent to England and Wales up to the seaward limits of the territorial sea.

The Order does not confer planning permission. However, a developer can request that planning permission is deemed to be granted, or planning permission can be sought from the Local Planning Authority. Similarly, it will be necessary to obtain a licence under Section 5 FEPA.

As the Greater Gabbard project is not contained solely within UK territorial waters, the optimum route is the first of the above because the Energy Bill that is currently going through Parliament contains provisions whereby the ambit of the Section 36 procedure will be extended to be applicable also to waters beyond the boundary of UK territorial waters. There is no such proposal to extend the legislation governing the alternative route in the same way.

1.4.2 Environmental Impact Assessment

The Environmental Impact Assessment Directive (97/1/EC) requires an EIA in support of an application for consent for projects listed in the Directive Annexes I and II. Offshore wind farm developments are listed in Annex II as *"installations for the harnessing of wind power for energy production (wind farms)"*.

Offshore power generating facilities now come within the ambit of the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 (SI 20000/1927) and in the domestic legislation require an EIA if a proposed development comprises more than two wind turbines.

Food and Environmental Protection Act

Although the EIA Directive does not technically apply to FEPA the licensing authority needs to be provided with such information as it deems necessary to enable it to properly consider the FEPA application. This information needs to include the equivalent of a formal ES in support of all offshore wind farm proposals to inform the process of impact assessment.

Coast Protection Act

An EIA is also required to satisfy the Harbour Works (Environmental Impact Assessment) Regulations 1999 where a scheme is to be sited in or partly within a port or harbour.

(A TWA order would not avoid the need for an EIA as the EIA directive also applies through Rules (SI 2000/22190) and an EIA will be required for all offshore wind farm projects seeking a TWA Order.)

Concern has been raised about the possible need for more than one EIA because of the nature of the development proposals. CEFAS advises that where the various consents impose a requirement for more than one EIA, the consenting authorities will normally be content for the developer to provide a single document, provided that its scope embraces the range of environmental issues to satisfy each of the consenting authorities. This may, take the form of separate volumes dealing with specific topics, such as the foreshore and land-based issues and sub-tidal matters.

The requirements of the EIA procedure and the information to be included in an ES are set out within the EIA Directive, and in Government publications on assessments under Section 36 and Section 37 of the Electricity Act 1989. Regard has been given to these.

The Habitats Directive

The Habitats Directive 92/43/EEC deals with the conservation of natural habitats, wild fauna and flora and aims to sustain biodiversity in the territory of European Member States. Consequently Special Areas of Conservation (SACs) are being established.

It is necessary to comply with the species protection provisions of the Habitats Directive. It is an offence deliberately to kill, capture or disturb European protected species or to damage or destroy their breeding sites or resting places.

The Directive requires that any activities, plans, or projects whether inside or outside a "Natura 2000" Site (SAC and/or Special Protection Areas (SPA)) likely to have a significant effect on the conservation status of the site's features shall be subject to assessment.

Therefore where a proposed offshore wind farm site is located within, or would be likely significantly to affect, a designated, proposed, or candidate "Natura 2000" Site consenting authorities must ensure an **Appropriate Assessment** is carried out under the Directive. During the Scoping stage for the EIA, discussions have been held with JNCC, English Nature and CEFAS.

If a proposed project does not fall within the boundaries of a European Site an appropriate assessment will only be required if it is considered (and fully justified) that significant effect on the site is likely. It is the responsibility of the competent authority, with advice from the conservation agencies to determine whether a proposed project is likely to have a significant effect on a European Site.

In the event that the development of a wind farm may result in some adverse impact on a European site, the scheme would only be granted consent if the Secretary of State is satisfied that:

- there is imperative overriding public interest;
- there is no alternative solution available and
- suitable compensating habitat(s) can be identified for the loss of that site

The Birds Directive

The Birds Directive 79/409/EEC aims to protect birds, their eggs, nests and habitats in the EU achieved by the protection of the birds' potential habitats. Through the preservation, maintenance or restoration of a sufficient diversity and area of habitats essential to the conservation of all species of birds principally through the establishment of *SPAs*.

Conduct of survey work

CEFAS advises that attention should be directed at:

- Sound sampling design applying to a pre-operational "baseline" survey, monitoring activities during the operational phase and post-operational "recovery" studies. Desk-based evaluation of all relevant information, e.g. on local hydrography, the distribution of sea-bed sediments and the associated benthic fauna and other man-made activities, will be an essential pre-cursor accompanied by a pilot survey to fill gaps in knowledge. The design will encompass representative locations at which turbines are to be located and, more importantly, wider-area sampling to demonstrate minimal environmental consequences during the operational phase, and recovery to conditions comparable in important respects with those prevailing pre-operationally, to show good husbandry.
- Effective sampling practice.
- Procedures to cover all aspects of the sampling to ensure that the outcome is of dependable quality.
- Sampling frequency may be influenced by factors such as the size of the proposed development, and the perceived ecological sensitivity of the target environment. In general, more frequent in the early stages following installation at most, annually (and at the same time of year); only exceptionally would there be a requirement for seasonal sampling.

Regard has been had to these requirements.

Domestic Nature Conservation

English Nature should advise on whether an Appropriate Assessment is likely to be requested under the Conservation (Natural Habitats, &c). Regulations 1994. An Appropriate Assessment requires some further work over and above that provided in the EIA as there is a large number of sites in the coastal waters of the UK which are protected under a range of nature conservation legislation. These include intertidal and coastal Sites of Special Scientific Interest (SSSI), *SPAs* for birds SACs for a range of other marine fauna.

Cumulative impacts

The need to consider cumulative impacts is a requirement of the EIA process. Projects to be included in such an assessment must include those in the past, present and foreseeable future (not only other potential wind farms but also other types of projects taking place in the marine environment). Cumulative impacts are considered in more detail in Section 5.4

1.4.3 Summary of Regulation and Policy

Regard will be given to the relevant requirements of all of the following:

- Electricity Act – Section 36
- Electricity Act – Section 37
- FEPA licence is required for placing of materials in the marine environment during construction and related actions; the disposal of waste at sea; and the introduction of tracers and biocides and other activities in the marine environment. Each off shore wind farm development will require a FEPA licence for a variety of works associated with the project. The licensing authority will pay particular regard to the environmental implications of the project.
- CPA – requires consent from the Secretary of State for Transport for marine works: the construction, alteration or improvement of any works on, under or over any part of the sea shore line below the level of mean high water springs; the deposit of any object or materials below the level of MHWS; and the removal of any object or materials from the sea shore below the level of mean low water springs.
- The Protection of Wrecks Act 1973
- The Merchant Shipping Act 1979
- The Protection of Military Remains Act 1986
- The Ancient Monument and Archaeological Areas Act 1979
- A code of practice (JNAPC – February 2004) seeks to guide the developer in relation to seabed archaeological issues.
- PPG16 (Archaeology and Planning) –policy and advice on the handling of archaeological remains and discoveries.
- PPG20 (Coastal Planning) – policy statement in relation to coastal planning including policy in relation to coastal energy generation (it refers to PPG22 for the detail).
- PPG22 (Renewable Energy) –policies on planning in relation to renewable energy guidance on the technology of harnessing wind energy and advice on planning implications.
- PPG23 (Planning and pollution control) –advice on the relationship between controls over development under planning law on under pollution control legislation.
- EIA Regulations –regulate the process by which environmental information is collected, publicised and taken into account in reaching a decision on a relevant application. Development within a relevant description in Schedule 1 to the Regulations always requires EIA. Development listed in Schedule 2 which meets one of the relevant criteria or exceeds one of the relevant thresholds or is located in a sensitive area will require EIA if it is likely to have significant environmental effects. Offshore wind farms are listed in Schedule 2 and the threshold is specified as being 2 turbines or more.
- County Structure Plans
- Local Plans
- Transport and Works Act Section 3(1)(b) order by which public rights of navigation may be overridden or changed temporarily or permanently to accommodate the scheme. (Unlikely to be used here.)

1.5 Strategic Environmental Assessment

In 2002, the DTI issued “*Future Offshore*”, a consultation document setting out a preferred strategy for additional rounds of offshore wind farm development. This document stated the Government's intention to undertake Strategic Environmental Assessments (SEA's) to inform future offshore wind farm allocations ahead of the introduction of the EU SEA Directive in 2004.

The SEA for Round 2 was issued for consultation in May 2003 and focused on 3 strategic areas, the Thames Estuary, the Wash and the North West (Liverpool Bay). Any subsequent rounds will be preceded by SEA of those areas.

The conclusions of the Phase 1 SEA consultation resulted in the issuing of guidance to the industry on the environmental restrictions that would need to be adhered to for site allocation within the 3 strategic areas in Round 2.

Greater Gabbard Offshore Winds Ltd supports the principle of SEA, and the Greater Gabbard site has been selected with the conclusions of this SEA in mind, notably:

- High sensitivity visual impact areas have been avoided
- Areas known to be of a high concentration for sensitive birds have been avoided
- Areas where marine mammals are known to concentrate have been avoided
- Designated sites have been avoided in terms of the turbine array and careful cable routing and cable installation will be undertaken to minimise disturbance to coastal designations
- MoD and Practice and Exercise Areas (PEXA's) have been avoided
- Main marine traffic areas have been avoided

1.6 Best Practice

Throughout the EIA process, and the construction and operation of the development, Greater Gabbard Offshore Winds Ltd will use the guidance drawn up by the following British Wind Energy Association documents :

- BWEA Best Practice Guidelines for Wind Energy Development, November 1994
- BWEA Health and Safety Guidelines, 2002
- Wind Farm Development and Nature Conservation, March 2001
- Best Practice Guidelines – Consultation for Offshore Wind Energy Developments, 2002
- BWEA Recommendations for Fisheries Liaison, December 2003

In addition, the following guidance will be reflected in the EIA process and the resulting Environmental Statement :

- Guidance Notes, Offshore Wind Farm Consents Process, DTI, January 2003
- Code of Practice for Seabed Developers, Joint Nautical Archaeology Policy Committee, 1998
- Steps Taken to Address Navigational Safety in the Consents Regime for the Establishment of Wind Farms off the UK Coast, MCA, July 2003
- Lighting of Wind Turbine Generators in United Kingdom Territorial Waters, CAA, 2003
- Wind Energy and Aviation Interests, Interim Guidelines, 2002
- Offshore Wind Farms – Guidance Note for EIA in respect of FEPA and CPA Applications, CEFAS September 2001

1.7 Assessment and Monitoring

Greater Gabbard Offshore Winds Ltd is committed to monitoring aspects of the construction phase and operations phase of the project, where appropriate. In general, where there is an effect which is either significant, or has the potential to become significant, Greater Gabbard Offshore Winds Ltd will carry out necessary assessments and incorporate monitoring as part of the process.

For issues which are not deemed significant, Greater Gabbard Offshore Winds Ltd would not propose to undertake monitoring – instead, measures to minimise the likelihood of effects on these issues would be incorporated into working procedures during either the construction, operation or decommissioning phases, with a comprehensive monitoring and reporting structure in place.

2 Project Description

2.1 Objectives of the Development

The primary objective of the development is the generation of energy from a renewable source, in line with the Government target of generating 10% of UK electricity demand from renewable sources by 2010. This figure has recently been increased to 15% by 2015. The project will offset the emission of greenhouse gases, in line with the UK's commitments under the Kyoto Protocol.

The successful development, construction and operation of the Greater Gabbard Offshore Wind Farm will further enhance Airtricity and Fluor's reputation and position within the renewable energy sector.

2.2 Clean Energy Generation / Electricity Supply

Under the "do nothing" scenario, the generation of electricity from conventional thermal sources, which comprise the majority of the supply mix in the UK, will generate emissions of greenhouse gases.

The proposed Greater Gabbard Offshore Wind Farm will make a significant contribution towards the reduction of harmful greenhouse gas emissions that will otherwise be generated from fossil fuel electricity generation.

A wind farm generating 1 kilowatt of electricity will displace the generation of 1 kilowatt of electricity by a conventional fossil fuel power station. In Planning Policy Guidance Note: Renewable Energy (PPG22) it is assumed that wind energy will have a carbon dioxide offset figure of 850 g/kWh, a sulphur dioxide offset figure of 11 g/kWh and a nitrogen dioxide offset figure of 2 g/kWh.

The net wind farm output each year for Greater Gabbard Offshore Wind Farm is based upon an estimated capacity factor of 40%, which includes an allowance for planned servicing, maintenance and repair operations. The capacity factor applied in the calculations below assumes that the wind farm will be generating electricity (at differing levels) between 80 and 90% of the time. This capacity factor estimate will in practice be validated using on-site wind measurements.

The annual net wind farm output is therefore:

$$500 \text{ (MW)} \times 40\% \times 8760 \text{ hours} \approx 1,752,000,000 \text{ kWh/year}$$

The table below summarises the amount of greenhouse gas emissions offset annually from Greater Gabbard Offshore Wind Farm (using PPG22 assumptions):

Emission Type	Annual Quantity Offset by Electricity Generated by Greater Gabbard Offshore Wind Farm (tonnes)	Calculation
Carbon Dioxide	1,489,200	0.00085 tonnes / kWh x 1,752,000,000 kWh
Sulphur Dioxide	19,272	0.000011 tonnes /kWh x 1,752,000,000 kWh
Nitrogen Dioxide	3,504	0.000002 tonnes /kWh x 1,752,000,000 kWh

Table 1: Predicted Annual Offset of Greenhouse Gas Emissions

The following table presents the total emissions offset, assuming a project lifespan of 25 years :

Emission Type	Quantity Offset by Electricity Generated by Greater Gabbard Offshore Wind Farm (tonnes)	Calculation
Carbon Dioxide	37,230,000	25 x 0.00085 tonnes / kWh x 1,752,000,000 kWh
Sulphur Dioxide	481,800	25 x 0.000011 tonnes /kWh x 1,752,000,000 kWh
Nitrogen Dioxide	87,600	25 x 0.000002 tonnes /kWh x 1,752,000,000 kWh

Table 2: Predicted Offset of Greenhouse Gas Emissions during Project Life

The proposed Greater Gabbard Offshore Wind Farm will generate enough electricity to supply the average domestic electricity supply of approximately 415,000 homes. This assumes an average domestic electricity consumption of 4,200 kWh per household per year, which is the approximate average of the values taken from the Electrical Association Review 2000 (4116 kWh-year) and the DTI Digest of UK Energy Statistics 1998 (4,256 kWh-year).

The calculation for the equivalent number of domestic homes whose equivalent consumption will be met by the output from the development is as follows:

$$\text{Equivalent number of homes supplied} = 1,752,000,000 / 4,200$$

$$\approx \mathbf{415,000 \text{ homes}}$$

2.3 Site Location

The proposed development site is located approximately 26km (14 nautical miles) off the Suffolk Coast at Felixstowe / Hollesley Bay, see Figure 1. The perimeter of the development area, as approved by The Crown Estate under the recent competition for development rights, is as follows (co-ordinates are expressed in both OSGB 36 and WGS 84) :

Inner Gabbard (Area = 59.4km²)

Corner	Easting	Northing	Long	Lat
A	668780	240350	1° 54.85'	51° 59.79'
B	671765	235830	1° 57.24'	51° 57.27'
C	667987	223733	1° 53.38'	51° 50.87'
D	664035	223733	1° 49.95'	51° 50.98'

The Galloper (Area = 42.9km²)

Corner	Easting	Northing	Long	Lat
F	672853	209034	1° 56.92'	51° 42.81'
G	675773	218876	01° 59.92'	51° 48.02'
H	675544	223034	01° 59.92'	51° 50.26'
I	672877	222803	1° 57.59'	51° 50.22'
J	670337	214552	1° 55.00'	51° 45.86'

Table 3 : Site Location Coordinates

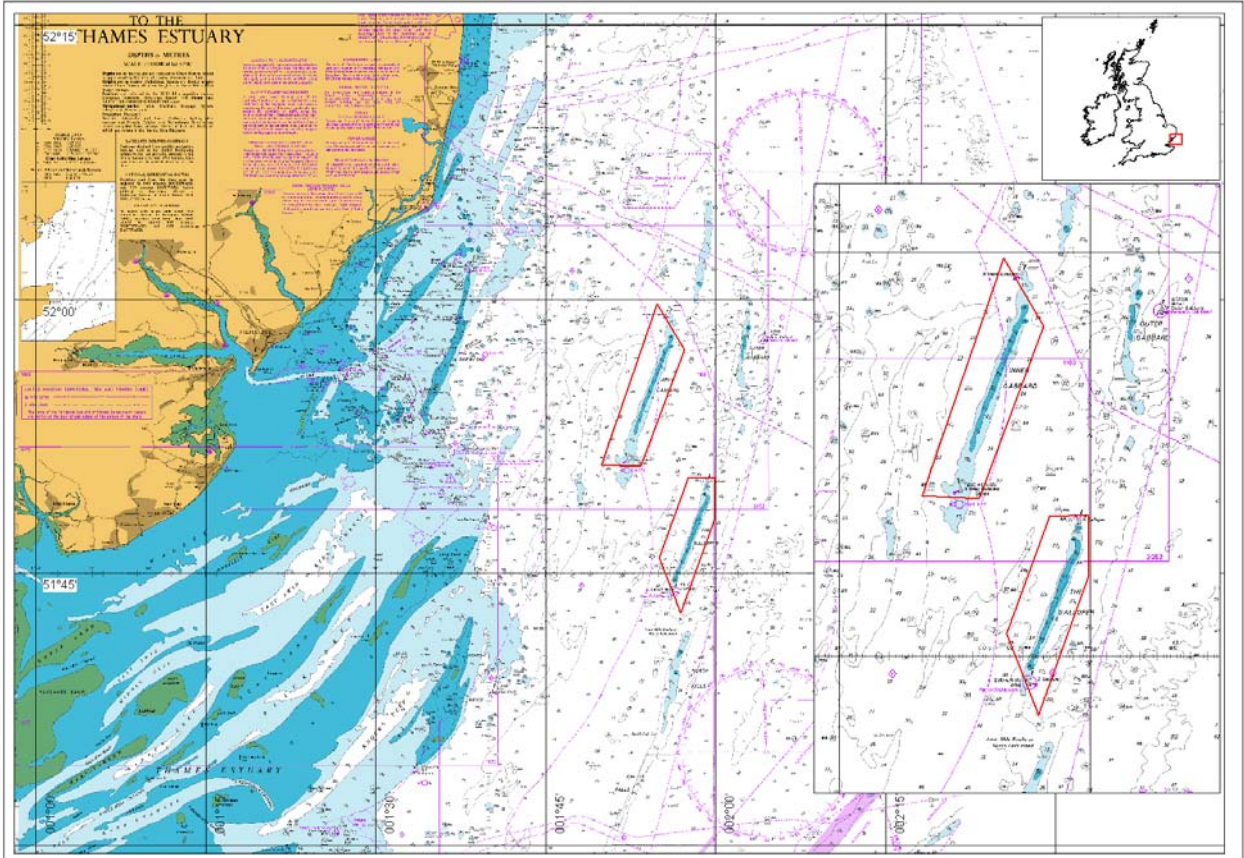


Figure 1 : Site Location

The total area within the perimeter, which includes the wind turbines and all wind farm infrastructure including met mast(s), offshore transformer station(s), is 102.3 km². In addition, a maximum of 4 export cables are anticipated to be required in order to transmit the generated electricity to shore. Cables are also required between the two wind turbine arrays for power transmission.

2.4 Physical Characteristics

2.4.1 Metocean Characteristics

The location for the proposed Greater Gabbard Offshore Wind Farm has the following metocean characteristics :

Estimated Average Mean Wind Speed	9.04 m/s at 80m AMSL
Water Depth Range	-3.6m to – 8m CD (Inner Gabbard) -2.4m to – 10m CD (The Galloper) -20m to –50m CD (off the banks)
Mean Surface Temperature	16.5°C (Summer) 6°C (Winter)
Salinity	< 34.75g/kg (Summer) > 34.75g/kg (Winter)

Table 4 : Metocean Characteristics

Astronomical tidal levels relevant to the Greater Gabbard site, determined from the Admiralty tide tables for the nearby Standard Ports of Walton-on-the-Naze and Harwich are summarised in Table 5 below.

