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Dogger Bank

Tranche B Selection Report

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Executive Summary

Forewind has agreed with The Crown Estate a target of 9GW by 2020, and believes the Dogger Bank Zone has the potential to deliver approximately 13GW.

In order to ensure that the works associated with achieving this objective are managed effectively, and to reduce the demand on our stakeholders and the supply chain, Forewind proposes to develop the zone in phases, or tranches.

This report describes how the footprint of the second tranche, Tranche B, has been selected and identifies the area which will now go forward for geophysical and environmental survey.

The process to identify the footprint builds on the work done in identifying Tranche A, and involves an examination of the relevant environmental and consenting issues associated with the zone, including input from various stakeholder meetings. An engineering workstream also evaluated the variation in the cost of energy across the zone, incorporated consideration of strategic issues and examined the Health and Safety implications of the options available.

The information collated for the Zone Characterisation Document (now in its 2nd edition) identified a number of activities and environmental considerations across the zone. A heat map was produced which enabled this range of considerations to be viewed in combination. When these considerations were combined it was determined that, from the information collected during the first phase of Zone Appraisal and Planning, no individual areas were more sensitive than others, with the exception of northern slope habitats and the discrete areas of hard constraints which were not considered appropriate locations for the early projects at Dogger Bank.

The engineering workstream identified a relative change in the cost of energy across the zone. Given the criticality of achieving the lowest cost of energy and ensuring the delivery of economic projects this helped to identify the optimum Tranche B location.

The Tranche B area is shown in Figure 2.3 below. It is an area of approximately 1,500km² in the south-east of the zone, the majority of which is in water depths of less than 35m LAT (Lowest Astronomical Tide). It represents an area with an equivalent probability of consenting to the rest of the zone, is capable of delivering reasonable cost of energy, and due to its large size offers significant flexibility in project design. The design and location of projects in the tranche will be determined through interpretation of the geophysical and environmental surveys, further stakeholder consultation and more detailed engineering assessments.

1.0 Introduction

About this document

- 1.1 This document has been developed to present “Tranche B”; the second area for offshore wind farm project development within the Round 3 Dogger Bank Offshore Wind Farm Zone.
- 1.2 It describes the approach taken by Forewind in identifying Tranche B and refers to the updated version of the Zonal Characterisation Document (ZoC) (www.forewind.co.uk/downloads/latest-downloads.html). The ZoC presents information on the relevant planning considerations compiled to date as part of the Zone Appraisal and Planning (ZAP) phase of development. Together with the Tranche A Selection Report (www.forewind.co.uk/downloads/zone.html) it provides information relating to the selection of areas thus far proposed for the development of offshore wind farms within the zone.
- 1.3 This report does not directly include consideration of the onshore points of connection or associated export cable routes associated with projects in Tranche A or Tranche B. Grid connection points will be determined by National Grid through the formal grid connection application process and, once established, a detailed site selection process will be undertaken to determine the location of the infrastructure associated with each projects.

Background

- 1.4 Forewind is a consortium comprising four leading international energy companies which joined forces to develop the Dogger Bank Zone as part of The Crown Estate's Round 3 development process for UK offshore wind farms. The consortium includes:



RWE npower renewables is the UK subsidiary of the German renewable energy company RWE Innogy (part of RWE AG) that has a strong, diversified position in renewables with significant ambition for growth throughout Europe.



SSE is one of the largest energy companies in the UK and is involved in the generation, transmission, distribution and supply of electricity; the storage, distribution and supply of gas; telecommunications; contracting; and other energy services.



Statkraft is Europe's leader in renewable energy. The group develops and generates hydropower, wind power, gas power and district heating, and is a major player on the European energy exchanges. Headquartered in Norway, Statkraft is active in more than 20 countries.



Statoil is an international energy company with operations in 34 countries. Building on more than 35 years of experience from oil and gas production on the Norwegian continental shelf, Statoil is committed to accommodating the world's energy needs in a responsible manner, applying technology and creating innovative business solutions. Statoil is headquartered in Norway with 20,000 employees worldwide, and is listed on the New York and Oslo Stock Exchanges.