Tidal Level (mCD)	MLWS	MLWN	MHWN	MHWS	HAT
Walton-on-the-Naze	+0.40	+1.10	+3.40	+4.20	+4.60
Harwich	+0.40	+1.10	+3.40	+4.00	+4.40

Table 5 : Tidal Levels

The tidal streams at The Galloper (51°44.3' N 1°48.3'E) are presented below in Table 6 :

Time from High Water at Sheerness (hrs)	Current Direction (°N)	Velocity (m/s)	
		Spring Tide	Neap Tide
-6	320	0.1	0.1
-5	215	0.4	0.3
-4	209	0.7	0.5
-3	211	0.9	0.6
-2	216	0.8	0.5
-1	221	0.5	0.3
High Water	275	0.1	0.1
+1	029	0.4	0.3
+2	037	0.7	0.5
+3	039	0.9	0.6
+4	038	0.7	0.5
+5	036	0.5	0.3
+6	020	0.2	0.1

Table 6 : Tidal Streams at The Galloper

2.4.2 Geological Characteristics

A description of the geological characteristics of the banks and the surrounding seabed is provided in Section 5.1.1

2.5 Wind Farm Components and Their Installation

The components for the wind farm will not be procured until much later in the project programme, after the necessary statutory consents have been granted. Therefore a description of the likely components and their installation will be provided in the Environmental Statement, together with any alternatives (if necessary) and corresponding methods of installation. The resulting assessment of environmental effects will correspond to all component options presented, during their construction, operation and decommissioning.

2.5.1 Wind Turbines

Greater Gabbard Offshore Wind Farm will feature up to 140 wind turbines each with a rated capacity in the order of 5MW. The maximum capacity of the project is limited to 500MW following the site award under the Round 2 procedure. Preliminary dimensions of the turbines are not expected to exceed a maximum tip height of 162.5m above Mean Sea Level with a nominal 100m hub height and 125m rotor diameter.

It is anticipated that the "air-gap", i.e. the clearance between the lowest arc of the rotor and water, will be no less than 22m at MHWS.

The wind turbines will be proven technology, incorporating tapered tubular towers and three blades attached to a nacelle housing containing the generator, gearbox, and other operating equipment. The unit transformer will be located either at the tower base (above the high tide

level) or at the top of the tower, depending on the type of wind turbine procured. The type of transformer (oil-filled or cast-resin) will be indicated in the Environmental Statement.

The wind turbines will begin generating power when the wind speed at the hub-height is between approximately 2 to 5 metres per second (m/s). The wind turbines power output increases with increasing wind speed and the wind turbines typically achieve their rated output at wind speeds of between 12 to 15 m/s at hub-height. The design of the turbines ensures "fail-safe" operation, such that if the average wind speed exceeds 25m/s at hub-height for extended periods, the turbines shut down automatically. All rotors will rotate in the same direction, i.e. clockwise when viewed from the windward direction.

The final decision on the colour of the turbine towers and blades will be made following the results of the visual and navigational risk assessment - at present the working assumption is that they will be a semi-matt pale grey colour, similar to other offshore wind farm projects.

The only distinguishing markings, discernable from a vessel, will be navigation markings, lighting protocol and the turbine number for identification purposes.



Figure 2 : Arklow Bank Offshore Wind Farm – Wind Turbine

Installation

Although offshore contractors have varying construction techniques, the installation of the wind turbines will invariably require a jack-up barge, possibly one of the vessels currently in the market or a purpose-built wind turbine installation vessel.

The wind turbine components will either be stored at an adjacent port (likely to be either, Harwich, Felixstowe or Lowestoft) and transported to site by support barge, or transported directly from the manufacturer to the wind farm site by the installation barge. The wind turbine will typically be installed using several lifts – the tower (2 lifts), nacelle (one lift), blades (1-2 lifts). A support jack-up barge, support barge, tug, safety vessel and personnel transfer vessel may also be required.

The works would be planned for 24 hours per day, with lighting of the jack-up barge at night, and accommodation for crew on board.

Following installation and grid energisation, the wind turbines are commissioned and are available to generate electricity.

2.5.2 Foundations

The wind turbines will be supported on foundations secured to the seabed. The final configuration of foundation for the project will be subject to the selection of wind turbine, ground conditions, metocean conditions, design and operations philosophy and life-cycle cost. It is likely that the foundations for Greater Gabbard Offshore Wind Farm will comprise one of the following concepts:

a) Steel piled foundation, single or multi-pile. These structures rely on the frictional properties of steel piles fixed into the seabed either by driving (using a hydraulic hammer) or drilled (using a bonding substance such as grout). The installation vessel would be a jack-up barge with attendant vessels.

Installation, Driven Solution – The driven piles are installed using a hydraulic impact hammer, and driven to their target penetration depth.

Installation, Drilled Solution – A socket is drilled into rock, into which the pile(s) are inserted and fixed using a grouting substance. A variation on the above is where the foundations are driven, the socket is then drilled, and the pile is driven for a second time avoiding the requirement for grout. This solution generates spoil from within the pile, requiring a separate FEPA licence if disposed of away from site. The Environmental Statement will provide consideration of spoil disposal locations and methods.



Figure 3 : Monopile Foundation, Arklow Bank

b) Steel suction caisson. These foundations rely on the pressure differential between the inside and outside of the caisson to withstand any axial forces. Although largely unproven for offshore wind turbines, three or four caissons could be used in conjunction with a tubular upstand to provide a support for turbines in deeper water.

Installation – The turbine and foundation is transported to the site pre-assembled, lowered onto the seabed and the caissons are evacuated in order to achieve the necessary internal pressure. The system can be decommissioned using a reverse method.

c) Concrete (or steel) gravity structure. These foundations rely on their mass to withstand the overturning moment of the wind turbines. They require some form of seabed preparation prior to installation, and following installation they sometimes require ballasting with an inert substance.

Installation – The seabed is levelled and covered with rock to make it stable. The gravity structure is either floated out to site, or transported on a barge to site. A large crane, probably floating, then lifts the foundation and places it onto the rock-bed.

d) A hybrid of the above concepts.

The foundations also carry the access ladder, J-tubes (to prevent cable damage), corrosion protection methods and crew platform.

The Environmental Statement will feature a range of possible foundation solutions, together with outline (preliminary) designs using site geotechnical data and site metocean data (if available). The Environmental Statement will also describe the installation methodology for each solution.

2.5.3 Corrosion Protection

Corrosion protection on the steel structure will be achieved by installing sacrificial anodes on the subsea structure.

The anodes are standard products for offshore structures and are welded onto the steel structures. The anodes typically consist of zinc and aluminium, they are connected to the structure via doubler plates to ensure the integrity of the primary structure is maintained in the unlikely failure of an anode connection. The number and size of anodes would be confirmed during detailed design.

2.5.4 Meteorological Mast

It is likely that a permanent meteorological mast will be required for the operations phase. Such a mast will be the same height as the wind turbine hub, and will invariably feature a foundation installed in a similar manner to the foundations for the wind turbines, described above. The proposed location of the met mast will be indicated in the Environmental Statement.



Figure 4 : Arklow Bank Met Mast

2.5.5 Scour Protection

The decision on whether to install scour protection (from a technical point of view) will be made by the developer and/or construction contractor once the detailed design of the support structures has been performed, i.e. post-consenting phase. It is therefore likely that the Environmental Statement will feature some form of scour protection, potentially using several

methodologies. The properties and installation of the scour protection material(s), together with their inspection and maintenance requirements, will be described in the Environmental Statement.

2.5.6 Cables

Subsea power cables are required to connect the wind farm to the electricity distribution or transmission network system. These cables will also comprise internal fibre optic communication links for wind farm control purposes. The 3-core cables being considered comprise copper conductors with integral insulation, core screening, and steel armour (for stiffness and impact resistance).

The inter-turbine cables will be standard 33kV cables, similar to many such examples already installed in the marine environment.

At present the working assumption is to bury the export and the inter-turbine cables. This is subject to the precise ground conditions which will be established following surveys. The need for cable burial is also inextricably linked to navigation risk assessment, density of fishing, ground conditions, metocean conditions and the potential link between EMF and effects on elasmobranchs. All these factors will be considered in the decision making process.

At the current time the exact route of the site to shore cables has not been finalised, but it is assumed that it will be the shortest distance between the wind farm site and landfall in proximity to the sub-stations. There are however a number of issues which will be taken into account prior to any final preferred option and it is likely that a number of options would be assessed on environmental, technical and economic grounds.

2.5.7 Offshore Transformer Station(s)

The purpose of an offshore transformer station is to transform the voltage of the electricity generated at the wind turbine to a higher voltage suitable for transmission of power ashore. For the Greater Gabbard Offshore Wind Farm, it is likely that 3-4 offshore transformer stations will be required. Such stations will each incorporate a step-up transformer, switch-gear and associated electrical hardware, supported on a foundation similar to a wind turbine foundation.



Figure 5 : Transformer Station, Horns Rev

2.5.8 Cable Crossings

There are existing telecommunications cables in the area, and the possibility exists for the export cables to cross these. Where cable crossings are necessary, the methodology for such crossings will be presented in the Environmental Statement.

2.5.9 Wind Farm Layout

The final wind farm layout will be subject to the following considerations :

- Ground conditions
- Metocean conditions
- Constraints identified from the agreed monitoring and individual assessments comprising the EIA
- Minimising, on balance, the potential for environmental effects from such assessments
- Minimising effects on statutorily designated sites and issues highlighted in the Scoping Process
- Energy yield
- Capital Cost
- Minimising electrical losses
- Rated power output and physical size of the selected wind turbine

The final wind farm layout will be described in the Environmental Statement, together with a description of the considerations (environmental and technical) for arriving at such a layout. In addition a review of alternative layouts, and the reasons for them being rejected in favour of the preferred layout, will be given.

2.5.10 Cable Landfall

The potential cable landfall locations are as yet undefined. The potential locations will be determined once the preferred grid connection location is known. However it is recognised that :

- Some adjacent coastlines are designated as being of interest for nature conservation and sites include Sites of Special Scientific Interest (SSSI's), National Nature Reserves, Special Protection Area for birds, Ramsar and candidate SACs. Fieldwork and careful location and installation would be necessary to minimise impacts on these features as well as liaison with the English Nature, RSPB, Environment Agency and the relevant Local Authority
- The security of any coastal or flood defences is of paramount importance, and careful design of the landfall is required
- The potential exists for disturbance to tourist resorts during the summer season, and careful location and timing may be required to minimise impacts.

2.5.11 Grid Connection and Onshore Works

The point of connection to the Transmission System has not yet been confirmed. However, initial discussions with National Grid Transco (NGT) indicate it is most likely to be one of the following as presented in Figure 6 :

- Existing 400kV sub-station at Bramford, 6km east of Ipswich
- Existing 400kV sub-station at Sizewell (site of Sizewell nuclear power station)
- Existing 132kV sub-station at Bradwell (site of a retired nuclear power station)

Further work with NGT will determine the preferred connection location and the extent and location of onshore works. Depending on the timing of the applications for statutory consents and the grid connection process with NGT, the Environmental Statement may include more than one connection option. For all the grid connection options, the Environmental Statement will include :

- Grid Connection Location
- Description and Location of Onshore Infrastructure
- Cable Landfall Option(s)
- Methods of installation

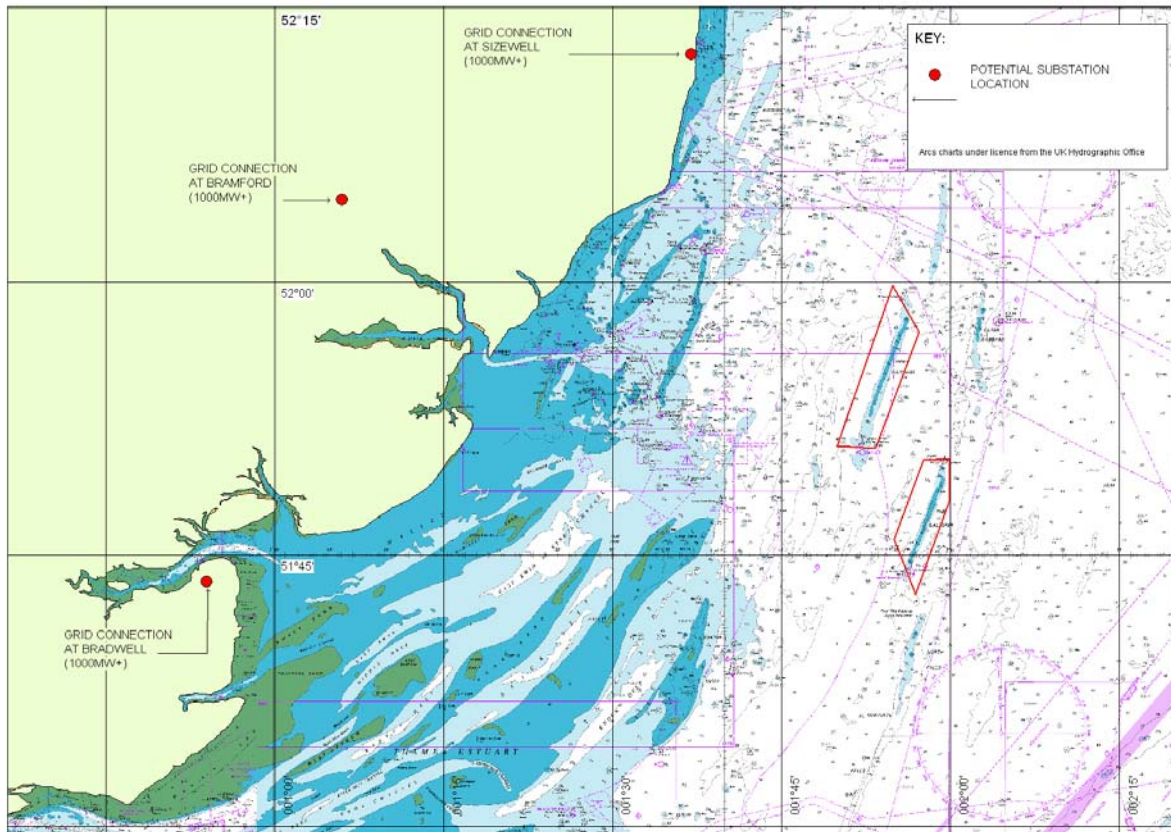


Figure 6 : Candidate Locations for Grid Connection

2.6 Wind Farm Construction

2.6.1 Access to Site

The construction phase for the Greater Gabbard Offshore Wind Farm project is scheduled to take place during all times of year. The marine part of the construction phase is scheduled to take place during the summer and autumn months as per the indicative construction programme below, where suitable weather conditions are statistically more likely to occur. However Greater Gabbard Offshore Winds Ltd would expect no seasonal restrictions on the time of year for working, subject to the results of the EIA process.

Construction in the marine environment is potentially hazardous, and in the interests of safe working the project should be permitted to take advantage of as much construction time in favourable conditions as is possible. Construction activity is expected to continue, subject to site weather conditions, for 24 hours per day until construction is complete.

A navigation risk assessment for the construction phase will be undertaken in order to assess whether a safety zone would be necessary, and if so its extent.

2.6.2 Lighting and Marking

The construction area will be depicted on Admiralty Charts by the UK Hydrographic Office, and information pertaining to construction will be disseminated through the Notice to Mariners procedure and regular communication with local and regional stakeholders. The construction area could also be marked by a series of temporary buoys around the perimeter.

2.7 Wind Farm Operation

2.7.1 Access to Site

Operation and maintenance of the offshore wind farm will continue 24 hours per day, 365 days per year, and therefore Greater Gabbard Offshore Winds Farm Ltd will require access to site at any time.

It is recognised that the presence of the wind farm could present a hazard to navigation. As part of the EIA, a navigation risk assessment will be performed to investigate whether any component of the wind farm, or indeed the whole wind farm, should be subject to a safety zone during the operation phase. Such an assessment will cover any risk to the project arising from commercial traffic, amenity craft and commercial fishing vessels, and will include an assessment of the resulting possible effects on such identified users of the sea.

2.7.2 Lighting and Marking

The lighting and marking of the wind farm will be specified by Trinity House Lighthouse Services, upon the receipt of project information and the navigation risk assessment.

The positions of the wind turbines, subsea cables and ancillary structures will be conveyed to the UK Hydrographic Office so that they can be incorporated into Admiralty Charts and the Notice to Mariners procedures.

2.7.3 Wind Farm Control

The wind turbines are configured so that they operate with a minimum of supervisory input. The turbines are monitored and controlled by micro-processors installed within the turbine tower. Should a turbine develop a fault, the status of the fault is diagnosed, and if necessary the turbine is automatically shut down for safety purposes. The turbine operation is based upon a "fail-safe" philosophy.

All information relating to on-site conditions (windspeed, direction, wave height, etc), turbine status and generated output is held within a central Supervisory Control And Data Acquisition (SCADA) system linked to each individual turbine micro-processor. The SCADA system is controlled from an operations base ashore, and allows for the remote control and shutting down of any individual turbine (or a number of turbines) should circumstances dictate.

2.7.4 Wind Farm Inspection and Maintenance

The wind farm will be serviced and maintained throughout the life of the wind farm (20-25 years) from a local port, possibly from either Harwich, Felixstowe or Lowestoft. Following the commissioning period of the wind farm, it is expected that the servicing interval for the turbines will be 6 months.

Maintenance of the wind farm is normally separated into three different categories:

- Periodic overhauls
- Scheduled maintenance
- Un-scheduled maintenance

Periodic Overhauls

Periodic overhauls will be carried out in accordance with the turbine manufacturer's warranty. These overhaul campaigns will be planned for execution in the periods of the year with the best access conditions, preferably in summer.

The periodic overhauls will be carried out according to the supplier's specifications. The work scope typically includes function and safety tests, visual inspections, analysis of oil samples, change of filters, lubrication, check of bolts, replacement of brake pads, oil change on gear box or hydraulic systems, etc.

Scheduled Maintenance

Scheduled maintenance applies primarily to inspections and work on wear parts susceptible to failure or deterioration in between the periodic overhauls. A scheduled inspection of each turbine is likely to take place every six months. The tasks will typically be inspection on faults and minor fault rectification.

Scheduled maintenance will be performed using small personnel craft operated from the local harbour.

Unscheduled Maintenance

Unscheduled maintenance applies to any sudden defects. The scope of such maintenance would range from small defects to complete failure or breakdown of main components. Such maintenance would require the intervention of construction vessels similar to those involved in the construction of the wind farm.

Inspections of support structures and subsea cables will be performed on a regular basis as will ad-hoc visits for surveillance purposes.

2.7.5 Operation Management (Environmental)

There are no anticipated direct discharges to the atmosphere during normal operation of the turbine array.

There are no anticipated solid discharges into the marine environment during normal operation of the turbine array. All waste generated during operation, for example associated with maintenance, will be collected and disposed of by licensed waste management contractors to licensed waste management facilities onshore.

There are no anticipated direct aqueous discharges to the marine environment during normal operation of the turbine array. However, there is a small risk of accidental discharges from the turbine array or marine vessels associated with operations and maintenance.

During the operations phase of the wind farm an Environmental Management System, based upon the system implemented for the construction phase, will be in place. The system will ensure that the environmental monitoring, as specified in the statutory consents, is undertaken and reported, and that the wind farm is operated and maintained in an environmentally responsible manner.

It is anticipated that the following aspects will be featured in the Environmental Management System during the operational phase:

- Environmental Management System
- Environmental Management Plan
- Environmental Monitoring Protocol
- Emergency Response
- Incident Reporting and Non Conformance Procedure
- Collision Risk Management Plan
- Marine Pollution Contingency Plan
- Waste Management Plan
- Dropped Objects and Materials Recovery Plan

The plans will generally be shorter versions of the corresponding construction plan – however, if major unscheduled maintenance works are required the construction plans may need to be invoked if larger construction vessels are required.

2.8 Wind Farm Decommissioning

Greater Gabbard Offshore Winds Ltd recognises the importance of considering the decommissioning process at an early stage. Decommissioning of the wind farm will form an integral part of the Environmental Statement for the project

2.8.1 Decommissioning Method

The objectives of Greater Gabbard Offshore Winds Ltd during the decommissioning process will be to minimise both the short and long term effects on the environment whilst making the sea safe for others to navigate. Based on current regulations and available technology, Greater Gabbard Offshore Winds Ltd proposes to perform the following level of decommissioning on the wind farm:

- Wind turbines – to be removed completely
- Structures and substructures – to be removed to the natural seabed level
- Infield cables – to be either removed (in the event they have not been buried during the construction phase) or to be left safely in-situ, buried to below the natural seabed level or protected by rock-dump
- Export cables – to be left safely in-situ, buried to below the natural seabed level or protected by rock-dump
- Cable shore landing – to be either safely removed or left in-situ, with particular respect to the natural pattern of longshore drift
- Scour prevention – to be left in-situ
- Onshore cabling – to be either safely removed if above ground or left in-situ if buried
- Onshore grid connection – equipment to be safely removed
- Onshore buildings – to be either converted to alternative uses or removed

The Environmental Statement will contain a brief description of the following :

- Decommissioning process (outline method statement) for all types of infrastructure (ie foundation type, etc) cited in the Project Description
- Possible methods of removal and likelihood of re-use or recycling of components, for example,
 - All steel components sold for scrap to be recycled.
 - The turbine blades (fibre-glass) to be disposed of in accordance with the relevant regulations in force at the time of decommissioning. One potential disposal method identified is to break down the fibre-glass into a pulp for use as cavity insulation in buildings
 - All heavy metals and toxic components (likely to be small in total) disposed of in accordance with relevant regulations
- Possible methods of disposal for products where re-use or recycling is not anticipated
- Decommissioning programme

2.8.2 Access to Site

It is envisaged that the requirements for access to site during the decommissioning phase will be similar to those required during the construction phase.

2.8.3 Ongoing Monitoring

The scope and duration of the monitoring requirements post decommissioning will be agreed between the operator of the wind farm and the DTI in consultation with other Government Departments and details will be included in the decommissioning programme. The operator will implement the arrangements for monitoring, maintenance and management of the decommissioned site and any remains of installations or cables that have been left in-situ in accordance with the agreement.

3 Relevant Projects and Studies

The Greater Gabbard Offshore Wind Farm is located approximately 26km (14 nautical miles) off the Suffolk Coast at Felixstowe / Hollesley Bay. The region in general is home to a range of offshore developments, including other wind farm projects, aggregate extraction, oil and gas and subsea cables and pipelines.

The development, appraisal and operation of such projects provide a useful source of background material for the appraisal of Greater Gabbard Offshore Wind Farm, and it is the intention of Greater Gabbard Offshore Wind Ltd to liaise / collaborate with the relevant projects and to reference as much existing information as possible.

3.1 Offshore Wind Farms

The offshore wind farms from Rounds 1 and 2 for the Thames Estuary are as follows :

Project (and Bidding Round)	Capacity	Developer / Owner	Location	Distance from Greater Gabbard
Gunfleet Sands (1)	Up to 108MW	GE Gunfleet Ltd	8km off Clacton	40km approx
Kentish Flats (1)	Up to 129MW	Elsam	8.5km off Whitstable	55km approx
London Array (2)	Up to 1000MW	London Array Ltd	20km off Essex	15km approx
Thanet (2)	Up to 300MW	Warwick Energy	13km off Margate	35km approx
Gunfleet Sands II (2)	Up to 64MW	Deltaic	10km off Clacton	40km approx

Table 7 : Offshore Wind Farms in Thames Estuary

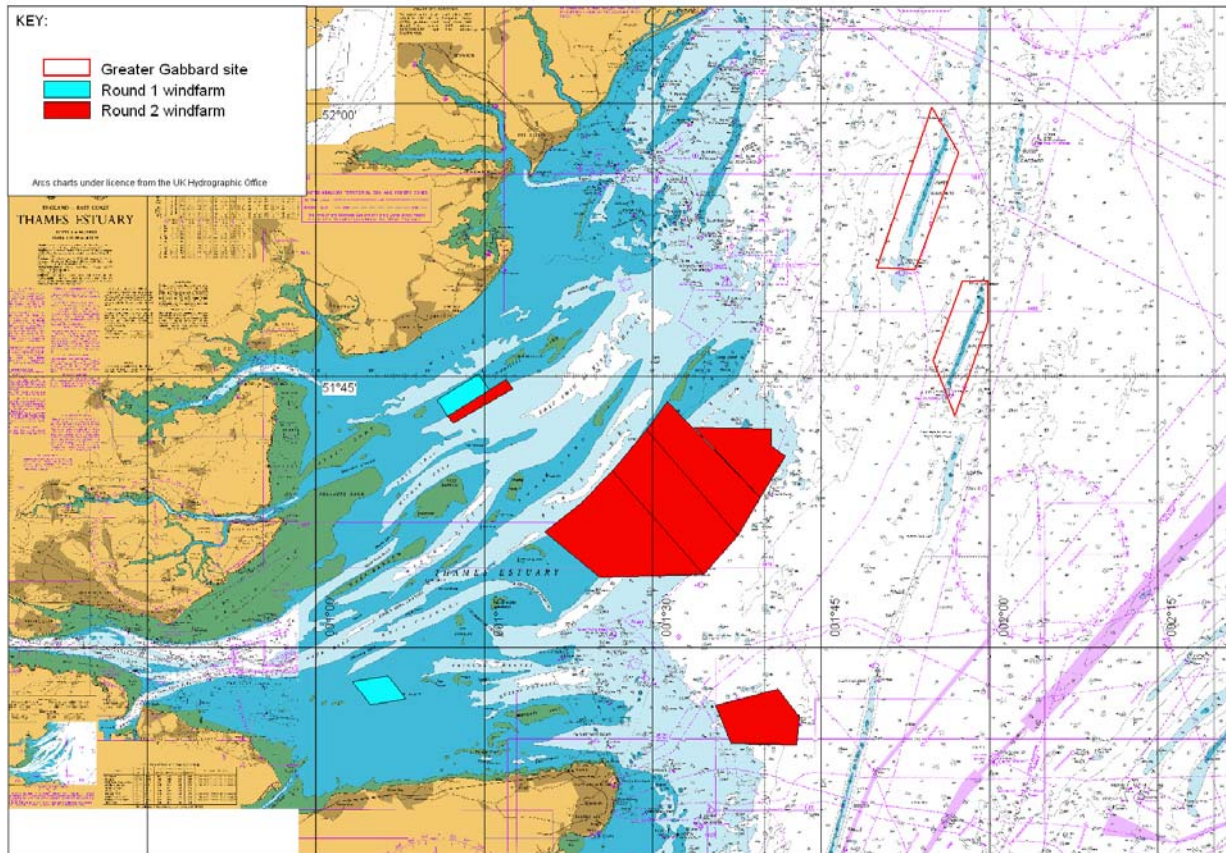


Figure 8 : Offshore Wind Farm Projects in the Region

3.2 Marine Aggregate Extraction

There are three areas licenced or to be licenced (subject to consent) for the extraction of marine aggregates (source : The Crown Estate), indicated below and shown in Figure 9

Company	Extraction Area Reference	Status	Distance from Greater Gabbard
RMC Marine (SCS)	239/1 and 452	Licence and Application	2.2km to NW
RMC Marine (SCS)	364/1	Licence	6.2km to NW
Hanson	119/3	Licence	4.1km to W

Table 8 : Marine Aggregate Extraction Areas adjacent to Greater Gabbard

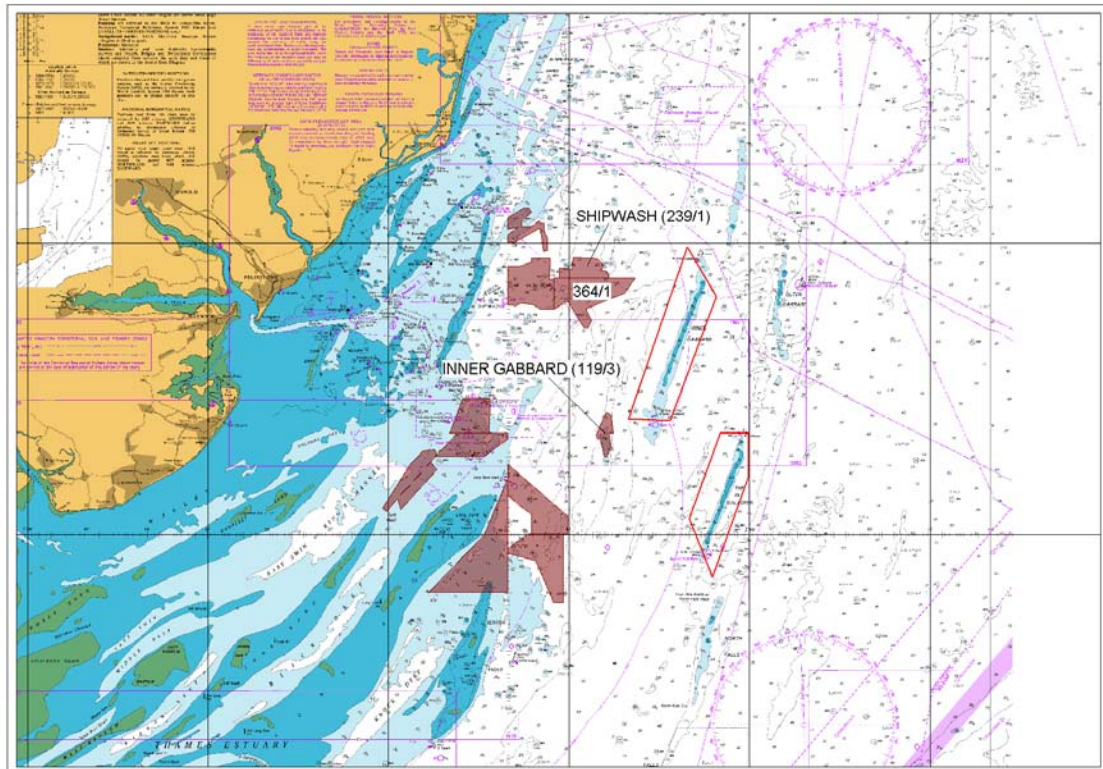


Figure 9 : Marine Aggregate Licence Areas

3.3 Offshore Oil and Gas

There are no known offshore oil and gas activities in the area of the project.

3.4 Disposal of Dredged Material

The proposed extension to the southern dock space in the Port of Felixstowe is currently under consideration. The material extracted during the construction process (up to 3.86 Mm³) will be disposed at the existing Inner Gabbard dispersive disposal site, and the site known as Inner Gabbard (east) disposal site.

3.5 Subsea Cables and Pipelines

There are three known subsea cables in the vicinity of the project (source :The Crown Estate) as indicated below and is shown on Figure 10. There are no known subsea oil or gas pipelines in the vicinity.

Company	Reference	Status	Distance from Greater Gabbard
National Grid Transco	UK-Netherlands Interconnector	Proposed Southern Route	3.0km to S
GT UK	Atlantic Crossing Seg B1	Telecomms	3.0km to E
British Telecom	Farlands	Telecomms	7.3km to N

Table 9 : Subsea Cables adjacent to Greater Gabbard

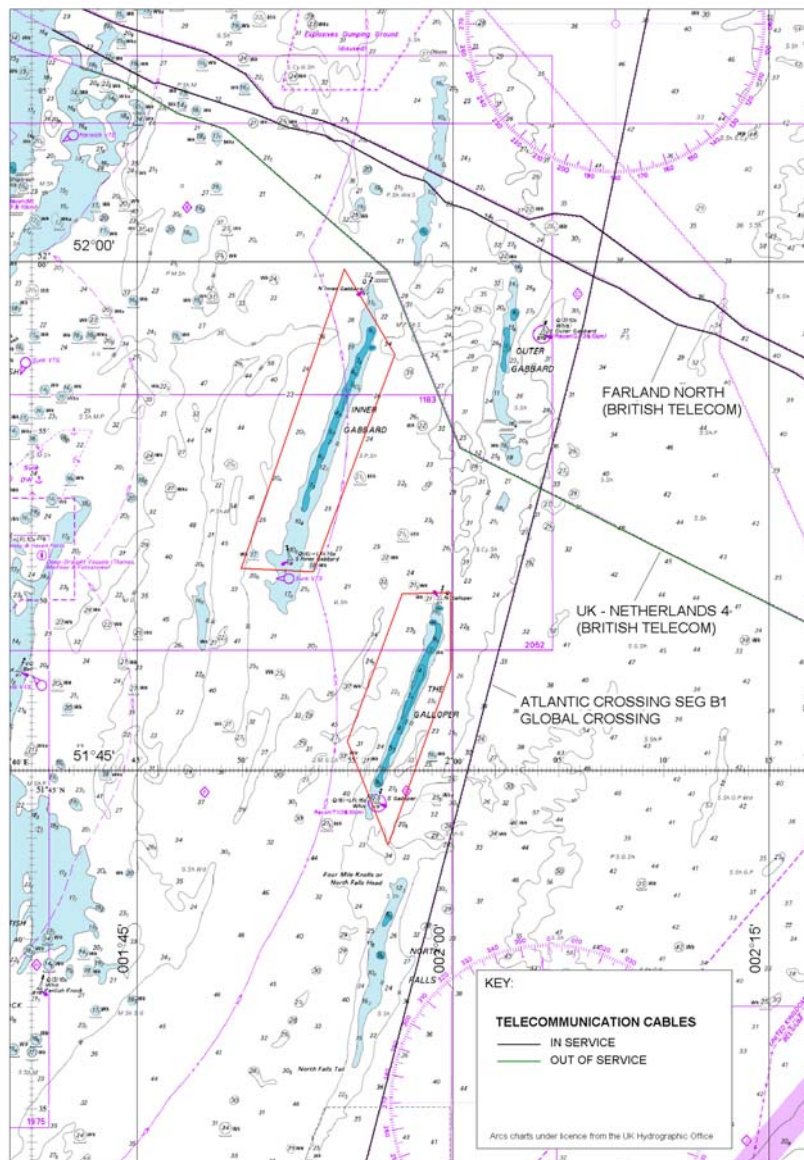


Figure 10 : Subsea Cables

4 Consultation

4.1 Consultation Overview

The objective of the consultation process is a clear and open dialogue and exchange of information between Applicant, Regulators, Consultees and the Public, from project inception to conclusion. As part of the EIA process, Greater Gabbard Offshore Wind Ltd will conduct a proactive consultation strategy through the following :

- Project briefings / seminars
- Public exhibitions
- Public perception survey(s)
- Project web-site
- Presentations to local clubs and societies
- EIA sub-groups

4.2 List of Consultees

The scoping report for Greater Gabbard Offshore Wind Farm has been sent to the consultees listed in Appendix B.

4.3 Consultee Responses

A summary of the consultation responses on Revision 1 of the scoping report will be incorporated into future versions of the report, and issued accordingly. Comments are requested by 8th April 2004, with a revised issue of the Scoping Report approximately two weeks following this date.

5 Scoping of Environmental Effects

5.1 The Physical Environment

The potential for effects on the physical environment arise from the physical presence of the wind farm, the construction methods and the materials & substances used.

5.1.1 Hydrodynamics, Water Quality, Seabed and Suspended Sediments

5.1.1.1 Potential Environmental Impacts

The presence of the wind farm will modify the wave and tidal conditions at the site through the wetted area introduced by the turbine foundations and ancillary structures. Such interactions provide the potential for localized changes in suspended sediment concentrations (due to scour and other sources). Potential sources of scour include the foundations and ancillary structures, and the cables should they be unburied or become exposed due to sedimentary processes.

As a result, offshore wind farms have the potential to create a range of effects on the sedimentary processes. In addition, the construction of the wind farm has potential to affect the geomorphology of the area. These effects can in themselves constitute an impact and can also indirectly impact upon the biological environment. In addition physical effects can occur in the surrounding marine environment and at the adjacent coastline.

Water quality can be affected by the mobilisation of sediments into the marine environment and by heavy metals or organic polymers associated with grouting and cementing materials, if required for structure foundations, and activities during the operations phase.

The potential effects on the physical environment include :

Construction Phase

- Increased turbidity during installation of drilled foundations, subsea cables, pipeline crossings, scour protection, and the indirect effect on benthos, fish and water quality in general
- Increase radioactivity inherent in rock strata extracted during the drilling process or contamination existing in the seabed from previous activities
- Degraded water quality due to handling of fuel, waste materials, chemicals, grout, and indirect effects as above
- Disposal of arisings, which may require a separate FEPA licence depending on the disposal location
- In-combination effects with other developments

Operations Phase

- Effects of the physical presence of the structures on hydrodynamics, i.e. :
 - wave regime
 - tidal currents
 - scour, local and potentially global
 - bathymetry, including bed features
- Increased turbidity due to scour, and subsequent effects on benthos, fish, coastal processes etc
- Changes to seabed morphology with resulting changes in water depth. These changes depend on the degree of sediment transport at and around the site, water depth and hydrodynamic conditions and the nature of the sediments at and around the site.
- Localised deepening of the seabed in the vicinity of the turbines caused by scour.

Bedrock

The bedrock geology of the Greater Gabbard site comprises a thick sequence of London Clay Formation of Eocene age. The formation thickens from west (20-100m) to east (80-150m) across the area, and where no recent sediments are present, it outcrops at the seabed. Vibrocore data shows the London Clay is composed of firm to stiff silts and clays. Seismic data provide evidence for complex small-scale faulting within the formation.

Older Palaeocene strata (Lambeth Group and Thanet Formation) lie below the London Clay and above the surface of the Upper Chalk. Neither they nor the chalk outcrop at the seabed beneath the site. The surface of the Upper Chalk varies in depth below the site between -100 and -190m CD.

Pleistocene-early Holocene

There are few Pleistocene or older Holocene deposits preserved across the site. The seismic data shows the presence of minor channel infills (up to 12m thick), but their origin and composition cannot be ascertained from the data available. In the northwest of the site, isolated small units of sediment (up to 4 m thick) sit directly on the London Clay. These may be Pleistocene glacial (till) or early Holocene deposits, but the evidence is not definitive.

British Geological Survey (1990) suggested that erosion of river valleys into the London Clay took place during the mid to late Pleistocene. The valleys trend north and east and extend to a depth of about -40m CD ('tunnel valleys' mirroring the - 40m bathymetric contour). The channels are generally not infilled, except possibly in the southeastern corner of the site and a small area in the northern part of the site. Here the sediments attain thicknesses of up to 20m and up to 10m, respectively.

Holocene-Recent

The thickest Recent sediments across the site form three narrow, linear sand banks; Outer Gabbard, Inner Gabbard and The Galloper. A fourth bank called North Falls is located just off the southern edge of the site. No seismic profiles cross these banks, and so their thickness resting on London Clay is unknown. However, the bathymetry indicates thicknesses of over 15 m. The flanks of Outer Gabbard, Inner Gabbard and The Galloper are steep and the thickness of the banks quickly thins to zero.

Seismic profiles and vibrocores between the banks and close to their flanks indicate either London Clay at surface or London Clay beneath a thin veneer of recent sediment (with occasional megaripples) or a lag. The lag appears to sit within low areas, and may have been formed by excessive erosion of the seabed.

A more persistent, thicker layer of sand rests on the older deposits across the southeast corner of the site. This sheet is a northeast extension of North Falls sand bank and does not appear to be connected to The Galloper. The sand sheet is up to 20 m thick and sculpted into a wide range of asymmetric sand waves and megaripples. Vibrocores into the top 3m of the sediment record coarse to very coarse sand (with shell fragments) with layers of fine and medium sand.

Sedimentary Processes

An overview of the oceanography and sediment transport of the Thames Estuary Strategic Area is provided in BMT Cordah (2003).

Sea Bed Sediments

The pattern and distribution of sediments across the site is shown in Figure 12. To a large extent, this distribution reflects the bathymetry across the site. Sediments consist mainly of sandy gravel and gravelly sand, with the exception of the sand bank areas and a number of patches of finer material and some isolated coarser grained patches.