- 1.5 Each of the four owners – all leading players in their own right - recognise that by joining forces they have a unique ability to both make a significant contribution to the future of wind energy in the UK and demonstrate commitment to the continuing development of offshore wind.
- 1.6 Forewind has the objective to achieve development consent for a target installed capacity of 9GW of offshore wind farm projects but believes that the zone has the potential to deliver up to 13GW. This figure equates to almost 10

per cent of the UK's projected electricity requirements. If fully developed, it is likely to be the world's largest offshore wind project. In order to ensure that the works associated with achieving this objective are managed effectively, and to reduce the demand on our stakeholders and the supply chain, Forewind proposes to develop the Zone in phases, or tranches of projects.

- 1.7 The ongoing Zone Appraisal and Planning (ZAP) phase (described in further detail in the ZoC) will use available information and the outcome of stakeholder consultations to identify the optimum location of "tranches" or areas for development within the zone.
- 1.8 At this stage it is anticipated that ZAP will identify four tranches for development in accordance with the programme outlined below:
 - Tranche A – identified in Autumn 2010;
 - Tranche B – identified in Autumn 2011;
 - Tranche C – likely area to be defined in 2012; and
 - Tranche D – likely area also to be defined in 2012.
- 1.9 An important objective of the zone-based approach to offshore wind development is to allow Zone developers more control over the way a zone is developed, and to give them the opportunity to identify as many of the environmental and planning constraints as possible at an early stage of development so that these can be more effectively managed during project development.
- 1.10 In this way, Forewind is better able to optimise the design of the zone in order to maximise the commercial return of their projects, accelerate delivery and ensure that works are undertaken safely, efficiently and with minimum overall impact for the environment and stakeholders.
- 1.11 The work undertaken to identify Tranche B is a component of Forewind's Zone Appraisal and Planning (ZAP) Strategy and comprised two related workstreams:
 - Consent Workstream – focussing on the stakeholder, environmental and planning considerations associated with the development of offshore wind farm projects in the zone;
 - Engineering Workstream – focussing on the relevant technical and commercial considerations of delivering offshore wind farm projects at Dogger Bank.
- 1.12 Forewind was supported in this process by their ZAP Coordinator (Emu Limited) who produced the ZoC document which characterises the Zone Development Envelope (ZDE) shown in Figure 1.1.