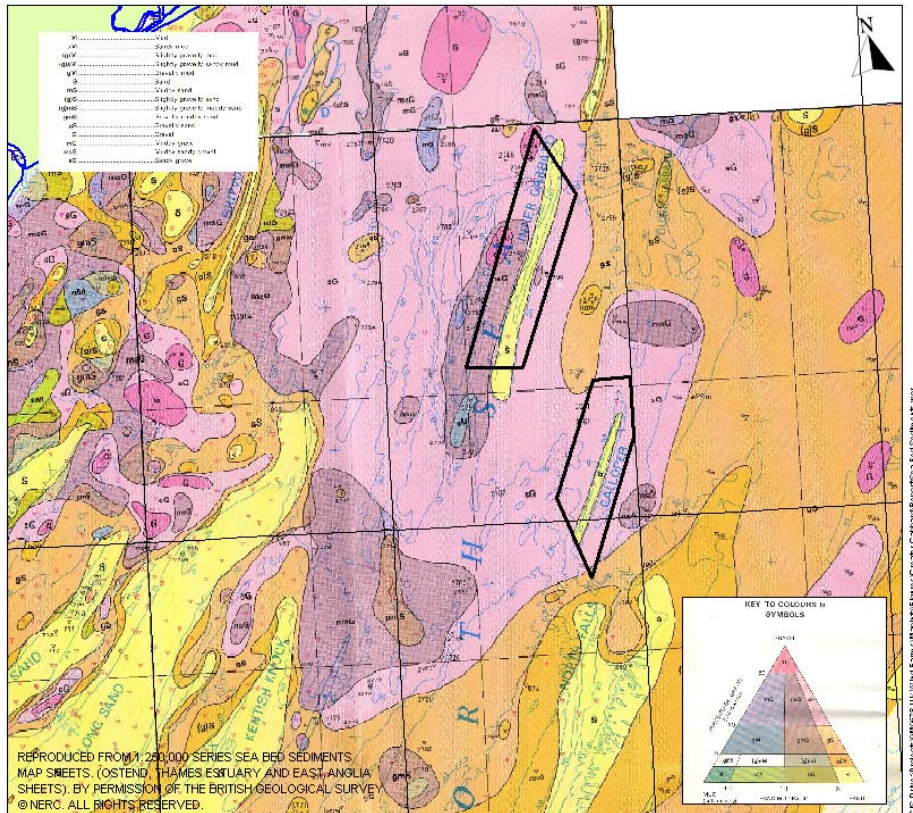


Figure 12 : Seabed Sediments

Sediments on Inner Gabbard are classified as sand with an area of more mixed sediments (muddy sandy gravel) to the west of the bank. Sediments on the Galloper Bank are also classified as sand. The sediments between the banks are sandy gravel. The area around the Outer Gabbard bank is gravelly sand and these sediments do not alter a great deal across the bank itself. Isolated patches of muddy sandy gravel are located in the northeast, central and the southeast areas of the site. The sandier sediments associated with the North Falls (a sand bank located immediately south of the site) reach into the southern edge of the site. Across most of the site, the seabed sediments are less than 1m thick with the exception of Inner Gabbard, Outer Gabbard and The Galloper where thickness reaches 10 – 20m.

Beyond the limits of the site, to the west, seabed sediments are composed of sandy gravels, to the Shipwash sand bank, which is composed of sandier sediment. Between the Shipwash Channel and the adjacent Suffolk coast a mixture of sediments are present, mainly sand and gravelly sand.

Bedforms

Within the Greater Gabbard site the main bedforms are sand waves associated with the sand bank. Sand waves are mesoscale bedforms (commonly 5 – 10m in height) that are dependent on present day wave action, tidal currents or surges (Pantin, 1991). Sand waves are

In addition to sand waves on the banks, there are also a number of bedforms beyond their limits. Between Outer Gabbard and The Galloper, bedforms indicate a potential pathway connecting the two features, with some indication of both southerly and northerly-directed transport (HR Wallingford, 2002). In the south of the site, there is some indication of a southerly-directed pathway between The Galloper and North Falls (located immediately south of the site) (HR Wallingford, 2002). Here, the largest sand waves measured on the seismic profiles reach heights of 10m.

Overview of Coastal Processes

The Southern North Sea Sediment Transport Study (HR Wallingford, 2002) argued that the sedimentary processes occurring at the Greater Gabbard site are not linked to the processes operating along the Suffolk and Essex coasts.

Overview of Offshore Sedimentary Processes

Inner Gabbard, Outer Gabbard and The Galloper are three narrow linear sand banks in water depths greater than 20 m and aligned sub-parallel to the tidal currents. They form part of a larger set of banks radiating out from the Dover Strait. North / south directed ebb and flood tidal currents control them. Elsewhere, the site has London Clay Formation at the seabed probably covered by a thin lag of immobile sand and gravel.

The position of the wind farm greater than 20km offshore in water depths of between 20m and 50m suggests it will have negligible impact on the coast. In addition, the coast is protected by sand banks in nearshore positions (eg. Shipwash, Bawdsey, Whiting, Alderburgh Ridge, Alderburgh Napes and the outer Thames Estuary banks) that any physical effects caused by the wind farm would be moderated before reaching the coast.

5.1.1.3 Scope of Assessment

The scope of assessment comprises the following high level activities :

- Acquisition of metocean and oceanographic data from the site and the environs
- Development of a coastal processes model, incorporating such data and information, together with the preferred foundation type, installation methodology, cable layout, etc to assess the effects
- Liaison with work on sub-tidal benthic ecology, to identify any existing radioactivity or contamination
- Development of a water quality model to assess effects
- Description of the measures during the construction phase to minimise the possibility of degraded water quality, increased turbidity etc

Data Acquisition

Geophysical Survey

A non-intrusive geophysical survey will be undertaken for the wind farm area and cable route(s) to shore. Techniques such as single beam bathymetry, side scan sonar, shallow seismic surveying, magnetometer, topographic surveys will be incorporated into this survey. Information from this survey will be used to inform the marine ecology, archaeology and coastal processes assessments, as well as giving valuable baseline information for wind farm

site layout. Summary information from the survey will be shown in the Environmental Statement.

Metocean Data Acquisition

The gathering of oceanographic data provides the basis for understanding the existing physical environment within the site and its surroundings. Such information will be used to inform the coastal processes assessment, with subsequent implications on the ecology studies and assessments of weather risk for the construction phase. The following oceanographic data will be acquired :

- Wind measurements – it is proposed to install a meteorological monitoring mast (met mast), similar to that shown in Section 2.5.4 at the site during the summer of 2004. The mast will acquire wind information at several heights, and will inform the wind resource studies, and also provide input into the coastal processes model.
- Wave measurements – either with wave rider buoy adjacent to or device attached to the on-site met mast.
- Current velocity – either using a free-standing system or attached to the on-site met mast. Minimum data gathering time is 4-6 weeks
- Tidal elevations - the tide gauge will be attached to the met mast
- Seabed sediment sampling - the collection of sediment samples across the site will inform the EIA process on existing levels of contaminants within the seabed
- Water quality sampling – water quality samples will be taken, and together with the interpretation of other oceanographic data, will form the basis for the assessment of effects on water quality

Coastal Process Modelling

A coastal processes assessment will be undertaken to assess the effects identified in the above section. The model will make use of any existing data, either from previous projects or from data sources such as The Met Office, together with information acquired from the data collection process described above.

It will be necessary to assess the impacts of the wind farm on wind climate, wave climate, tide levels, tidal currents, sea bed behaviour, sediment transport and shoreline responses (e.g. erosion or accretion, etc). Each of these impacts is to be considered in the context of spatial impacts (i.e. at or adjacent to the development site, between the site and the shoreline and at the shoreline), temporal impacts (i.e. during construction, during operation and during decommissioning) and cumulative impacts (i.e. over time, and in combination with other offshore developments and activities).

5.1.2 Air Quality

During the construction and decommissioning phases of the project air quality may be affected in the following ways :

- Transportation of equipment and workers to the development site
- Use of installation equipment on site
- Increase in vehicle movements

Due to the location of the site, and the relatively low amount of construction onshore, any effects will be slight and temporary.

During operation of the wind farm there will be no atmospheric emissions as a direct result of energy generation. Due to the use of a renewable energy resource, the development is expected to have a positive impact on air quality. As mentioned previously the development will offset the annual release of approximately 1,489,200 tonnes of carbon dioxide, that would otherwise have been released into the atmosphere by conventional forms of fossil fuel generation. This also equates to annual reductions of 19,272 tonnes of sulphur dioxide, when equated to conventional forms of solid and liquid fossil fuel generation, and 3,504 tonnes of nitrogen dioxide.

Scope of Assessment

It is proposed that as effects will not be significant air quality is not specifically assessed in the Environmental Statement for the Greater Gabbard Offshore Wind Farm, i.e. air quality is scoped out of the assessment.

5.2 The Biological Environment

Impacts on the biological environment are categorised as follows :

- Designated Sites
- Sub-Tidal Benthic Ecology
- Fish (including commercial species)
- Marine Mammals
- Inter-Tidal and Terrestrial Ecology
- Birds

5.2.1 Designated Sites

The project has the potential to affect sites designated for nature conservation in the following ways:

- Direct impacts through the location and construction of the export cabling and onshore works
- Indirect impacts from construction activity
- Direct and indirect impacts on Annex 1 bird species
- In-combination effects with other developments

There are no designations in the vicinity of the project that extend offshore, although much of the coastline adjacent to Greater Gabbard has some form of conservation status. The designations along the coastlines of northern Essex and Southern Suffolk, at least 26km away from site, are as follows:

SITES DESIGNATED UNDER INTERNATIONAL CONVENTIONS AND DIRECTIVES

Ramsar Sites

Site Name	Grid Ref	Area (ha)	Date Designated	Qualifying Interest
Minsmere - Walberwick	TM465662	2,004	1976, extended 1992	Representative wetland; rare species
Alde-Ore Estuary	TM432487	2,437	1996	Rare species; substantial numbers of individual waterfowl indicative of wetlands; 1% of waterfowl species population
Deben Estuary	TM295504	976	1996	Rare species; 1% of waterfowl species population
Stour and Orwell	TM169331	3,428	1994	Rare species; regularly supports over 20,000 waterfowl and 1% of a waterfowl species population
Hamford Water	TM 235255	2,179	1993	1% of waterfowl species population
Mid Essex Coast – Colne Estuary	TM075155	2,701	1994	Representative wetland; rare species; genetic and ecological diversity; regularly supports over 20,000 waterfowl and 1% of a waterfowl species population

Special Protection Areas (SPA's)

Site Name	Grid Ref	Area (ha)	Date Designated	Qualifying Interest
Minsmere - Walberwick	TM465662	2,000	1992	Nationally important numbers of seven species of wintering wildfowl and raptors;

				breeding raptors, waterfowl and passerines
Alde-Ore Estuary	TM432487	2,437	1996	Nationally important numbers of Annex 1 species (marsh harrier, avocet, ruff, Sandwich tern, little tern); internationally important numbers of redshank and lesser black-backed gull
Orfordness - Havergate	TM400470	117	1982	Internationally important numbers of breeding lesser black-backed gulls, nationally important numbers of breeding and wintering wildfowl
Deben Estuary	TM295504	976	1996	Internationally important numbers of wintering and passé redshank; nationally important numbers of dark-bellied brent goose, shelduck and black-tailed godwit
Stour and Orwell	TM169331	3,334	1994	Internationally important numbers of six wintering waterfowl species; nationally important numbers of six wintering waterfowl species; regularly supports over 20,000 wintering waterfowl
Hamford Water	TM 235255	2,179	1993	1% of waterfowl species population
Mid Essex Coast – Colne Estuary	TM075155	2,701	1994	Internationally important numbers of wintering dark-bellied brent geese and redshank; regularly supports over 20,000 waterfowl; nationally important numbers of breeding little tern, pochard, ringed plover, nationally important numbers of wintering hen harrier and a further ten species

Table 10 : Sites designated under International Conventions and Directives

SITES DESIGNATED UNDER NATIONAL STATUTE

The larger (in terms of area) of the Suffolk and Essex SSSI's are presented below :

Sites of Special Scientific Interest (SSSI)

Site Name	Grid Ref	Area (ha)	Date Designated
Minsmere – Walberswick Heath and Marshes	TM465662	2,326	1987
Sizewell Marshes	TM466638	104	1992
North Warren and Thorpeness mere	TM460594	130	1986
Orfordness - Havergate	TM400472	602	1985
Alde-Ore Estuary	TM398452	2,554	1985
Deben Estuary	TM295504	976	1991
Bawdsey Cliff	TM338380	23	1987
Landguard Common	TM285315	31	1984
Orwell Estuary	TM170415	1,293	1985
Stour Estuary	TM180330	2,150	1985
Harwich Foreshore	TM263320	11	1986
Hamford Water	TM235255	2,130	1987
Holland Haven Marshes	TM211170	209	1992
Colne Estuary	TM075155	2,915	1989

Areas of Outstanding Natural Beauty (AONB)

Site Name	Area (ha)	Date Designated
Suffolk Coast and Heaths	40,400	1970

Table 11 : Sites Designated under National Statute

SITES IDENTIFIED BY STATUTORY AGENCIES

Site Name / Designation	Identified By	Grid Ref	Date Designated
Suffolk Coast / Heritage Coast	Countryside Agency	TM537845 to TM325365	1973
Orfordness Sensitive Marine Area	English Nature	N/A	1994

Table 12 : Sites Identified by Statutory Agencies

The designated sites are also represented in Figure 14.

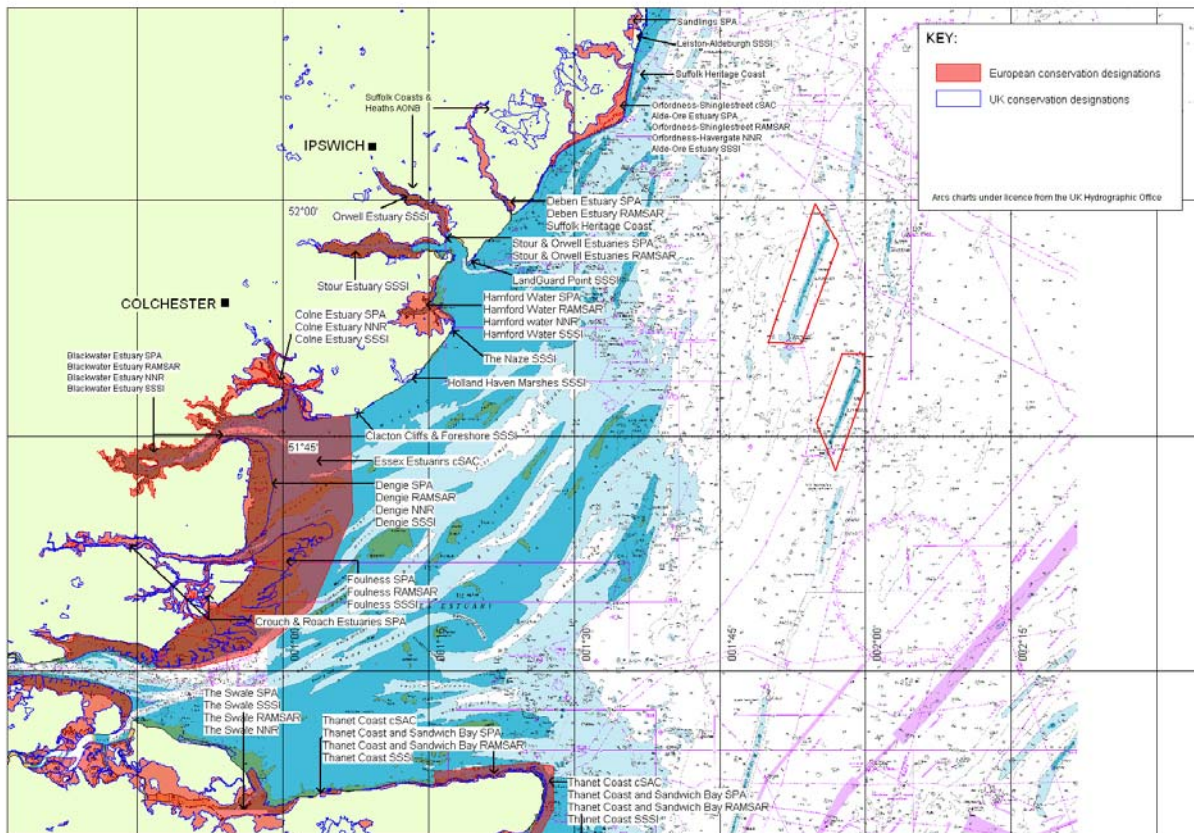


Figure 14 : Conservation Designations

Habitats Directive in the Marine Context

Annex I of the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora lists those habitats of community interest whose conservation requires the designation of SAC's. Included in the list are offshore sublittoral sandbanks and reefs. Areas that potentially qualify as both sublittoral sandbanks and reefs exist within the wind farm site, see Figure 11. The sandbanks of the outer Thames Estuary are entirely formed of tidal current ridges and are predominantly sand with the exception of Outer Gabbard, which is gravelly sand. They have large sandwaves, particularly the South Falls bank (Johnstone *et al.* 2002).

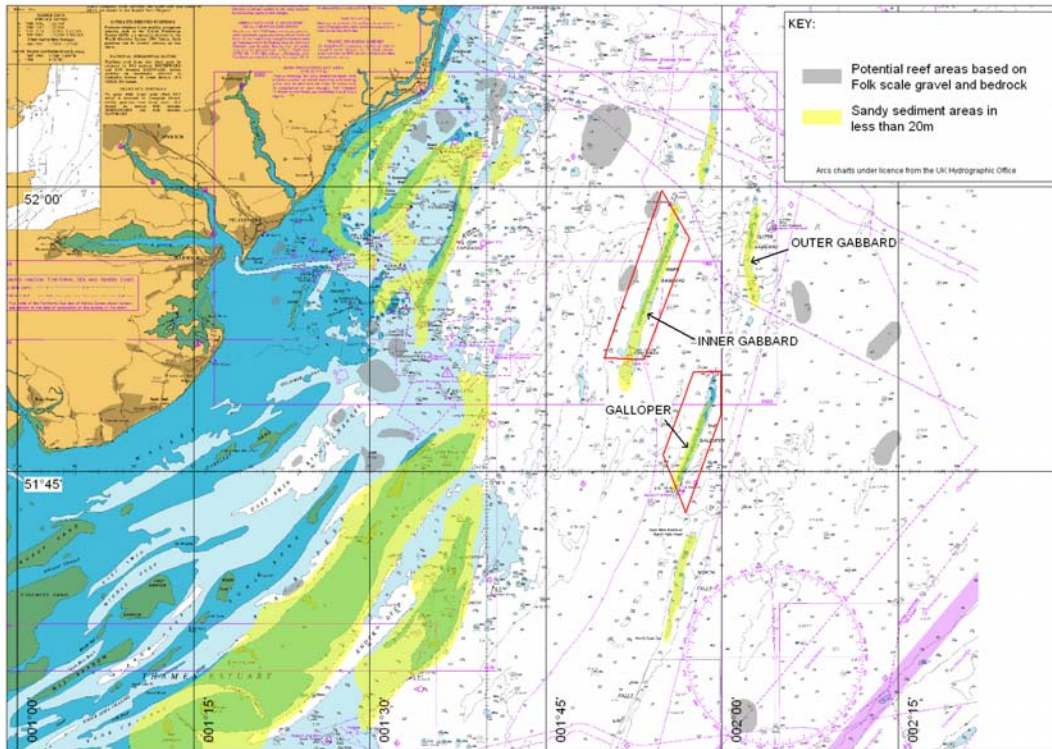


Figure 15 : Habitat Areas Which May Qualify For Protection under the Habitats Directive

5.2.2 Sub-Tidal Benthic Ecology

There is clear statutory guidance on the generic issues that need to be considered in relation to the potential impacts on the benthos arising from offshore wind farms.

The construction, operation and decommissioning of an offshore wind farm has the potential to affect sub-tidal benthic ecology in the following ways :

- Habitat loss or disturbance during construction from turbine placement and cabling, either due to the footprint of construction vessels or the width of cable laying equipment;
- Indirect effects through increased turbidity or smothering resulting from construction;
- Loss of habitats due to scour around turbine bases;
- Benthos loss due to movement of any cables which may have become unburied;
- Colonisation of turbine structures and the net environmental benefits that may accrue;
- Potential alterations to the sediment composition and associated communities due to changes in the current and wave regime, including localised scour (erosion) of seabed around the base of the turbines and cable.
- Disturbance effects of drilling and piling equipment on benthic organisms, particularly during spawning, nursery or migratory periods.
- Potential contamination of sediments and marine organisms from accidental release of cementing/grouting materials, oils/greases/chemicals during construction, and/or release of existing sediment bound contaminants (eg radioactivity).
- Loss of habitats during decommissioning that have formed as a result of the foundation installation
- Cumulative or in-combination effects

Much of the southern North Sea is shallow with a sandy seabed. This would indicate the presence of *Abra alba* (bivalve) communities in fine sands/muddy sands and *Venus* communities on coarser sands (Jim Ellis, CEFAS, Pers. comm. 10/07/03; Barne *et al*, 1998). The closest CEFAS 4 m beam trawl, taken in August 1998, was 7 km north of the site. It was dominated, in descending order of biomass, by the bryozoan *Alcyonidium diaphanum*, the common starfish *Asterias rubens*, and the polychaete worm *Sabellaria spinulosa* (Ellis and Rogers, 1999).

A survey for a proposed disposal area on the western boundary of the site revealed that the polychaete *Pomatocerus lamarcki* (keelworm), an encrusting species present on the surface of cobbles and gravel, and a variety of bryozoan species were common (Posford Haskoning, 2003). The area surveyed consists of relatively coarse sediments by comparison with much of the southern North Sea. Other species were present in relatively low abundance, with the common sea urchin *Psammechinus miliaris* being the most common epifaunal species. Other species included the common hermit crab *Pagurus bernhardus* and the common starfish *Asterias rubens* (Posford Haskoning, 2003).

There is, therefore, potential for a wide variety of substrate types within the site (eg sand banks, cobble and gravel areas and biogenic reefs). Such a heterogeneous seabed is likely to support a wide diversity of associated species/communities.

Site specific information about the marine communities present is limited. The presence of areas that could qualify as sublittoral sandbank habitat and areas that could qualify as reef habitat indicate a possible heterogeneous seabed within the site with a variety of associated community types.

In contrast to much of the southern North Sea, a survey for a proposed disposal site on the western boundary of the site revealed an area of relatively hard, stable substrate comprising cobbles and gravel (Posford Haskoning, 2003). This was reflected in the benthic communities present. CEFAS 4 m beam trawls close to the site recorded the presence of the polychaete worm *Sabellaria spinulosa* and a different epibenthic community, probably reflecting a different substratum type (Ellis and Rogers, 1999).

The Ross worm *Sabellaria spinulosa*

The species that may be of concern is the reef-building polychaete worm, *Sabellaria spinulosa* since surveys indicate that it is present in the surrounding area. This species is of conservation importance and a Habitat Action Plan for the species has been defined by the UK Biodiversity Group. If significant examples of biogenic reef are present within the site the impact of direct physical damage during construction would be of concern. *Sabellaria spinulosa* is, however, tolerant of all but the most severe episodes of sediment deposition (Jackson & Hiscock, 2003).

Proposed Scope of Assessment

The proposed scope of assessment is summarised in Appendix E – “Greater Gabbard Offshore Wind Farm, Environmental Impact Assessment Scoping, Marine Ecology”, Centre for Marine and Coastal Studies Ltd, February 2004.

5.2.3 Fish including Commercial Species

Offshore wind farms have the potential to affect natural fish resources in a number of ways, including:

- Effects of noise and vibration, particularly during spawning, nursery or migratory periods.
- Direct loss of habitat and food resources from installation of turbine foundations and cables.
- Increased suspended sediment concentration leading to impaired respiratory or reproduction functions or disruption to migration/spawning.

- Subsequent deposition of mobilised sediment, resulting in smothering of some species (shellfish beds, over-wintering crabs).
- Potential alterations to the sediment composition and associated communities due to changes in the current and wave regime.
- Effects of electromagnetic fields on electro-sensitive organisms such as elasmobranchs.
- Potential contamination of sediments and marine organisms from accidental release of cementing/grouting materials and/or release of existing sediment bound contaminants (eg radioactivity).
- Noise and vibration effects (construction/operation).
- Effects on migratory fish, salmonoids, especially adjacent to primary spawning rivers, from subsea cables.

Natural Fish Resources

The results of an epibenthic trawl survey on the western boundary of the site undertaken as part of a disposal site proposal revealed very few fish species, as presented below. By far the most common species was the Lesser spotted dogfish *Scyliorhinus canicula*, with the Queen scallop *Chlamys opercularis* also present characteristic of the coarse sediments in the area. Other species included pink shrimp *Pandalus montagui*, poor cod *Trisopterus minutus*, the common goby *Pomatoschistus microps* and lemon sole *Microstomus kitt* (Posford Haskoning, 2003). These were all rare finds however, appearing as single specimens in no more than two of the ten survey trawls.

The closest CEFAS beam trawl survey site, approximately 7 km to the north, was again dominated by the Lesser spotted dogfish *Scyliorhinus canicula*, but other species such as lemon sole *Microstomus kitt*, thornback ray *Raja clavata*, dab *Limanda limanda*, sole *Solea solea*, and pouting *Trisopterus lucius* were common (Ellis and Rogers, 1999).

Fish and Shellfish Spawning Areas

The table below provides species information relevant to the fish spawning areas at the site and its environs.

Table 2.8 Fish Spawning Areas

Species	Location and extent of spawning	Sensitive period
Herring <i>Clupea harengus</i>	Herring deposit their sticky eggs on coarse, clean substrates, usually at water depths between 15 and 40m. Spawning is thought to occur within the southeast corner of the site and beyond.	Nov-Jan
Whiting <i>Merlangius merlangus</i>	Whiting spawn in the Southern Bight of the North Sea earlier than in more northerly areas and this is thought to occur throughout the Greater Gabbard area.	Jan-May
Plaice <i>Pleuronectes platessa</i>	Peak spawning occurs in February in the eastern part of the site but spawning intensity is higher in deeper waters further to the southeast. The spawning area is extensive.	Dec-Mar
Sole <i>Solea solea</i>	The site is within a recognised sole spawning area providing the relatively shallow sandy conditions that sole require. Sole are limited to the southern North Sea by water temperatures.	Mar-May
Lemon sole <i>Microstomus kitt</i>	Little is known about the spawning habits of lemon sole, and it is thought to spawn everywhere it is found including the waters off the east coast of England.	Apr-Sept
Sandeel <i>Ammodytes marinus</i>	Sandeel are thought to spawn throughout much of the southern and central North Sea, but especially on sandy sediments. Thought to spawn throughout the site.	Nov-Feb

Sources: Coull *et al.*, (1998); DTI (2001)

The majority of the spawning areas are geographically extensive, however, the dependency of herring on specific substrates and traditional spawning grounds makes the species particularly sensitive to development.

In addition to these species, the spawning requirements of which are quite well studied, it is likely that the site also provides spawning habitats for other key `resource species` (i.e. targeted by commercial fishermen), including dogfish, rays and spurdog as well as non `resource` species, that although not commercially targeted, form an important part of the marine ecosystem (i.e dragonet, pogue, gobies).

Fish Nursery Areas

The prevailing water temperature and availability of food can alter the position of nursery grounds from year to year and as a result it is difficult to precisely define the limits of nurseries (Coull *et al.* 1998). The site is too far offshore to conflict with the nurseries of herring, whiting, plaice, and sole. It is thought that juvenile cod use the area but cod nurseries in the southern North Sea are extensive (Coull *et al.* 1998). The same is true for mackerel, lemon sole, sandeel, and sprat.

Demersal trawls on the western boundary revealed a sparse fish community reflecting coarse sediments, dominated by Lesser spotted dogfish with other species including the Queen scallop present in low numbers. The contents of other trawls in the region consisted of elasmobranchs and a variety of flatfish.

The commercially important sole is believed to spawn in and around the site as well as herring, whiting, plaice, lemon sole and sandeel. The main nursery areas are likely to be distributed further inshore, but cod, mackerel, lemon sole, sandeel and sprat juveniles may be found within the site (Coull *et al.* 1998). The juvenile/larval stages of fish development are more susceptible to the impacts of developments than adult fish because they have less control over avoidance reactions due to their limited swimming ability. Therefore, impacts that occur within a nursery area have greater scope for damage to natural fish resources.

Adult fish are likely to exhibit avoidance reactions to elevated noise levels until conditions return to background. If these unacceptable levels last for a long period of time, access to spawning areas or feeding grounds may be inhibited. Quantitative values for construction and operational noise levels compared to existing background levels would allow full assessment of impacts.

A significant increase in suspended sediment concentration can have a number of impacts on natural fish resources. These include impaired growth of adult fish, decreased spawning success, a reduced hatching rate, increased larval mortality, destruction of spawning beds, elevated pathological effects of gill epithelia, behavioural avoidance of turbid conditions and changes in fish species composition.

The dependence of herring on specific substrates and traditional spawning grounds makes the species particularly sensitive to changes in sediment composition. Herring spawning is thought to occur within the southeast corner of the site and beyond (Coull *et al.* 1998), and although information about the exact location of herring spawning sites is lacking, they may exist within the zone of influence of the wind farm induced changes to the hydrodynamic and sedimentation regime.

Elasmobranchs (Sharks and Rays)

The limited information about natural fish resources in the area indicates that elasmobranchs are common, particularly the Lesser spotted dogfish *Scyliorhinus canicula*. Recent results from research work on the potential effects of electro-magnetic cables flux on this species (CCW 2001) showed that only 8% of the fish in the studies exhibited an avoidance reaction to the electrical fields used, whilst only 2% showed a positive response. The avoidance reactions were also noted at a distance of around 10cm, suggesting that these effects are very localised. The studies were limited in nature and as a result of continuing concern a study is currently underway as part of the COWRIE research program.

Scope of Assessment

The proposed scope of assessment is summarised in Appendix E "*Greater Gabbard Offshore Wind Farm, Environmental Impact Assessment Scoping, Marine Ecology*", Centre for Marine and Coastal Studies Ltd, February 2004.

5.2.4 Marine Mammals

Offshore wind farms have the potential to affect marine mammals in several ways, including:

- Disturbance through increased noise and vibration
- Reduction in food resource through impacts on the marine ecology and natural fisheries of the area
- Degraded water quality as a result of handling of chemicals, cementing/grouting materials, fuels, etc
- Cumulative and in-combination effects

There are few marine mammal related concerns in the vicinity of the site. Small numbers of common seal at Hamford Water may restrict options for the site to shore cable landfall. It is possible that noise and vibration, during the construction phase and operational phase, will discourage seals and any cetacean species present from using the area to feed.

Seals

Common seals are sparsely distributed in the area and grey seals are rarely seen. The nearest location where common seals are regularly seen is Hamford Water nearly 40 km to the west, with around 12 individuals regularly seen (Barne *et al.*, 1998). JNCC Seabirds at Sea data revealed no seal sightings in the vicinity of the wind farm site.

Cetaceans

The cetacean fauna of the southernmost North Sea is poor both in terms of number of animals and diversity of species. The harbour porpoise *Phocoena phocoena* is the most

frequently observed but is nevertheless rare in the region (Barne *et al*, 1998). JNCC Seabirds at Sea data revealed no cetacean sightings in the vicinity of the wind farm site.

Scope of Assessment

As part of the EIA, the following work requirements will be necessary:

- Obtain data about noise and vibration emissions during construction and from turbines once operational. A literature review into potential operational effects on marine mammals will be required.
- It may be possible to incorporate a seal and cetacean survey into boat based bird surveys to provide detailed data for the specific development site.
- A study of in-combination effects with other developments

5.2.5 Inter-tidal and Terrestrial Ecology

Where cabling from the wind farm comes ashore (landfall) and connects to the onshore infrastructure, there is the potential for ecological impacts associated with the construction phase of the project as follows :

- Physical disturbance from plant and machinery (cable installation equipment, diggers, trucks)
- Increased turbidity and subsequent indirect effects
- In combination effects with other developments

The location and timing of cabling works may also give rise to potential effects on the EC Bathing Water Directive (76/160/EC), which sets the standards for water quality at beaches. There is potential for the operations to adversely affect the rating of local beaches which, with careful consideration of location and timing together with consultation, could be avoided.

The following beaches were awarded the “Blue Flag” Standard in 2003 :

Beach	County	Beach Manager	Distance from Greater Gabbard
Dovercourt Bay	Essex	Tendring District Council	27km approx
Felixstowe, South	Suffolk	Suffolk Coastal District Council	26km approx
Southwold Pier	Suffolk	Waveney District Council	30km approx

Table 13 : “Blue Flag” Standard Beaches in vicinity of Greater Gabbard

In addition, the installation of onshore electrical infrastructure (eg sub-station etc) give rise to the potential for ecological impacts adjacent to the works.

Scope of Assessment

The value of the intertidal environment will be assessed through the collection and analysis of sediment cores and biotope mapping; the general classification of an area by its habitat types and associated species. Biotope mapping will give a general indication of the habitats and species present within the area of the cable landfall. More specific data will be obtained through core sampling of sediments, a well-established technique for obtaining quantitative data on infauna (organisms living within sediments). Should any legally protected species be identified, appropriate surveys would be undertaken and mitigation measures drafted accordingly.

A Phase I habitat survey will be carried out on the terrestrial route(s) between the proposed cable landfall and the connection point. The purpose of the survey will be to both identify and map the different vegetation habitats, especially those of particular ecological value, such as hedgerows, or ditches, which are likely to be impacted by the routing of the power cables, and the siting of the associated infrastructure.

The results of the intertidal and terrestrial surveys will be evaluated and recommendations provided for impact reduction or mitigation of any identified adverse ecological effects.

5.2.6 Birds

The effect of the development on bird populations is likely to be one of the most significant potential biological issues requiring environmental assessment. Offshore wind farms have the potential to affect bird populations in the following ways :

- Potential mortality through collision with turbine blades, towers and other ancillary structures
- Effects of noise and vibration
- Disturbances to habitat, due to the placement of turbine bases with displacement of feeding birds
- Indirect habitat loss through disturbance within areas in close proximity to the turbines. Such disturbance may occur as a consequence of wind farm construction work, or the siting of the wind farm on habitual flight routes, e.g. disruption to flight corridors and migration patterns. Additional indirect loss of habitat may occur through disturbance to feeding and loafing populations from maintenance operations, including the use of support boats
- There may also be positive impacts including increased prey availability and the provision of roost structures, although the latter, particularly in conjunction with lighting, may also have disadvantages
- Attraction of birds to lit structures
- Effects on wading birds during inter-tidal construction works
- Effects arising from the construction of the onshore electrical infrastructure
- In-combination effects with other developments

The existing environment with respect to birds is summarised in Appendix F "*Greater Gabbard Offshore Wind Farm Project: Scoping For The Ornithological Impact Assessment*", Ecology Consulting, January 2004

Scope of Assessment

The proposed scope of assessment is summarised in Appendix F "*Greater Gabbard Offshore Wind Farm Project: Scoping For The Ornithological Impact Assessment*", Ecology Consulting, January 2004.

5.3 The Human Environment

The effects on the human environment are categorised as follows :

- Landscape and Seascape
- Commercial Fisheries
- Commercial Navigation
- Archaeology and Cultural Heritage
- Socio-economics
- Noise
- Marine Recreation and Amenity
- Traffic
- Offshore Oil and Gas
- Marine Aggregate Extraction
- Subsea Cables and Pipelines
- Marine Waste Disposal and Dumping
- Military and Civil Aviation
- Abandoned Munitions
- Electromagnetic Interference

5.3.1 Landscape and Seascape

The Concise Oxford Dictionary defines “seascape” as a “picture or view of the sea”. However a more complete definition in these circumstances includes the following :

- Views from land to sea
- Views from sea to land
- Views along the coastline
- The effect on landscape of the conjunction of the sea and the land

The effects on the visual environment are likely to be a major consideration within the EIA for the Greater Gabbard Offshore Wind Farm. There is guidance on the assessment of effects on seascapes through the Countryside Council for Wales (CCW) Guide to Best Practice in Seascape Assessment (March 2001).

The potential for effects on the visual environment, throughout the lifetime of the project, is provided by the following :

Construction Phase

- Presence of construction vessels and associated craft in the seascape
- Lighting of construction vessels (24 hour working)
- Temporary lighting protocol during construction
- Cable burial works adjacent to shore, within the inter-tidal range
- Cable installation and onshore construction works

Operations Phase

- Size, colour and rotation of the wind turbines
- Permanent lighting protocol, during day and night
- Cumulative and in combination effects with other developments, notably wind farms

Decommissioning Phase

- Presence of decommissioning vessels and associated craft in the seascape
- Lighting of decommissioning vessels (24 hour working)
- Temporary lighting protocol during decommissioning

The nearest point of the site is approximately 25 km from the Suffolk coastline, which includes the Suffolk Coasts and Heaths AONB and Suffolk Heritage Coast. Stretches of the Essex coastline are in excess of 36 km away. Figure 16 below presents the landscape designations in the vicinity of the proposal.

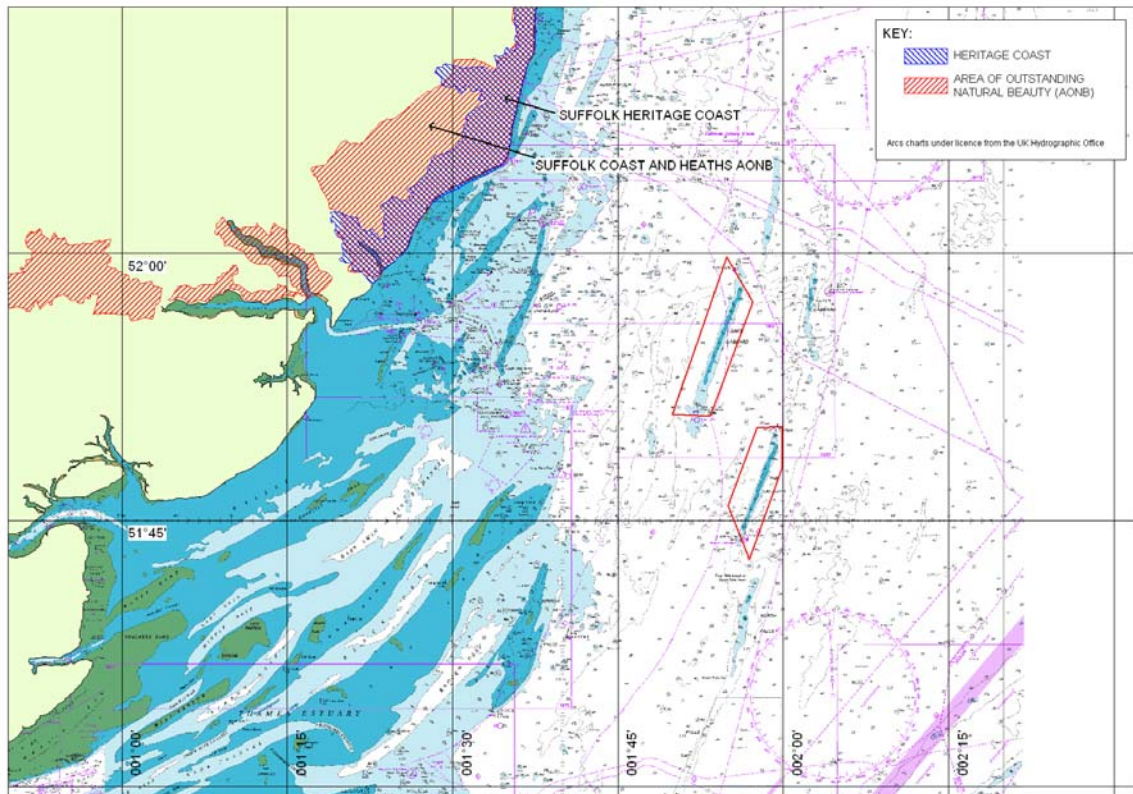


Figure 16 – Landscape Designations

The adjacent coastline is characterised as having a High sensitivity to change (BMT Cordah, 2003). The table below proposes likely effects of wind farm developments located at various distances from such seascape units.

Seascape unit sensitivity	Significance of effect		
	Possible Minor or No Effect (Preferred Areas)	Threshold of Possible Medium Effects	Threshold of Possible Major Effects
Low/no sensitivity	8km+ offshore	N/A	<8km offshore
Medium sensitivity	13km+ offshore	8-13km offshore	<8km offshore
High sensitivity	24km+ offshore	13-24km offshore	<13km offshore

Table 14 : Significance of Visual Effects from Offshore Wind Farms

Source: BMT Cordah (2003) Offshore wind energy generation: Phase 1 proposals and environmental report. DTI.

At first glance the table above suggests that the proposed Greater Gabbard Offshore Wind Farm will have a possible minor effect or no effect on the visual environment. However this issue will be further investigated by means of a full Landscape and Seascape Visual Assessment.

Scope of Assessment

It is proposed that an EIA sub-group is formed to discuss seascape issues. The intention is that such a group, which would meet at regular intervals, would be to provide a forum for all landscape consultees to express their views on the development. It is anticipated that the

group would include representation from Greater Gabbard Offshore Wind Ltd, Countryside Agency, Suffolk County Council, Suffolk Coastal District Council, Essex County Council and Tendring District Council.