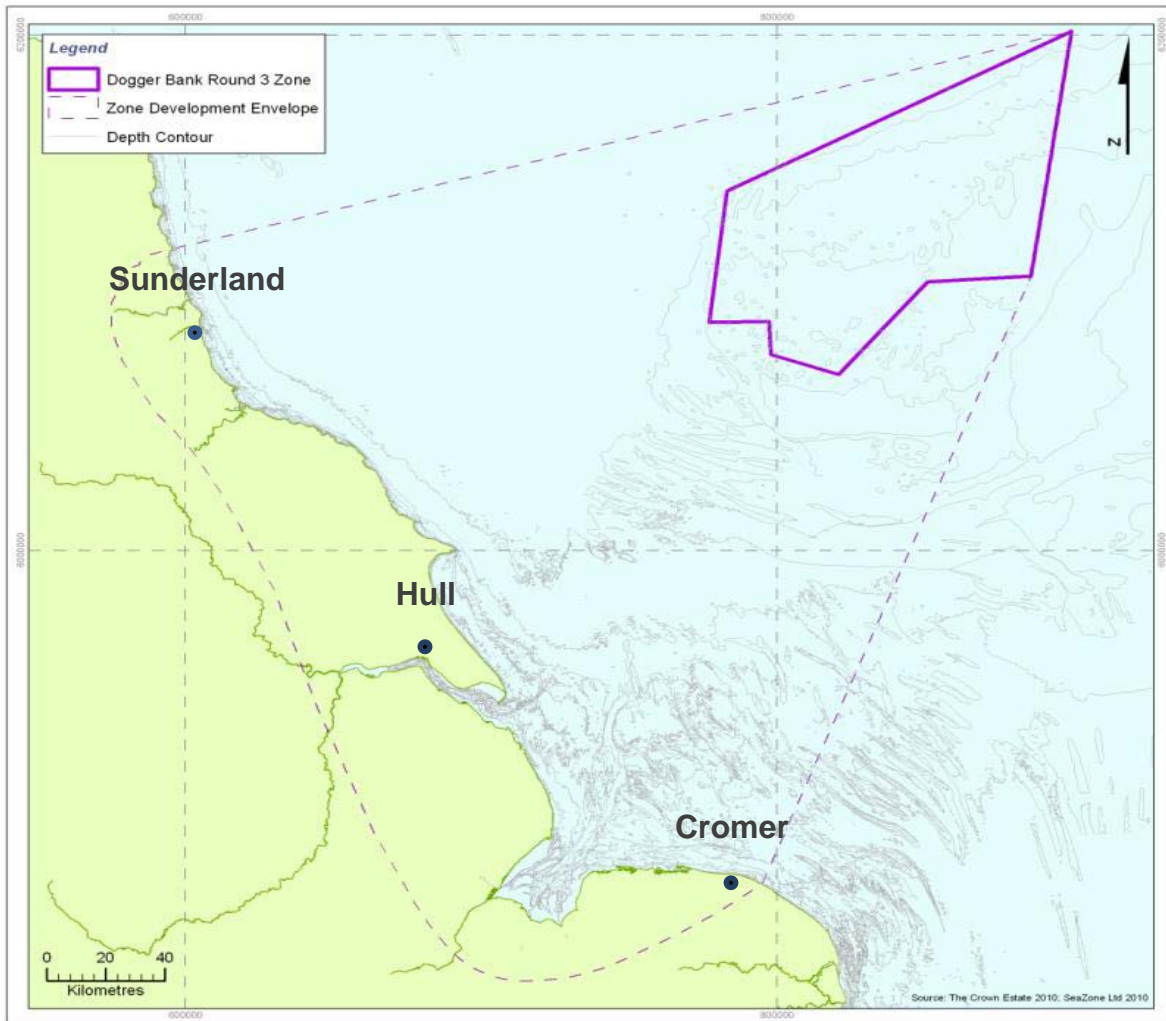


Figure 1 Dogger Bank Zone Development Envelope

1.13 The approach adopted for defining Tranche B is broadly summarised by the following steps:

- Identify relevant planning considerations in the ZDE;
- Compile information and data sources and (where appropriate) input into GIS (including those derived from stakeholder meetings and workshops);
- Update the workstream-specific heat mapping (previously undertaken for the identification of Tranche A); and
- Combine workstreams in order to identify preferred area for development.

2.0 Tranche B Selection Process

Planning Considerations

- 2.1 As was described in the Tranche A Selection Report, Forewind considers the characteristics of a successful project to include technical and commercial viability, safety, minimum possible disruption to the environment and to stakeholders and delivery in accordance with programme. Collecting information and optimising project designs to ensure that these things can be achieved is a process that starts with Tranche identification during the ZAP phase and continues until projects are delivered.
- 2.2 During ZAP, information across relevant planning and environmental topics is gathered to support the identification of Tranches and to subsequently support the definition of projects (to be undertaken at EIA level). The broad topics considered relevant at ZAP level are presented below and described in further detail in the ZoC Document (2nd Edition) which has been updated to support the identification of Tranche B.

Geology	Marine Mammals	Military, Aviation and Radar
Metocean	Noise	Aggregates & Disposal Sites
Benthic Ecology	Nature Designations	Cable and Pipelines
Fish Resource	Commercial Fisheries	Seascape and Visual
Archaeology	Navigation & Shipping	Other Marine Users
Ornithology		

Update of Workstream Heat Mapping

- 2.3 For the identification of Tranche A, Forewind established consenting and engineering workstreams which produced consents and cost of energy heat

maps to provide a spatial representation of the relevant planning and engineering considerations across the zone.

2.4 For the identification of Tranche B these heat maps were updated with new information collected during the second phase of ZAP.

Consenting Workstream

2.5 The consents heat map for the Tranche B selection process was produced in a similar way to that presented in the Tranche A Selection Report except that an additional category of risk was introduced in order to help provide a clearer distinction between constraints and to make it easier to differentiate between more and less favourable areas of the heat map.

2.6 In the Tranche A heat map constraints that represented a 1-50% risk of consent not being achieved were identified as having a “Moderate” risk to consent. For Tranche B, Forewind introduced an additional risk category - low risk to achieving consent (1-25% risk) and to adjust the moderate risk category to 26-50% risk (see table below).

Heat	Risk (consent by 2014)	Descriptor
Black	100%	Hard constraint. Consent cannot be achieved.
Grey	100%	Time constraint. Consent cannot be achieved before 2014.
Red	51 – 99%	High risk. Highly sensitive area. Justified stakeholder objection requiring substantial negotiation, mitigation and management. Avoid or keep to a minimum.
Amber	26 – 50%	Moderate risk. Environmentally sensitive but stakeholder interests can be satisfied and consent can be achieved with mitigation and management agreements.
Yellow	1 – 25%	Low risk. Low sensitivity and some stakeholder interest, but consent can be achieved with mitigation and management.
Green	0%	Risk is insignificant. Non-specific issue covered in standard ES. No additional risk to consent exists. Confident of consenting by 2014.

- 2.7 The following receptor layers were updated in the Tranche B heat map:
- The Couillet *al.* (1998) spawning and nursery areas for some select species of fish (such as Sandeel, Sole, Plaice, Herring and Cod) with exchanged with more recent and accurate areas derived by Ellis *et al.* (2010) during a recent Cefas project;
 - Oil and gas licence and infrastructure changes which had taken place since the 26th Offshore Licensing Round; and
 - New wreck sites recently identified during Forewind’s geophysical surveys.

- 2.8 All constraint layers and their levels of risk were reviewed and updated. Two key changes included:
- The downgrading of military practice areas in the southwest corner of the Zone from moderate risk to insignificant risk, in light of communication with the Ministry of Defence confirming that there are no conflicts of interest between military exercises and potential wind farm development in that area; and
 - The reduction in perceived risk associated with habitats and biotopes along the northern margin of the Zone (which represented a potential area of the sensitive BAP habitat, 'Seapen and burrowing megafauna'). While the importance of this area is still recognised, it was decided that a high level of risk was not warranted.
- 2.9 The Updated Consents Heat Map is shown in Fig 2.1 below. The colour at each location on Fig.2.1 represents the combined levels of risk from all constraint layers at that location.

Engineering Workstream

- 2.10 The Engineering Workstream updated the cost of energy heat map that was produced for the Tranche A selection process with revised considerations of:
- Cost of capital;
 - Capital cost of construction (including the variation in foundation with water depth);
 - Variation in connection cost with distance to shore;
 - Cost of operations and maintenance (including consideration of metocean characteristics);
 - Gross energy production (using wind resource estimations); and
 - Availability and losses.
- 2.11 The updated cost of energy heat map describes the relative change in cost of energy across the zone. Some of the detail of this information is commercially sensitive and has been provided to Forewind by suppliers and/or development partners in confidence. However it is possible to define the factors which most significantly influenced the cost of energy as being:
- Variation in foundation cost with water depth;
 - Effect of distance from shore on connection costs; and
 - Changes in wind speed and hence energy capture across the zone.
- 2.12 The cost of energy is a significant consideration in the development of all projects but is considered to be even more so for the initial projects at Dogger Bank as the location and physical characteristics of Dogger Bank present new

challenges to the delivery and operation of projects. Ensuring that these are effectively managed is a key objective for Forewind's Engineering and Supply Chain team. Maintaining low costs of energy is essential in order to ensure continued expansion and development in the supply chain, to encourage on-going investment in the industry and to reduce costs to the consumer.