The seascape assessment would focus on visual impacts and a careful analysis of the recreational use of the study area, both on land and sea. The methodology would be guided by several publications, including:

- Guide to Best Practice in Seascape Assessment, Countryside Council for Wales (CCW), Brady Shipman Martin, University College Dublin, March 2001
- Guidelines for Landscape & Visual Impact Assessment, published by the Landscape Institute and Institute of Environmental Assessment (1995)
- Design Manual for Roads and Bridges Volume 11 (Environmental Assessment) Section 3, Part 5, 'Landscape Effects' published by the Department of Transport in 1993 and updated in August 1994

The seascape and visual assessment will feature the following key tasks :

1. Derivation of Study Area

The study area would comprise the following :

- the coastal environment, including all of the inter-tidal areas and areas on land directly related to the marine environment
- the marine environment, the seaward limits of which are related to visibility
- the hinterland environment, which is defined primarily by the zone of landward visual influence, with additional reference to landform and landcover

The main assessment would be carried out within the 'Regional' study area (using CCW terminology) surrounding the site. Drawing on the CCW study, the proposed seaward extent of the study area would be 10-15km from the coast, whilst the landward extent would be determined by the Zone of Visual Influence (ZVI). This could be up to 15km inland, although it is likely that it will be less due to the distance of the project from shore.

2. Collection and presentation of baseline data

Baseline data would be collected by a combination of desk studies and site survey.

Desk studies

The desk studies will include :

- ZVI of the hinterland, to establish potential visibility.
- Review of LANDMAP for landscape character
- Review of the Local Plans for Tendring District Council and Suffolk Coastal District Council Local Plan for landscape and related designations
- Review of Navigation Pilots and meteorological information
- Research on cultural and historical associations. This would include visits to the local Records Office, libraries, museums and web-sites.
- Review of Tourist guides.

Site Surveys

A series of site surveys would be undertaken in order to provide a baseline character of the seascape :

- Site survey data to provide a Seascape Character baseline would be collected using the CCW survey pro-forma
- A sea-based survey would also be performed, travelling approximately 5km off-shore.

- Maritime activity information would be requested from Harbourmasters, Tourist Information offices, marina offices and yacht / sailing / watersports clubs. Such information would inform the marine amenity and recreation section of the EIA

3. Effects on Visual Amenity

In consultation with the determining authority and statutory consultees, a range of viewpoints across the development ZVI would be agreed. Such viewpoints would be representative of the range of receptors affected by the development proposal. Although the majority of these would be land based, depending on research they may also include sea based viewpoints, such as fixed ferry routes or established amenity vessel routes.

The findings of the viewpoint analysis would be used to assess the potential effects of the development on the visual amenity of the main sensitive receptors in the study area.

In addition to fieldwork observations and professional judgement, computer generated tools would be used for this assessment, including:-

- digital terrain model (DTM) – a three-dimensional map of the topography of the study area, sampling the Ordnance Survey digital terrain height data
- digital model of the wind turbines – each turbine to be located on the DTM, and a digital model of the proposed turbine size and design
- wire frames – computer generated perspectives of the topography and wind turbines to illustrate the predicted views from each viewpoint
- photomontages – computer generated images of the wind turbines accurately located and overlaid onto scanned photographs of the existing view; used to illustrate the predicted view from a selection of viewpoints. The intended properties of the photomontages are as follows :
 - Lens focal length (35mm format), 50mm
 - Included angle, 90°
 - Format - Double A3

The assessment would examine the potential effects of the proposed wind farm development on seascape and visual amenity, as follows:

- effects on the seascape fabric;
- effects on seascape character and quality; and,
- effects on visual amenity.

4. Appraisal of Mitigation Measures

An appraisal of the mitigation measures incorporated into the project would be performed. These measures would form part of the project design phase, and would include :

- Layout considerations. The effects of alternative layouts on the visual environment will be assessed, in addition to the effects on safety, environmental, technical and economic considerations.
- Wind turbine colour, if any variations are technically acceptable. If considered necessary, photomontages can be used to assess the benefits of colour or locational options during the design stage.
- Design/planting mitigation of any new onshore infrastructure or of the existing sub-station.

5.3.2 Commercial Fisheries

There is clear statutory guidance on the generic issues that need to be considered in relation to the potential impacts on commercial fisheries arising from offshore wind farm construction (CEFAS, 2002). The development of offshore wind farms has the potential to affect commercial fishing operations in a variety of ways :

- Creating a physical obstacle to fishermen employing certain fishing methods such as nets, trawls and dredges
- Increased probability in seabed debris following construction and during operation
- Reduction in access to the site, either through statutory exclusion or establishment of safety zones, with the potential for reduction in catches and loss of income
- Increased conflict between displaced vessels and the remainder of the fleet
- Increased navigational risk
- Displacement of, or reduction in, fish and shellfish resources due to direct effects of wind farm or changes to habitat resource.
- Indirect effects arising from effect on spawning and nursery areas
- Loss or damage to fishing gear
- Temporary effects from anchor mounds
- Adverse impacts on fish and shellfish populations that are commercially exploited
- Increased risk of seabed obstruction (compared to pre-construction) following decommissioning activity

DEFRA Sea Fisheries Inspectorate surveillance observations between 1998 and 2002 are illustrated in Figures 17 and 18. These data indicate that there is significant fishing effort in the area with trawling effort particularly intense to the west of the site and, to a lesser degree, to the east and south. The proportion of different gear types observed in use within the site is illustrated below:

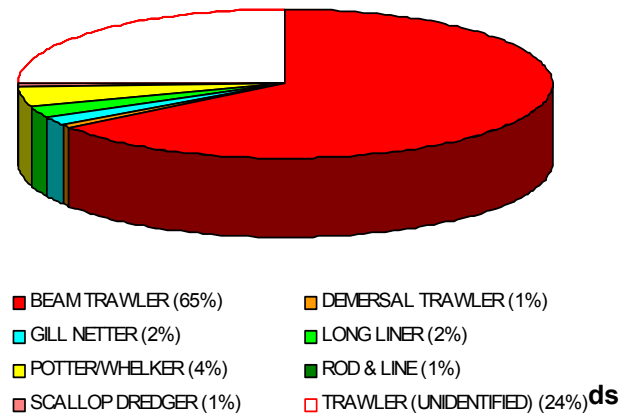


Figure 17 : Proportion of Fishing Gear Types used in the Region of the Site

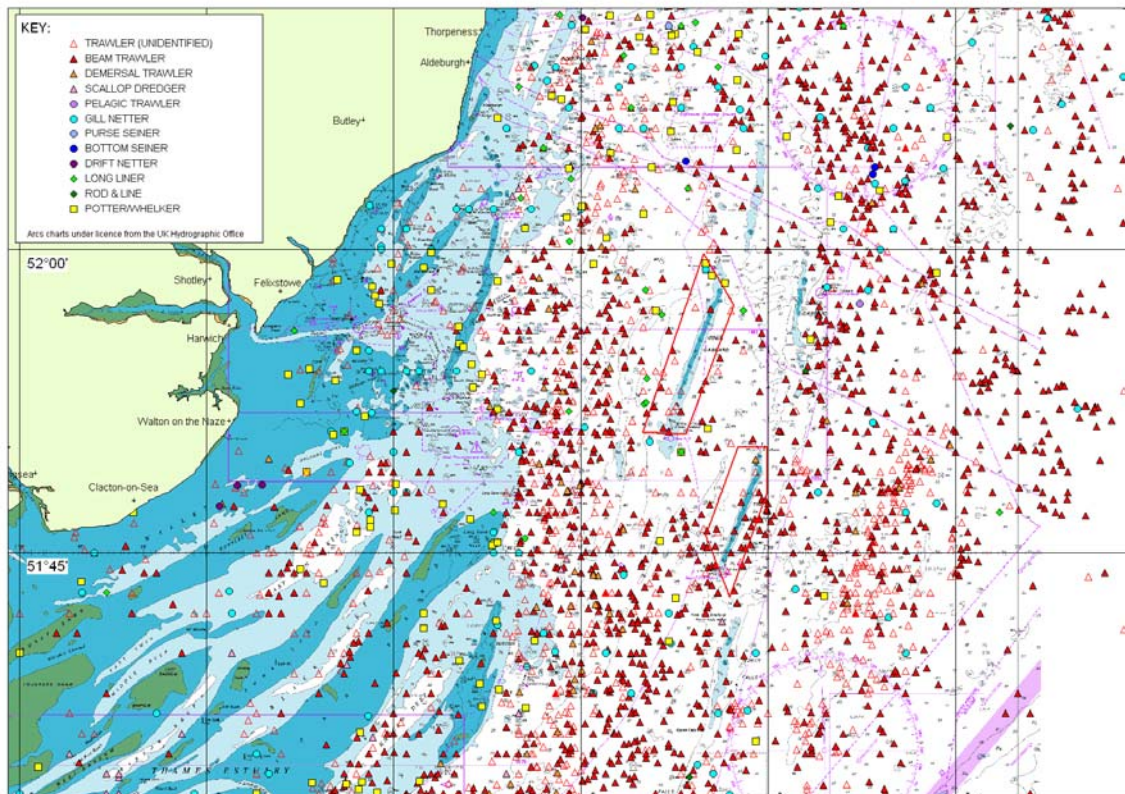


Figure 18 : Fisheries Surveillance Records (1998-2002)

In the Outer Thames sole are targeted with demersal trawls, particularly beam trawls, taking a bycatch of plaice, turbot, brill, flounder and rays. Some trawlers also target brown shrimp. Gill netters and longliners were also observed within the site. These target rays and dogfish, cod, whiting, pollack and ling. They also target seabass in the summer. Potters/whelkers target brown crab, lobster and take whelks to a lesser degree (Pawson *et al.* 2002).

Scope of Assessment

The recently published “*BWEA Recommendations for Fisheries Liaison*” will be used as the starting point for the commercial fisheries assessment.

It is vital that dialogue is initiated between Greater Gabbard Offshore Wind Ltd and the fisheries community as soon as possible, to seek to map more accurately the scale and extent of effort from the various fisheries, to attempt to mitigate potential impacts that might arise from the development, and to attempt to engage in a constructive and long term dialogue with the industry. To this end, a Fisheries Liaison Officer will be appointed to advise on fisheries issues and to provide a focal point for fisheries consultations, reporting to the fisheries point of contact within Greater Gabbard Offshore Wind Ltd.

A detailed fisheries activity study will be commissioned to support the EIA process. This will involve extensive consultation with skippers, vessel operators, merchants, representative bodies and local Sea Fisheries Committee(s) and DEFRA personnel in the region in order to gain up to date information on precise locations of fishing, seasonality of effort and key target species. A detailed assessment of the species landed, fishing activity and economic value of catches from within the site and adjacent areas will be undertaken. This will include the use of DEFRA fisheries surveillance information, DEFRA landings and fishing effort data for ICES sub-rectangles, DEFRA registered vessels lists, and consultation with fishing organisations

and committees, including the Kent and Essex Sea Fisheries Committee, Eastern Sea Fisheries Committee and Sea Fisheries Inspectorate.

Results from the fish resource trawl survey will provide further site-specific information to inform the assessment process. This is noted as being especially important where either safety zones or an exclusion zone covering the wind farm site is concerned. Early and continuing consultation with the local fishing industry is noted as being essential

The effects of the construction activity on the local and regional fishery will be assessed, together with possible working methods to increase the safety to all concerned.

During the operational phase, the probability and associated environmental risks relating to a collision between a ship and wind turbine will be assessed.

A study of in-combination effects with other developments will be performed through all stages of the development.

5.3.3 Commercial Navigation

The construction process, operational phase and decommissioning of the wind farm could impact upon the safety of navigation in a number of ways, including :

- Direct interference / obstruction
- Indirect interference, and resulting increase in vessel density elsewhere
- Weather effects on safe navigation
- Impacts on communications, radar and positioning systems
- Access to and navigation within wind farms, this point being linked to the issue of Safety Zones
- In-combination effects with other developments

Shipping routes information for commercial vessels was obtained from the ShipRoutes database. ShipRoutes is a UK shipping route database developed to assist in identifying shipping passing in proximity to proposed offshore developments such as oil and gas sites, windfarms and dredging areas. Anatec's ship density model was then used to calculate the density of shipping within each cell based on the shipping routeing database (Anatec 2003).

The shipping routes identified within 12 nm of the centre of the Greater Gabbard site are presented in Table 15, in ascending order of CPA (Closest Point of Approach).

Route No.	Description	CPA (nm)	Bearing (°)	Ships Per Year	% of Total
1	Humber-Dover Strait c*	0.2	286	959	3%
2	Felixstowe-Rotterdam S Chan*	0.5	173	9,452	27%
3	Tees-Dover Strait d*	4.2	277	4,853	14%
4	Humber-Flushing g*	6.0	82	715	2%
5	Thames-Rotterdam Gat*	6.5	153	4,728	14%
6	Felixstowe-Flushing S Chan*	6.7	212	2,780	8%
7	Thames-Hamburg Black Deep*	7.9	316	1,721	5%
8	Thames-Hamburg Barrow Deep*	8.7	324	2,555	7%
9	Ostend-Felixstowe Cork*	11.0	243	688	2%
10	Thames-Flushing TSS Black Deep	11.2	248	168	0%

Route No.	Description	CPA (nm)	Bearing (°)	Ships Per Year	% of Total
11	Felixstowe-Ostend S Chan*	11.2	249	556	2%
12	Dover Strait-Thames Black Deep*	11.2	252	428	1%
13	Felixstowe-Dover Strait DW*	11.2	252	3,428	10%
14	Thames-Humber c*	11.2	298	1,386	4%
TOTAL				34,417	100%

Table 15 : Routes Passing within 12 nm of Greater Gabbard (51° 51' 15" N, 001° 57' 17" E)

* Where two or more routes have identical Closest Point of Approach (CPA) and bearing they have been grouped together. In this case, the description lists the sub-route with the most ships per year.

ShipRoutes contains 14 unique routes passing within 12 nm of Greater Gabbard. The total annual traffic volume on these routes is estimated to be 34,417 vessels (approximately 94 to 95 vessels per day).

A plot of the mean route positions passing the site is presented in Figure 19

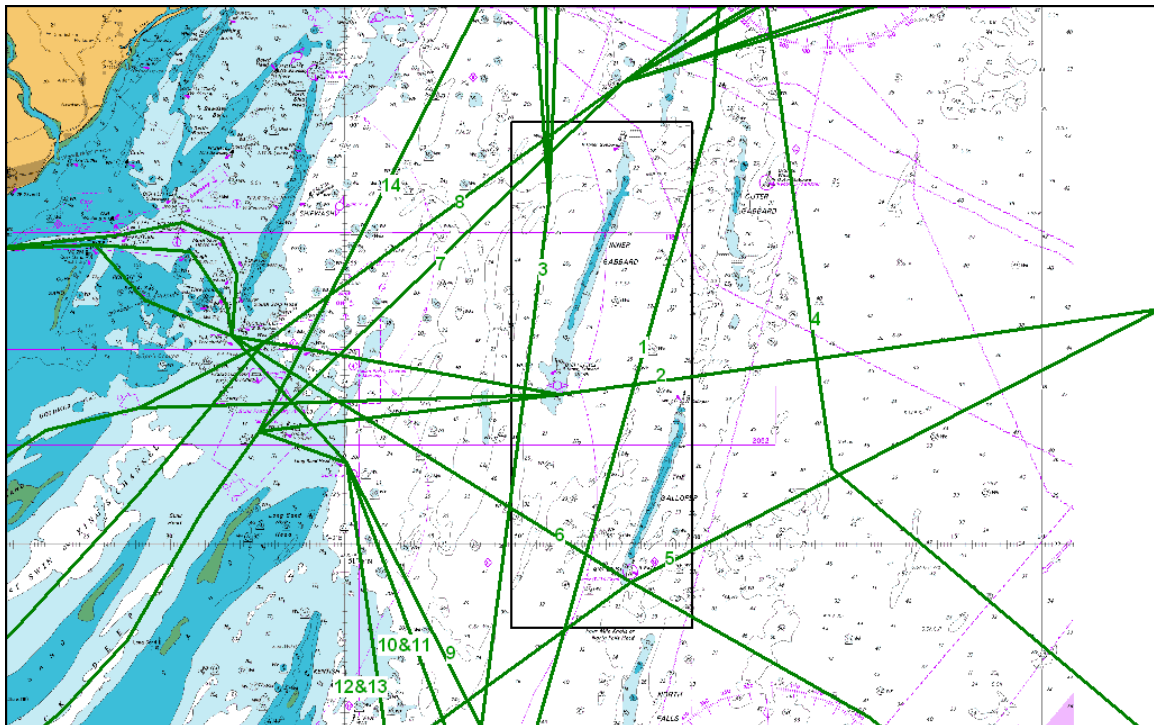


Figure 19 : Shipping Route Positions within 12 nm of Greater Gabbard Site Centre

The composition of the traffic on each route distributed by vessel type and size (deadweight tonnage) was identified and an overall breakdown of traffic by vessel type and size is presented below.

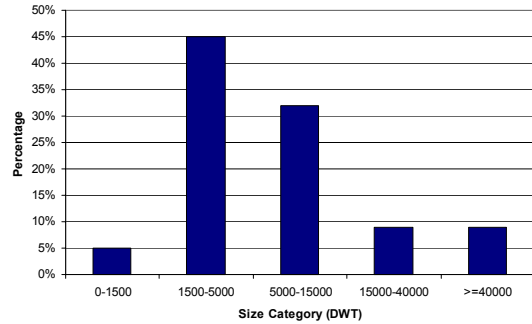
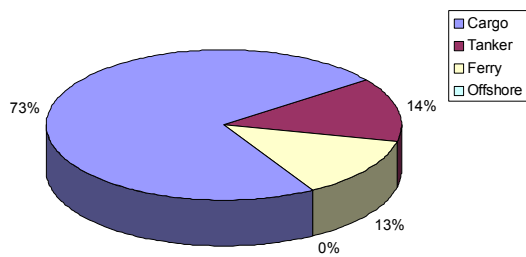


Figure 20 : Commercial Traffic, Vessel Type and Size

Route No. 1 passes North/South through the centre of the Greater Gabbard area between Inner Gabbard and Outer Gabbard. It is used by an estimated 2-3 ships per day.

Route No. 2 passes East/West through the centre of the area between Inner Gabbard and The Galloper. There are an estimated 26 ships per day on this route mainly heading between ports in Harwich Haven and ports in continental Europe, such as Rotterdam and Zeebrugge.

Route No. 3 is a busy route used by an estimated 13 ships per day passing to the West of the Inner Galloper shallows.

The majority of the other routes are associated with ports in Harwich Haven, the entrance of which is approximately 19nm (35km) to the West of Greater Gabbard.

A thematic map showing the estimated variation in shipping density within the Greater Gabbard site is presented in Figure 21.

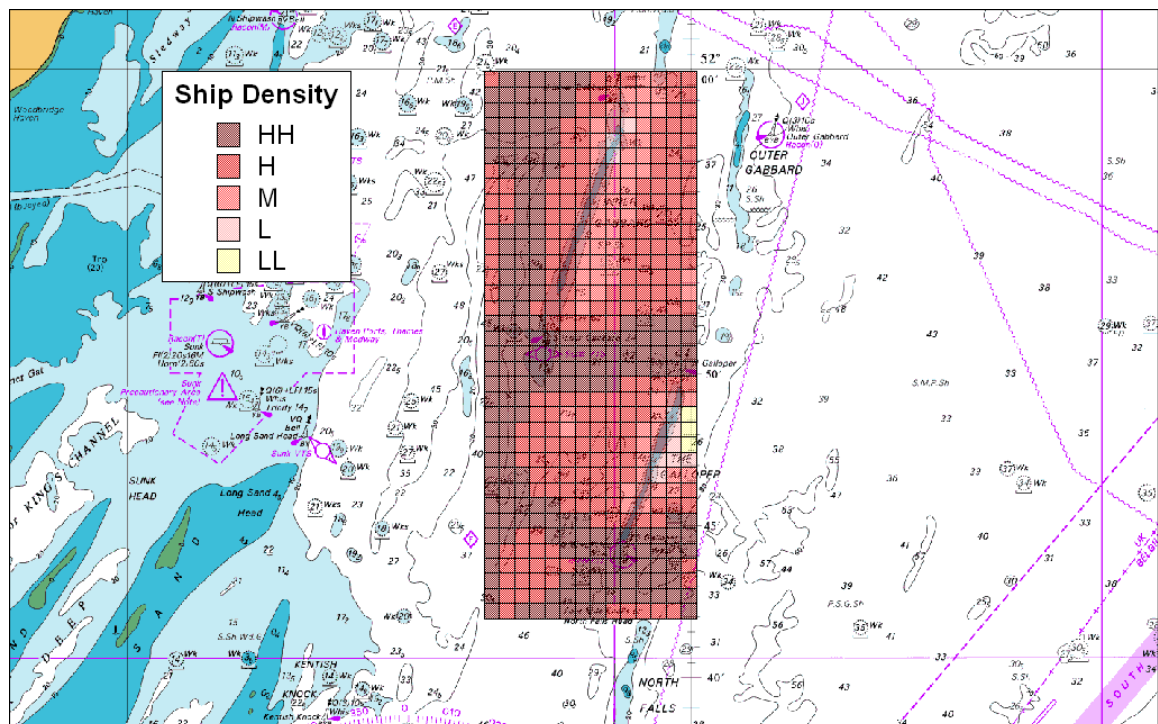


Figure 21: Shipping Density within Greater Gabbard

Proposed Scope of Assessment

The guidelines recently issued by the Maritime and Coastguard Agency "*Steps taken to Address Navigational Safety in the Consents Regime for the Establishment of Wind Farms off the UK Coast*" will form the basis for the assessment of the proposed development on navigational safety.