2.13 The Updated Cost of Energy Heat Map is shown in Figure 2 below.

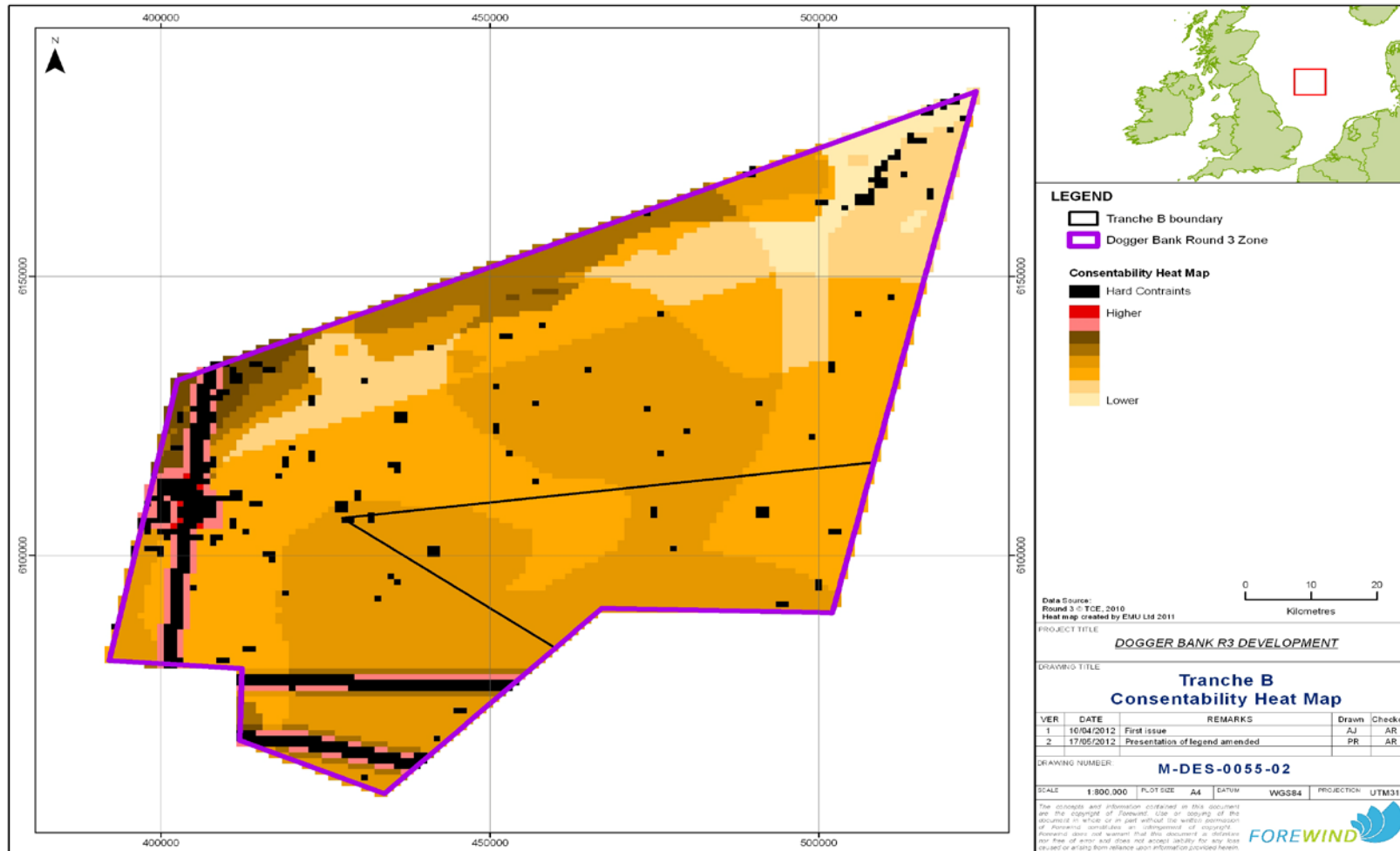


Figure 2 Updated Consents Heat Map

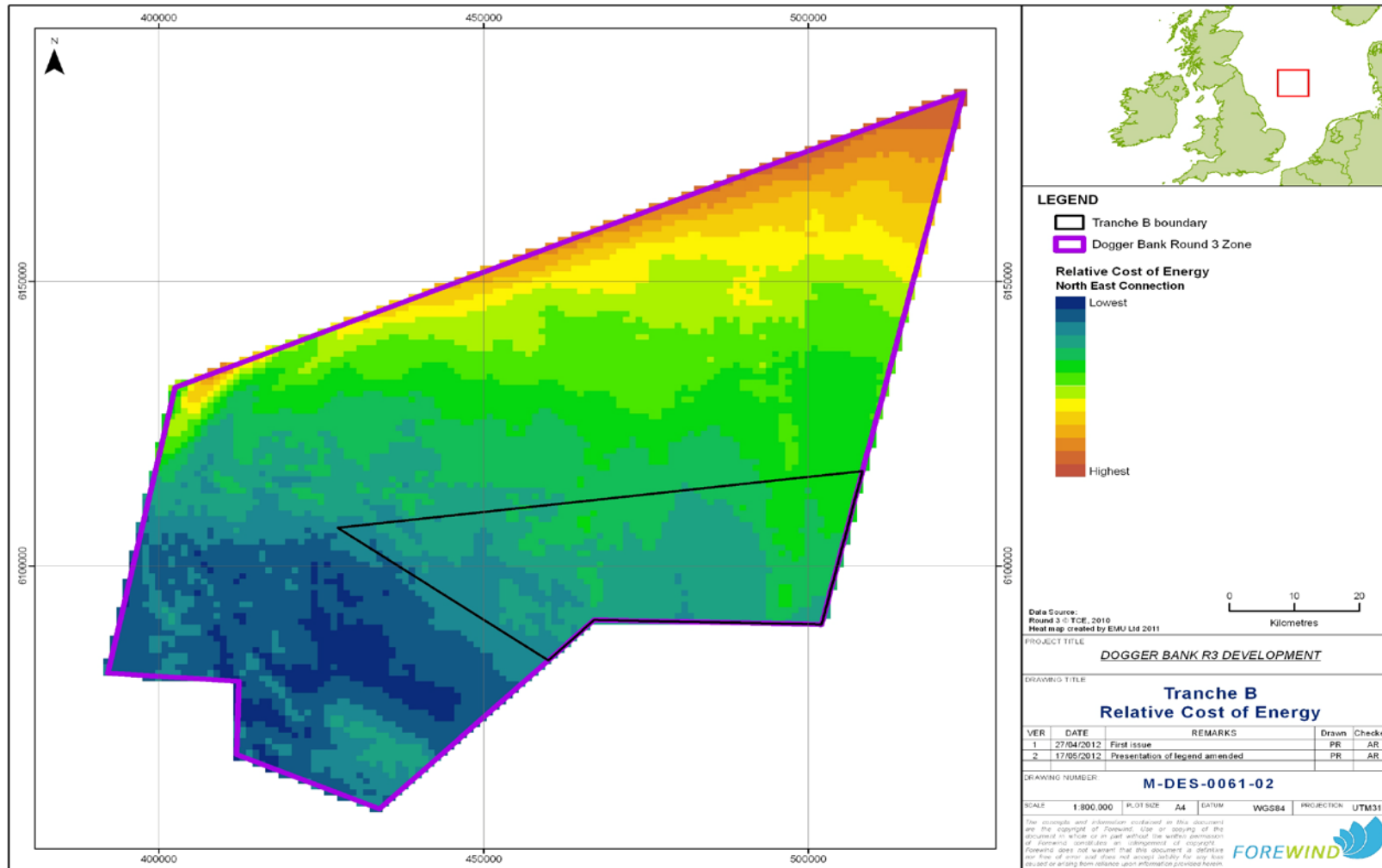


Figure 3 Updated Cost of Energy Heat Map

Strategic Design Considerations

2.14 The wider strategic considerations that were considered relevant for determination of Tranche B include:

Cumulative Effects

2.15 In addition to the heat map data collected by Forewind (and presented in the updated Zonal Characterisation Document, 2nd Edition), other factors were also considered:

- Main shipping main routes (identified by Anatec Ltd) for vessel traffic and the routine occurrence of specific vessels. An effort was made during the Tranche B selection workshop to ensure options remained for the safe navigation and passage of these vessels between Tranches and projects;
- Preliminary abundance and distribution plots produced from Forewind's survey data for key bird species and harbour porpoise; and
- The known distribution of fishing activity.

2.16 The data sets are not yet complete (as survey work is on-going) and therefore it is not possible to draw conclusions from the spatial distribution of the data. However, it was possible to identify whether the location of Tranche B in one particular area of the zone when combined with Tranche A had the potential to result in a greater cumulative effect on a particular receptor.

2.17 This comparison ensured that current data and further information on these receptors gathered through stakeholder consultation were incorporated into the Tranche B Selection Process.

Uncertainties around project boundaries and wind recovery areas

2.18 Project locations or boundaries have not yet been confirmed for Tranche A projects or projects in the wider offshore wind farm zone. This process is subject to further consideration of the survey data, stakeholder consultation and the output of the engineering design packages expected in Summer 2012.

2.19 The relative benefits of wind recovery areas versus wider turbine spread are also not yet understood and progress is not expected to be made on this until the engineering design work is completed in Summer 2012.

2.20 Hence it is not the role of the Tranche B selection process to determine the optimal designor location for projects.

Tranche boundary principles

- 2.21 Tranche boundaries are not intended to represent hard constraints to the location of projects. It is possible that a project may cross the boundary between tranches. Instead tranche boundaries should be thought of as “survey areas” within which Forewind proposes to concentrate its survey and stakeholder consultation efforts for the development of projects.
- 2.22 The ability to spread projects across tranche boundaries gives Forewind additional flexibility to maximise developable areas and avoid constraints that may be identified within tranches. Hence Forewind has determined to site Tranche A close to and bordering with Tranche B.

Approach to the safeguarding of shipping and navigation

- 2.23 Forewind consulted the shipping industry on the potential impact associated with the delivery of offshore wind farm projects in the Dogger Bank Zone both in isolation and when combined with the effects of the development of the HornseaZone and East Anglia Zone. Amongst other things, these consultations are aiming to identify the preferred way to safeguard shipping and navigation through the identification of shipping channels routed either through or around the offshore wind farm zones.
- 2.24 Whilst these consultations are on-going, maintaining the potential to establish a shipping channel in an appropriate location and orientation across the zone is a key consideration for the identification of Tranche B. Anatec undertook an analysis of shipping traffic data and identified a number of options for potential shipping channels which were considered as part of the process to identify Tranche B.

Tranche B

- 2.25 Using the consents and cost of energy heat maps and the strategic design considerations Forewind determined the area for Tranche B as shown in Figure 2.3.
- 2.26 Tranche B has a total area of 1,500 km².
- 2.27 The area was considered to be the best location for the next phase of projects at Dogger Bank because it:
- Is adjacent to Tranche A and therefore offers:
 - The potential to site projects across tranche boundaries or else introduce wind recovery areas as required;
 - The ability to avoid constraints whilst making best use of survey areas; and

- More flexibility for future tranche design.
- Offers greater flexibility for the siting of shipping routes by maintaining the busier area for shipping traffic to the north of Tranches A and B whilst consultations with the shipping industry are concluded;
- Uses the shallowest water and has the most consistent bathymetry making it attractive from a cost of energy perspective;
- Takes good advantage of the prevailing wind direction by making use of the relevant free edge of the zone;
- Utilises a good proportion of the lower cost of energy area; and
- Makes best use of low risk geology areas.