More specifically, the scope of the assessment will include :

- A detailed site-specific assessment of the existing traffic, which will be performed in accordance with the guidelines recently published by the Maritime and Coastguard Agency. This assessment will validate and update the shipping data where necessary based on consultation with relevant experts, such as local harbour masters, pilots, Ship Masters and Ship Operators. This will ensure the best available data is used to assess the navigational impact of the site and subsequent decision-making to minimise obstruction and danger to shipping.
- A request to the Port of Felixstowe and Harwich Haven Authority to analyse their ship radar archive, if applicable.
- A Navigational Risk Assessment, again according to MCA guidelines. This involves assessing the base level of risk in the area (ship to ship collision and vessel grounding risks) and the additional risks as a result of the wind turbines being located in the area (change in ship to ship, collision, grounding risks and ship to turbine collision risks). Such an assessment will provide information on whether safety zones in or around the wind farm are necessary.
- A statistical assessment of the probability of collision, using industry standard software.
- An assessment of the potential of the wind farm to interfere with communications, radar and positioning systems
- An assessment of the effects on marine recreation and amenity, following consultation with the Royal Yachting Association, local clubs and societies and the local councils.
- An unambiguous statement relating to the use of safety zones (if applicable) together with associated implications, for all phases of the wind farm life
- A brief description of measures to be implemented during the construction and operation phases to ensure that the safety of navigation is given high priority
- A brief description of emergency response contingency plans
- A study of in-combination effects.

5.3.4 Archaeology and Cultural Heritage

It is acknowledged that the seas around Britain contain many archaeological sites and remains. Such sites reflect the changing nature of both the coastline around Britain and the activities of the country throughout previous centuries, and broadly include:

- Archaeological landscapes formed when parts of the UK seas were still dry land
- Remains and sites, including but not limited to shipwrecks, evidence of Britain's early history
- More recent sites, reflecting Britain's role as a major naval, mercantile, industrial and imperial power

The placement of foundations, cables and ancillary structures provide the potential for damage, either directly or indirectly, to sites of archaeological potential inside or in close proximity to the wind farm, cable route, landfall or onshore infrastructure. Potential impacts may include :

- Damage to archaeological remains in or on the seabed arising from placement of foundations, cables, met masts, transformer platforms
- De-stabilisation of sites through changed sedimentary regimes

- Damage to archaeological remains in the inter-tidal zone from excavations or cable installation
- Damage or contamination of archaeological remains at sea or on land from the disposal of spoil, use of chemicals/oils etc
- Damage to archaeological remains or their settings on land arising from cable installation or construction of electrical infrastructure

The site does not contain any protected wrecks or wrecks of known archaeological significance. Data from the National Monuments Records Centre, however, identifies 5 wrecks and/or obstructions within the site, and admiralty charts indicate the presence of further wrecks. None of these wrecks are designated as War Graves.

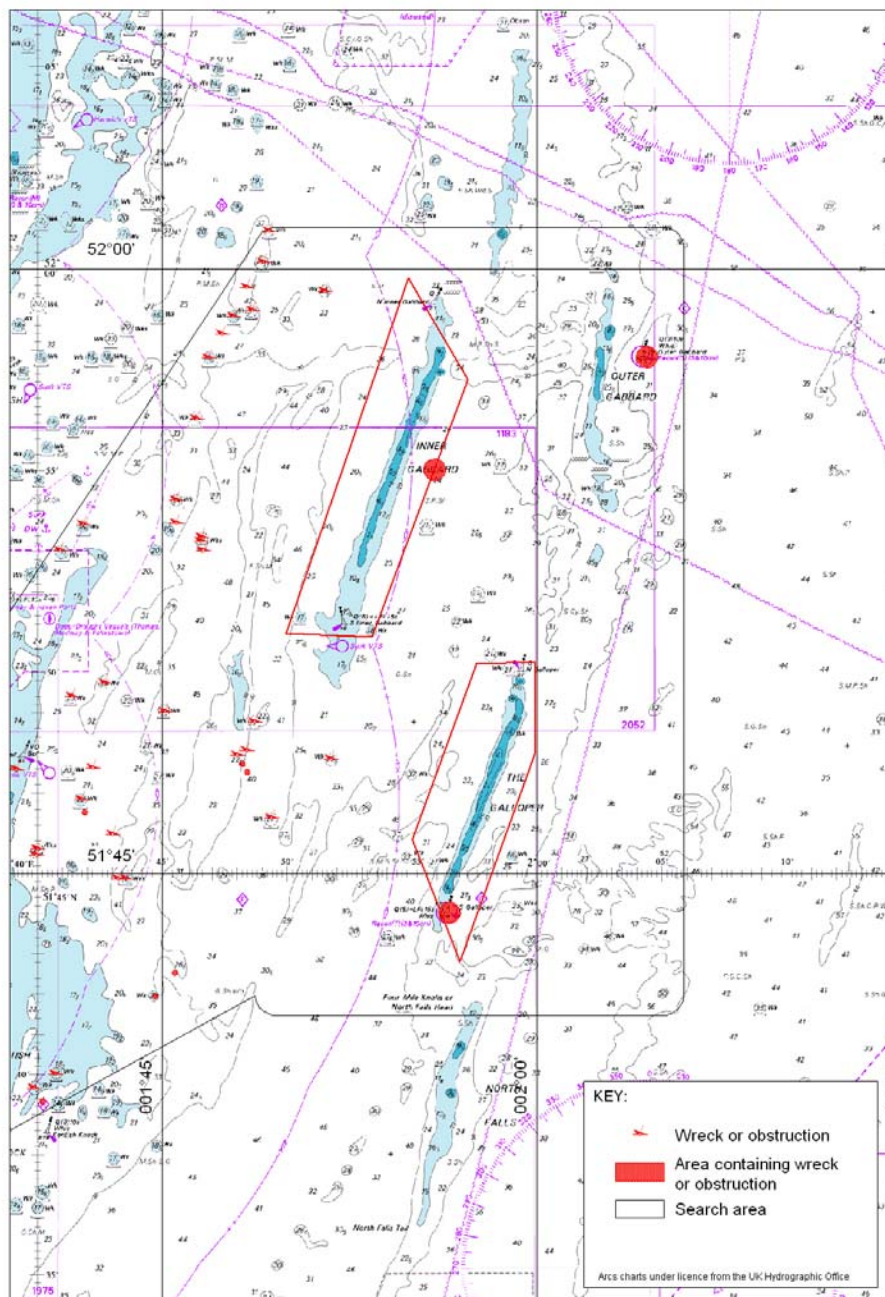


Figure 22 : Wrecks and Obstructions

Proposed Scope of Assessment

As part of the EIA process, an Archaeological Impact Assessment will be undertaken by an experienced consultant or contractor specialising in marine archaeology. The scope will follow the non-statutory *Code of Practice for Seabed Developers* produced by the Joint Nautical Archaeology Policy Committee, and, where applicable, following the following guidance and legislation :

- Planning Policy Guidance Note 16 “Archaeology and Planning”
- Protection of Wrecks Act 1973
- The Merchant Shipping Act 1979
- The Ancient Monuments and Archaeological Areas Act 1979
- Protection of Military Remains Act 1986

The assessment will adopt the following methodology sequence :

a) Desktop assessment of archaeological potential and significance.

This would involve the collation of existing documentary evidence from a variety of sources in order to predict the likely character and extent of archaeological remains at the site and inter-tidal region, to inform further fieldwork. Such an assessment would be undertaken for the onshore components of the development by a suitably qualified consultant / contractor.

b) Field assessment of archaeological potential and significance.

Such an assessment is likely to include :

- Interpretation of geophysical data by a qualified marine archaeologist, the results of this assessment being incorporated into the constraint map for the site layout
- Survey and interpretation of 10% of proposed grab samples
- Archaeological-diver inspection of anomalies, if necessary
- Archaeological walk-over of the sites and routes of proposed onshore infrastructure

It should be noted that if any offshore wreck material is recovered, the developer will inform the Receiver of Wreck under Section 236 of The Merchant Shipping Act 1995, and await further instruction.

c) Proposed measures for mitigating impact.

An assessment of potential mitigation measures will be undertaken during the design phase in order to reduce the predicted impacts. The range of potential mitigation measures includes avoidance, re-positioning of components or adoption of specific construction techniques to reduce impact.

This section of the assessment will also briefly describe the management practices which will be developed for the construction phases of the project, both onshore and offshore, to reduce any effects on the known and unforeseen archaeology. Such practices would include surveying, reporting, auditing and implementation of contingency plans.

5.3.5 Socio-economics

The socio-economic effects of the development can be summarised as a combination of the following high-level aspects :

- The effect of the development on the local, regional and national economies
- Public perception
- Perception of the development by local and regional businesses
- Levels of direct, indirect, permanent and temporary employment during the phases of the development
- The effect of the development on tourism, re-generation and local and regional initiatives

The proposed development has the potential to provide a positive effect at local, regional and possibly national levels. The stated Government aspiration to generate 20% of the UK's electricity from renewable sources by 2020 should, in theory, lead to an increase in the number of competitive UK-based suppliers of wind turbines, materials suppliers, offshore contractors, support companies etc.

Proposed Scope of Assessment

As part of the EIA process, a socioeconomic assessment will be undertaken. Such an assessment will comprise the following steps :

a) Consultations

Consultees are likely to include principal suppliers, local port operators, local businesses, and representatives from the appropriate local authorities and other public agencies in order to establish :

- The potential range of activity to be supported by the wind farm development
- The potential for additional private sector investment and public sector top-up in the area as a result of the wind farm development (including potential for spin-off tourism activity)
- The potential level of direct and indirect employment arising from the construction and operational phases of the development.

As a parallel exercise, a public perception survey will be undertaken in the vicinity of the development, with a view to gauging the local opinion on the development. The results from this survey, together with responses from exhibitions and events, would inform the socio-economic assessment.

b) Economic Modelling

The economic modelling will conform to the HM Treasury guidelines for socioeconomic assessment, incorporating the following issues :

- Assessment of development impacts (jobs, investment, etc.)
- Regeneration impacts
- Construction phase benefits
- Less tangible impacts (e.g. investment linked to image, perceptions, etc.)
- Factor in deadweight and displacement
- Direct, indirect and multiplier benefits
- Estimates of net, attributable impacts

c) Impact Assessment

The assessment will summarise the results of the economic modelling and place these into context with respect to the local, regional and national economies. The assessment would also summarise the extent of consultations performed by the developer to date and to provide some evidence of the public perception of the development at that stage.

5.3.6 Noise

Noise emissions during the construction and operational phase of the wind farm, both airborne and within the water column, are likely to occur.

The effects during the construction phase, predominantly as a result of piling operations, inter-tidal and onshore works, have the potential to be audible at the shore, and the effects within the water column could be more acute. Noise during the operational phase will be limited to turbine operational noise, and activities arising from remedial works should any be required.

It is likely that construction noise limits will be imposed on the project by way of a consent condition.

Scope of Assessment

A detailed baseline noise survey of 2-4 weeks duration, correlated with windspeed and direction as measured at the wind farm site, will be conducted at representative locations onshore as agreed with the Local Authority Environmental Health Officer. Another survey will be performed offshore (subsea) over 1-2 weeks, potentially with equipment installed at the offshore met mast.

The noise levels for the construction, operational and decommissioning phases, both underwater and airborne, will be predicted using robust prediction techniques, and the spatial and temporal effects will be assessed. Sources of noise will include :

- General construction activity
- Piling – hopefully using monitored data from previous wind farm projects
- Load-out
- Beach works
- Onshore works (sheet piling etc)
- Wind turbine operation – using warranted wind turbine noise levels and industry standard prediction techniques

Such noise predictions will inform other parts of the EIA process, notably :

- Marine Mammals
- Fish
- Commercial fisheries
- Marine Recreation and Amenity

Mitigation measures and noise management techniques will be incorporated into the construction phase of the project, and these will be briefly described in the Environmental Statement.

A study of in-combination effects with other developments will be performed.

5.3.7 Marine Recreation and Amenity

The construction process, operational phase and decommissioning of the wind farm could impact upon marine recreation and amenity in a number of ways, including :

- Direct interference / obstruction
- Indirect interference, and resulting increase in vessel density elsewhere
- Weather effects on safe navigation
- Impacts on communications, radar and positioning systems
- Access to and navigation within wind farms, this being linked to the issue of Safety Zones
- In-combination effects with other developments

The adjacent coastline is home to many sailing and cruising clubs, and recreational angling clubs. In addition, the site itself is used during offshore races, eg Royal Ocean Racing Club. The following marinas have been identified in the area :

- Shotley Marina (350 berths)
- Suffolk Yacht Harbour (500 berths)
- Woolverstone Marina (200 berths)
- Fox's Marina, Ipswich (150 berths)
- Neptune Marina, Ipswich (150 berths) and,
- Haven Marina (180 berths)

Scope of Assessment

It is essential that all local clubs, societies, emergency services are aware of the project from an early stage, and Greater Gabbard Offshore Wind Ltd will engage with such organisations. It is proposed that the RYA be the central point of contact with affiliated clubs, and the point of reference for offshore racing societies, cruising clubs etc.

The RYA believes that the threat to recreational yachts can be minimised by specifying a minimum rotor height clearance above flat sea level (mean high water springs) of 22 metres, and this will be borne in mind when designing the site.

The effects of the wind farm on recreational angling will be assessed.

An assessment of the cumulative effects of Greater Gabbard Offshore Wind Farm and other relevant projects will also be performed.

5.3.8 Traffic

There will be temporary minor increases in traffic (road, rail and sea) resulting from the transportation of materials and equipment to the development location, particularly during construction and decommissioning of the wind farm. It is anticipated that the main traffic movements will be marine based.

Scope of Assessment

The existing traffic infrastructure, road network and shipping lanes, will be investigated. The levels of traffic, both land-based and sea-borne will be established for the construction, operations and decommissioning phases of the project. The traffic for the operations phase will include an estimate of the traffic requirements for the several operation modes as stated above in Section 2.7.4

5.3.9 Offshore Oil and Gas

Offshore wind farms have the potential to affect oil and gas operations through proximity of certain components of the wind farm, invariably power cables. In addition, the dimensions and positions of the turbines can affect helicopter operations, which can have knock-on effects on the operations of these installations.

There are no known oil and gas installations in the vicinity of the development.

5.3.10 Marine Aggregate Extraction

Offshore wind energy has the potential to affect marine aggregate extraction in the following ways :

- Interference / lack of access for dredging operations
- Increased traffic, bringing increased navigational risk

In addition, cumulative and in-combination effects of the two activities include :

- Increases in turbidity, and subsequent effects
- Increased traffic and navigation risk
- Seabed and geomorphological issues

There are three areas licenced or to be licenced (subject to consent) for the extraction of marine aggregates (source : The Crown Estate), indicated below and shown in Figure 10 :

Company	Extraction Area Reference	Status	Distance from Greater Gabbard
RMC Marine (SCS)	239/1 and 452	Licence and Application	2.2km to NW
RMC Marine (SCS)	364/1	Licence	6.2km to NW
Hanson	119/3	Licence	4.1km to W

Table 16 : Marine Aggregate Extraction Areas adjacent to Greater Gabbard

Scope of Assessment

The operators of marine aggregate licences will be consulted at the earliest opportunity, and their operating practices, amount of material extracted (including locations and temporal characteristics) will be examined. The effects of the wind farm on such activities, and the likely cumulative and in-combination effects, will be assessed in the Environmental Statement.

5.3.11 Subsea Cables and Pipelines

Offshore wind farms have the potential to affect cables and pipelines through proximity of certain components of the wind farm, invariably power cables.

There are three known subsea cables in the vicinity of the project (source :The Crown Estate) as indicated below and also shown previously on Figure 10. There are no known subsea gas pipelines in the vicinity.

Company	Reference	Status	Distance from Greater Gabbard
National Grid Transco	UK-Netherlands Interconnector	Proposed Southern Route	3.0km to S
GT UK	Atlantic Crossing Seg B1	Telecomms	3.0km to E
British Telecom	Farlands	Telecomms	7.3km to N

Table 17 : Subsea Cables adjacent to Greater Gabbard

Scope of Assessment

Wherever possible, subsea cables and pipelines will be avoided in the project design. However, if this is not possible, the effects of the projects on such cables and pipelines will be assessed, in consultation with the corresponding cable / pipeline operators. Should a crossing be necessary, a method statement will be included in the Environmental Statement.

An assessment of cumulative and in-combination effects will be performed.

5.3.12 Marine Waste Disposal and Dumping

The dumping of waste at sea, as opposed to discharge into the sea via outfalls, along with the use of materials during coastal defence works or construction works is controlled by means of licenses issued under Part IIA of FEPA. Scientists from CEFAS recommend license conditions and undertake visits to construction sites, treatment works, disposal vessels and storage facilities to ensure compliance.

Wind farms have the potential to indirectly cause the release of such disposed materials through coastal processes effects, and as such assessment of the effect on waste disposal sites is necessary.

There are no disposal sites within the site. The closest is the Inner Gabbard (TH052) located approximately 4 km west of the site, which is designated for the disposal of maintenance

dredgings. This site, and another to the east, are proposed as the site of dredged material from the Felixstowe South Reconfiguration.

Scope of Assessment

Consultation with CEFAS will provide a valuable insight into the existing and previous licenced areas for the disposal of marine waste. The results of the coastal processes assessment will be interpreted and any effects on disposal sites will be assessed.

5.3.13 Military and Civil Aviation

Wind turbines have the potential to affect commercial and military aviation (fixed-wing and helicopters), either through their physical dimensions limiting access and affecting safeguarding or safe passage, or through their effects on primary or secondary radar systems.

It is acknowledged that the following guidance notes are available for developers in the design and development of wind farms, including offshore wind farms :

- Lighting of Wind Turbine Generators in United Kingdom Territorial Waters, CAA, 2003
- Standards and Procedures for Wind Turbine Generator Shutdown in the Event of a Search and Rescue, Counter Pollution or Salvage Incident in or Around a Wind Farm, MCA July 2003.
- Wind Energy and Aviation Interests, Interim Guidelines, 2002.

Following the consultation to date, the Civil Aviation Authority and the Ministry of Defence have expressed no objections to the proposal.

Proposed Scope of Assessment

All military and civil aviation stakeholders will be engaged at an early stage, and re-consulted throughout the EIA process, with their concerns noted and taken into account in the final design of the wind farm. The design changes and predicted effects on stakeholders will be presented in the Environmental Statement.

5.3.14 Abandoned Munitions

The remote possibility exists that the area within and adjacent to the development has some abandoned munitions from previous conflicts, notably World War II. As such there are no records of abandoned munitions at the site.

Proposed Scope of Assessment

The assessment of abandoned munitions will be an extension of the marine archaeology assessment. It is intended that the interpretation of geophysical data from within and around the site will be analysed for signs of potential abandoned munitions. Should there be any suspicion about any particular remains, the developer will contact MoD, Receiver of Wreck, and English Heritage, and await further instruction.

In addition, an assessment of the likely impact of the development on abandoned munitions will be stated, together with a contingency procedure to be effected in the event of unforeseen munitions during the construction and operation phases of the development.

5.3.15 Electromagnetic Interference

Wind turbines, as with any large structure, can potentially interfere with electromagnetic signals, particularly television and communications systems. The quality of television reception may be affected, and viewers may suffer loss of picture quality and acoustic interference.

The turbines also have the ability to affect radar performance and interfere with communication networks.

Please note that the potential effects of the wind farm on marine navigation systems, VHF, ship radar, etc) are discussed in Section 5.3.3.