2.28 As with Tranche A, Tranche B will be the subject of further survey work and stakeholder consultation.

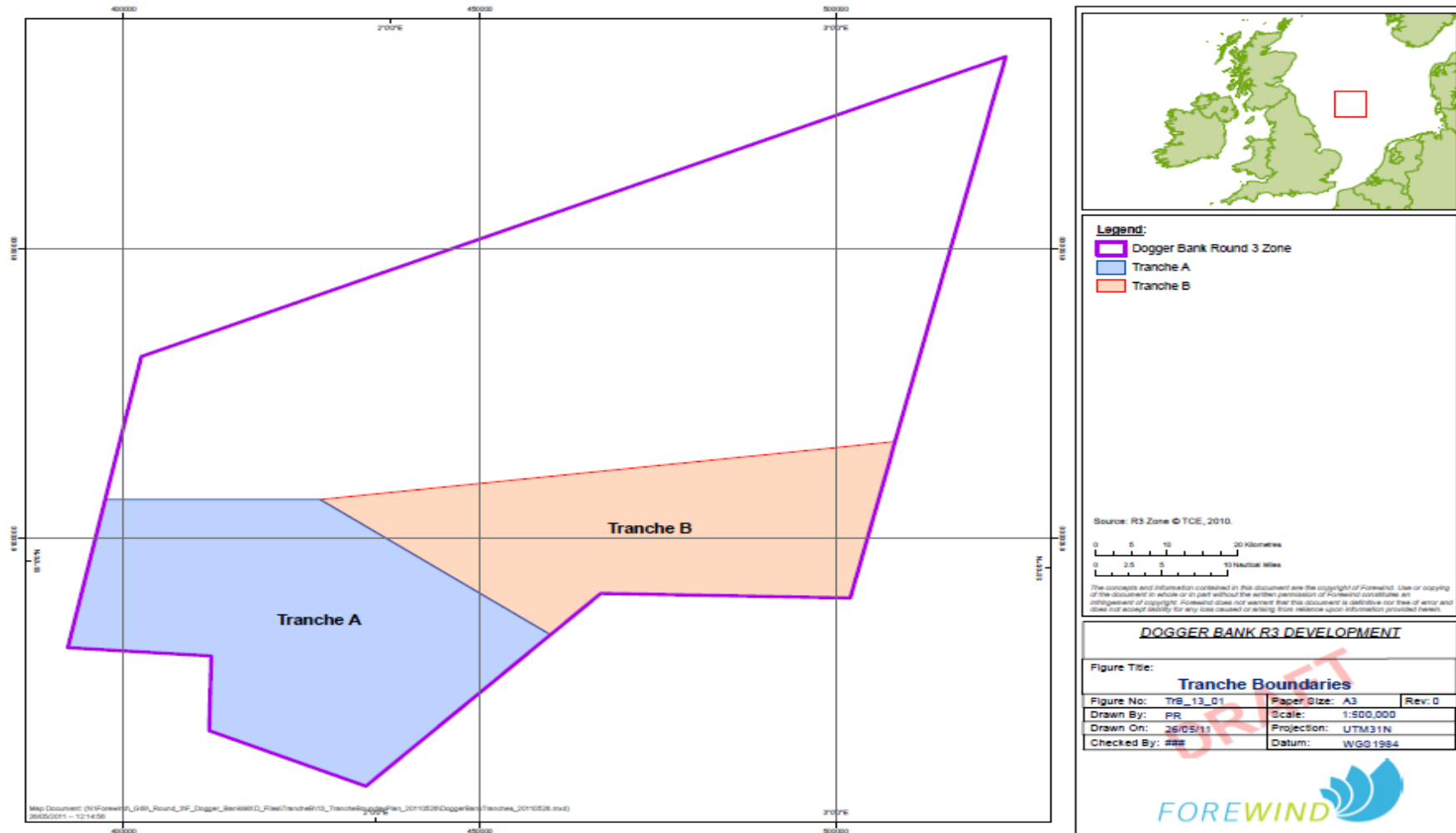


Figure 4 Locations of Tranches A & B

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