Proposed Scope of Assessment

It is proposed to consult with the local and regional television and radio service providers, as well as operators of communications infrastructure (eg mobile phone companies) at the earliest opportunity. Should any concerns be raised, these can be factored into the constraints within the site area, and the wind turbine layout amended accordingly.

The list of proposed consultees is as below :

BBC	ntl Group
BT	One-to-One
Cellnet	Orange PCS
Crown Castle Ltd	Radiocommunications Agency
Home Office	Vodafone
Independent Television Commission	WS Atkins (for Cable and Wireless)
MLL Telecom Ltd	

Table 18 : Electromagnetic Interference Consultees

If required, an assessment of the effects on TV reception will be undertaken, comprising a prediction of those areas likely to be affected, a survey of existing signal levels in those areas. If an adverse effect is predicted, a contingency plan will be described in the Environmental Statement.

5.4 Cumulative Effects

Schedule 3 of the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 requires that the characteristics of the development (carrying out of building, engineering or other operations) be considered for potential cumulative effects with other projects.

Article 6(3) of the Habitats Directive (92/43/EEC) makes explicit, and guidance on the provisions of this Article (IAU 2001) reiterates, the need for assessment of effects on Natura 2000 sites to be considered in combination with other plans and projects that may affect that site.

Cumulative effects of wind farm sites, potentially on nature conservation interest at a level of importance below that of European sites, is also required by the Environmental Impact Assessment Directive (97/11/EEC).

One definition of cumulative impacts is *“impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project”* (Hyder 1999).

Proposed Scope of Assessment

The Environmental Statement will include a cumulative impact assessment to identify, describe and evaluate the cumulative effects that are likely to result from the project in combination with other projects and activities that have been or will be carried out. It will cover potential impacts of plans and projects in all sectors, not just offshore wind, including:

- coastal onshore wind farms
- aggregate extraction

- dredging and disposal of dredged material
- shipping
- oil and gas exploration and production

To carry out the assessment of cumulative effects, the following types of project will be included, subject to availability of information :

- existing completed projects
- approved but uncompleted projects
- ongoing activities (eg discharge consents, fisheries)
- plans or projects for which an application has been made and are under consideration by the consenting authorities
- plans and projects which are “reasonably foreseeable” (i.e. developments that are being planned, including other offshore wind farms awarded development rights by The Crown Estate)

The assessment will comprise data collection from those projects deemed to be “in combination” with Greater Offshore Wind Farm, such projects to be agreed with Statutory Agencies. The range of projects in the region is highlighted in Section 3. In assessing the potential significance of these various activities acting in combination on the environment, a structured methodology based on the guidance provided by the SEA and from various sources such as English Nature will be applied.

5.5 Environmental Impact Matrix

The range of potential environmental effects described above is summarised in a preliminary Environmental Impact Matrix. The environmental factors have been determined by considering each stage of the development in turn and identifying potential issues that may arise. The matrix refers to construction, operation, and decommissioning of the offshore wind farm and provides a guide to initial conclusions regarding the likely significance of particular impacts. The matrix is only to be used as a guide to the potential environmental impacts arising from the development project.

Please note that the matrix is not exhaustive, and for a more complete description of impacts, please refer to Sections 5.1 to 5.4.

Environmental Factor	Manufacture of Components and Transportation	Construction Phase	Operation Phase	Decommissioning Phase	Overview of Significance / Requirement for Assessment
Discharges to Water / Water Quality	Spillage or leakage of fuels/oils during transport of components from the construction port to the turbine array	Mobilisation of contaminants already in seabed. Spillage or leakage of fuels or chemicals at the port or from vessels Potential release of foundation grouting and cementing materials, if utilised. Deposit of drill arisings, if necessary	Spillage or leakage of oils or chemicals stored in turbines, or within maintenance vessels	As with construction phase (except references to grout and drill arisings)	Effects likely to be small. Nevertheless assessment required
Coastal Processes	N/A	Minor short term localized effects on sediment transport likely to occur. Possible minor changes to local geomorphology may result with potential effects further afield.	Effects of physical presence of structures on metocean characteristics. Potential for localized scour and effects further afield. Possible minor changes to local geomorphology may result with potential effects further afield	As with construction phase	Effects likely to be minor and localized. Sediment transport modelling as part of the assessment process will highlight any significant adverse impacts. Assessment required.
Marine Sediments	N/A	Increased suspended sediment concentrations in vicinity of construction works (turbines, cables, ancillary structures). Impacts on dredging and dredging spoil disposal areas Increased suspended sediment during construction could impact on fish or marine mammals	Localised impacts on sediment transport processes likely	As with construction phase	Impacts of increased suspended sediment in the water column requires assessment
Discharges to Air / Air Quality	Vehicle/vessel emissions during raw material and component transport. Emissions during extraction/processing of raw materials and components. Impact generally unavoidable, but likely to be small	Emissions from construction vessels and port handling vehicles. Impacts generally unavoidable, but likely to be small	Vehicle / vessel emissions during routine operations, likely to be small. Reduced emissions of gases associated with burning of fossil fuels The development will offset the annual release of approximately : 1,489,200 tonnes of CO ₂ 19,272 tonnes of SO ₂ 3,504 tonnes of NO ₂	Vehicle/vessel emissions during transport of decommissioned components	Any adverse air quality impacts will be minor short term effects and are in general unavoidable. The offset in gaseous emissions will be a permanent positive benefit. Recommend that air quality assessment is not required. Emissions offset will be presented in Environmental statement.

Environmental Factor	Manufacture of Components and Transportation	Construction Phase	Operation Phase	Decommissioning Phase	Overview of Significance / Requirement for Assessment
Sub-tidal Benthic ecology	N/A	Localised impacts on benthic communities in areas near to turbine foundations and cable routes Localised impacts on benthic communities in spoil disposal areas, if disposal required	Removal of habitat from areas under foundations Possible vibration effects Cable movement may affect benthos Potential for "artificial reef effect"	As construction phase	Removal of habitats in the vicinity of the turbine bases will be unavoidable, but potentially small. The sensitivity of habitats in these areas and others, and the ability of species to re-colonise requires assessment. Assessment required Assessment required
Fish	N/A	Noise / vibration effects Direct loss of habitat and food resources, contamination via chemical release Effects on migratory fish	Effects from noise and vibration Effects of electromagnetic fields on electro-sensitive organisms such as elasmobranchs. Effects on migratory fish Potential for noise and vibration effects Potential for reduction in food resources	As construction phase	Assessment required Assessment required
Marine Mammals	N/A	Short term noise and vibration effects Potential for impacts from any degradation in water quality	Potential for noise and vibration effects Potential for reduction in food resources	As construction phase	Assessment required
Ecology (Inter-Tidal and Terrestrial)	N/A	Potential for localized disturbance / damage from inter-tidal and onshore construction Potential for displacement during busy periods and piling Indirect effects on food	Short term disturbance if remedial works are required Potential for displacement, blockage, bird collision Indirect habitat loss Effects of lighting	As construction phase	Assessment relating to all inter-tidal and onshore options required Assessment required
Birds	Potential for displacement due to increased marine traffic	Potential for displacement during busy periods and piling Indirect effects on food	Potential for displacement, blockage, bird collision Indirect habitat loss Effects of lighting	As construction phase	Assessment required
Landscape / Seascape	Minor short term impact during transportation	Minor short/medium term effects on seascape, increased marine activity	Permanent change to seascape, due to turbine size and rotation. Effects of lighting and marking	Minor short term effects on seascape	The visual impact of the wind turbine array during operations is a significant issue - assessment required Large distance from shore could reduce principal effects.
Commercial Fishing	Possible short term minor disruption to movement of fishing vessels	Indirect effects on fish behaviour Potential loss of access. Possible effect to fishing grounds Increased navigational risk	Potential loss of access Indirect effects from effects on fish	Possible effects to fishing grounds following decommissioning activities	Effects on fishing operations during all phases of the project requires assessment

Environmental Factor	Manufacture of Components and Transportation	Construction Phase	Operation Phase	Decommissioning Phase	Overview of Significance / Requirement for Assessment
Commercial Navigation	Temporary disruption to other vessels at construction port	Temporary short term obstructions to navigation. Potential for increased traffic volumes along local routes away from the port.	Obstruction to navigation in line with requirements for safety zones. Risk of collision from other users and associated pollution incidents. Impacts on communications, radar and positioning systems	Temporary obstruction to navigation. Potential increased traffic volumes along local routes away from the port.	Effect on Commercial Navigation is a significant issue - assessment required
Archaeology and Cultural Heritage	N/A	Potential disturbance of sites due to adjacent construction activity, onshore or offshore De-stabilisation of offshore sites through changed sedimentary regimes	De-stabilisation of offshore sites through changed sedimentary regimes	As with construction phase	There are several identified wrecks within the development area. Assessment required
Socio-economics	Commercial benefits to the holding port and associated activities	Increased employment in local area and associated with manufacture of components	Increased employment associated with operation and maintenance of turbines	Increased employment associated with decommissioning activities	There are potential benefits from direct and indirect employment, particularly during the construction phase and the decommissioning phase - assessment required
Noise & Vibration (airborne)	Noise related to extraction of raw materials and the manufacturing process and transportation.	Noise and vibration during installation of turbine foundations and cables Noise during inter-tidal and onshore works, Noise in proximity to construction port	Noise impact on local communities due to turbine operation Noise impact on local users of the surrounding area of sea	Vehicle/vessel noise during transport of dismantled components	Noise and vibration during the construction phase will be the most significant aspect, assessment required. Impact during operation expected to be low. Assessment still required
Noise (Subsea)	Increased vessel activity	Increased vessel activity Piling Noise	Vibration arising from turbine operation Maintenance traffic	As construction phase, except piling	Assessment required
Marine amenity, Recreation & Tourism	Minor short term disruption to marine recreation activities	Minor short term impact on marine recreation in construction area for turbines and sea bed cable	Effects of safety zones (if required) Visual impact of turbines on marine recreation activities and any associated tourism	Temporary impact on marine recreation activities	Assessment required

Environmental Factor	Manufacture of Components and Transportation	Construction Phase	Operation Phase	Decommissioning Phase	Overview of Significance / Requirement for Assessment
Traffic	Short term effects of marine traffic at construction port and at site	Short term effects of marine traffic at construction port and at site	Onshore effects unlikely. See commercial navigation for offshore effects	As construction phase	Assessment required
Offshore Oil and Gas	N/A	Potential interference to operations	Potential interference to operations	Potential interference to operations	No oil or gas interests in vicinity
Marine Aggregate Extraction	Increased navigation risk	Potential interference to dredging operations Increased navigation risk	Potential interference to dredging operations Increased navigation risk	Potential interference to dredging operations Increased navigation risk	3 licence blocks in vicinity. Consultation and assessment required. Cumulative effects to be assessed
Subsea Cables and Pipelines	N/A	Physical effects from adjacent construction activities	Physical effects from adjacent infrastructure	Physical effects from adjacent decommissioning activities	3 cables in vicinity – no pipelines. Consultation and assessment required
Marine Waste and Disposal	N/A	Effects on disposal sites if disposal of material is required	Potential for effects from sedimentary changes	As construction phase	Assessment required
Military and Civil Aviation	N/A	Potential for limitations in military and civil aviation use Effects on radar installations	Potential for limitations in military and civil aviation use Effects on radar installations	Potential for limitations in military and civil aviation use Effects on radar installations	Consultations and assessment required
Electromagnetic Interference	N/A	Effects unlikely	Potential for disruption to television, radio and mobile phone signals	As construction phase	Consultations and assessment required

6 Monitoring

The EIA will provide a proposal for ongoing monitoring to be undertaken should the application for statutory consents be approved. This will include pre-construction, construction and post-construction phases.

7 Proposed Structure of the Environmental Statement

The Environmental Statement for the proposed Greater Gabbard Offshore Wind Farm will comprise three volumes :

Volume 1 : Non Technical Summary

Volume 2 : Text

Volume 3 : Drawings and Figures

Volume 2, which forms the bulk of the Statement, will present the pertinent issues relating to each subject (Vol 2 and Vol 3 may be combined into a single volume). Full reports incorporating raw data and data analysis, will be provided as supplementary information by the individual consultant. The proposed structure of Volume 2 is presented in Appendix D.

8 References

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Posford Haskoning : Greater Gabbard Offshore Wind Farm : Annex to Tender submitted by Airtricity, 9M9678/R/ASL/Pbor, September 2003

Posford Haskoning : Felixstowe South Reconfiguration, Environmental Statement, November 2003.

Planning Policy Guidance Note 22 : Renewable Energy, 1993

Wind Energy and Aviation Interests, Interim Guidelines, 2002

Appendices

Appendix A - Glossary

AONB	Area of Outstanding Natural Beauty
CAA	Civil Aviation Authority
CD	Chart Datum
CEFAS	The Centre for Environment, Fisheries and Aquaculture Science
CCW	Countryside Council for Wales
DEFRA	Department for Environment, Food & Rural Affairs
DTM	Digital Terrain Model
FEPA	Food and Environmental Protection Act
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
MCA	Maritime and Coastguard Agency
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
MW	Megawatts
NGT	National Grid Transco
PEXA	Practice and Exercise Area
SAC	Special Area of Conservation
SCADA	Supervisory Control and Data Acquisition
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

Appendix B - List of Consultees

The consultees for Draft 1 of the Greater Gabbard Offshore Wind Farm Scoping Report are as follows :

Department of Trade and Industry	Suffolk County Council
Department of Environment, Food and Rural Affairs – Marine Consents and Environment Unit	Essex County Council
Department for Transport – Ports Division	Suffolk Coastal District Council
Department for Culture, Media and Sport	Waveney District Council
The Crown Estate	Maldon District Council
Government Office for East of England	Babergh District Council
East of England Regional Assembly	Tendring District Council
English Nature	Thanet District Council
CEFAS	Port of Lowestoft
Joint Nature Conservation Committee	Port of Felixstowe
Countryside Agency	Port of Ramsgate
Environment Agency	Brightlingsea Harbour Commissioners
English Heritage	Harwich Haven Authority
MoD Defence Estates	East of England Development Agency
Directorate of Airspace Policy	Renewables East
National Air Traffic Service	East of England Tourist Board
Royal Commission on the Historical Monuments of England	British Helicopter Advisory Board
English Heritage	International Chamber of Shipping
Maritime and Coastguard Agency	Chamber of Shipping
Trinity House Lighthouse Service	British Marine Foundation
UK Hydrographic Office	Essex Wildlife Trust
Receiver of Wreck	Suffolk Wildlife Trust
DEFRA Sea Fisheries Inspectorate	Suffolk Coast and Heaths Unit
Kent and Essex Sea Fisheries Committee	Marine Conservation Society
Eastern Sea Fisheries Committee	Greenpeace
National Federation of Fishermen's Organisations	Friends of the Earth
National Federation of Sea Anglers	Royal Society for the Protection of Birds
Association of Sea Fisheries Committees of England and Wales	Royal Yachting Association
British Telecom	Royal National Lifeboat Institution
Hanson Aggregates	Royal Ocean Racing Club
GT UK	Council for the Protection of Rural England (Central and Essex)
Suffolk Preservation Society	Wildlife and Wetlands Trust
RMC Marine	British Sub Aqua Club
National Grid Transco	Sea Mammal Research Unit
Port of London Authority	Whale and Dolphin Conservation Society

Appendix C - Environmental Policy

FLUOR[®]

FLUOR LIMITED

QUALITY ASSURANCE, SAFETY, HEALTH AND ENVIRONMENTAL POLICY

It is our policy to conduct business activities compliant with applicable safety, health and environmental laws and customer requirements, through the implementation of an integrated management system.

We support Fluor Corporation's "Target Zero" goal of no accidents, no ill health and no dangerous incidents or environmental damage resulting from our work.

We will identify safety, health and environmental risks and impacts arising from our activities. We will reduce these risks to the lowest reasonably practicable levels so as to prevent harm to individuals and the infrastructure.


We will maintain and continually develop awareness of quality, safety, health and environmental matters by reviewing and communicating relevant legislation, codes, standards and guidelines, and through training of personnel.

We will continually improve performance by monitoring projects and their supporting activities, ensuring feedback on performance is analysed and acted upon.

Fluor will demonstrate its continuing commitment to quality, safety, health and environmental issues by:

- maintaining a documented quality, safety, health and environmental management system.
(Compliant with the requirements of BS EN ISO 9001, BS EN ISO 14001, customer requirements and guidance provided in BS 8800 and HS(G)65 / OHSAS 18001),
- providing appropriate trained and experienced quality, safety, health and environmental resources.
- addressing safety, health and environmental issues in all phases of its activities and working for the adoption of best practice.
- setting goals and standards, ensuring responsibilities are assigned, understood and acted upon.
- measuring, monitoring and assessing our performance,

and in so doing seek continual improvement in the performance of our ongoing activities.



Patrick Flaherty,
Managing Director

Fluor Limited
Riverside Way,
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June 2003

Appendix D - Structure of the Environmental Statement

Greater Gabbard Offshore Wind Farm Environmental Statement

Volume 1 : Non Technical Summary

Volume 2 : Text

Volume 3 : Drawings and Figures

Volume 2

1 Introduction

- 1.1 The Developer
- 1.2 The Project
- 1.3 The Need for the Project
- 1.4 Benefits of the Development
- 1.5 Scope of the Environmental Statement
- 1.6 Structure of the Environmental Statement

2 Consultation

- 2.1 Overview
- 2.2 List of Consultees
- 2.3 Public Perception

3 Project Description

- 3.1 Objectives of the Development
- 3.2 Site Selection
- 3.3 Site Location and Physical Characteristics
- 3.4 Construction Contract, Works and Programme
- 3.5 Detailed Components of the Development
- 3.6 Wind Farm Operation
- 3.7 Decommissioning
- 3.8 Assessment of Alternatives

4 Relevant Projects

- 4.1 Wind Farms
- 4.2 Marine Aggregate Extraction
- 4.3 Offshore Oil and Gas
- 4.4 Subsea Cables and Pipelines

5 Regulatory and Planning Context

- 5.1 Introduction
- 5.2 Consents Policy Framework for Offshore Wind Energy in UK
- 5.3 National and Local Policy Framework
- 5.4 National Planning Policy
- 5.5 Wind Power in UK
- 5.6 Conclusion

6 Existing Environment

- 6.1 Context
- 6.2 Designated Sites
- 6.3 Physical Environment
 - 6.3.1 Metocean Characteristics
 - 6.3.2 Seabed Sediments and Features
 - 6.3.3 Water Quality / Suspended Sediment

- 6.4 Biological Environment
 - 6.4.1 Sub-Tidal Benthic Ecology
 - 6.4.2 Fish
 - 6.4.3 Marine Mammals
 - 6.4.4 Inter-Tidal and Terrestrial Ecology
 - 6.4.5 Birds
- 6.5 Human Environment
 - 6.5.1 Visual Environment
 - 6.5.2 Commercial Fisheries
 - 6.5.3 Commercial Navigation
 - 6.5.4 Archaeology and Cultural Heritage
 - 6.5.5 Socio-Economics
 - 6.5.6 Noise
 - 6.5.7 Marine Recreation and Amenity
 - 6.5.8 Traffic
 - 6.5.9 Offshore Oil and Gas
 - 6.5.10 Marine Aggregate Extraction
 - 6.5.11 Subsea Cables and Pipelines
 - 6.5.12 Waste Disposal and Dumping
 - 6.5.13 Military and Civil Aviation
 - 6.5.14 Abandoned Munitions
 - 6.5.15 Electromagnetic Interference

7 Assessment of Environmental Impacts

- 7.1 Physical Environment (sub-sections as above)
- 7.2 Biological Environment (sub-sections as above)
- 7.3 Human Environment (sub-sections as above)
- 7.4 Cumulative Impact Assessment
- 7.5 Effects on the Integrity of Natura 2000 Sites

8 Mitigation Measures

- 8.1 Physical Environment (sub-sections as above)
- 8.2 Biological Environment (sub-sections as above)
- 8.3 Human Environment (sub-sections as above)

9 Monitoring

- 9.1 Physical Environment (sub-sections as above)
- 9.2 Biological Environment (sub-sections as above)
- 9.3 Human Environment (sub-sections as above)

10 Conclusions

Appendix E

Greater Gabbard Offshore Wind Farm
Environmental Impact Assessment Scoping
Marine Ecology

Centre for Marine and Coastal Studies Ltd, February 2004

Provided under Separate cover

Appendix F

Greater Gabbard Offshore Wind Farm Project
Scoping for The Ornithological Impact Assessment

Ecology Consulting, February 2004

Provided under Separate cover