FOREWIND
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Dogger Bank Tranche A Selection Report

This report was prepared by Forewind

In 2010, the development company Forewind Limited (Forewind) was awarded the exclusive right to develop offshore wind farm projects at the Dogger Bank Zone through the third round of offshore wind farm leasing undertaken by The Crown Estate. The Dogger Bank Zone is located within the UK territorial waters, off the east coast of Yorkshire between 125 and 290 kilometres offshore.

Forewind Limited (Forewind) is a consortium comprising four leading international energy companies; Scottish and Southern Energy plc (SSE), RWE npower renewables (an RWE Innogy company), Statoil and Statkraft.

Together these companies combine extensive experience of international offshore project delivery and renewables development, construction, asset management and operations. Through the combined forces of its owner companies, Forewind has the 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.

A brief summary of each of the partner companies is provided below.

RWE npower renewables: RWE npower renewables is the UK subsidiary of RWE Innogy and is one of the UK's leading renewable energy developers and operators, committed to developing and operating wind farms and hydro plant to produce sustainable electricity. RWE Innogy is the renewable arm of European energy group RWE AG.

RWE Innogy plans, builds and operates renewable power generation facilities across Europe and is committed to investing €1.4 billion per year in renewables. The expansion of onshore and offshore wind power is a key driver behind RWE Innogy's goal to have 4,500MW in operation or construction by 2012.

SSE: 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. As well as being the second largest supplier of energy in the UK with 9 million customers, SSE is also the leading renewable energy company in the UK, with a total operating portfolio of renewable energy of 2,000MW. SSE's portfolio shows its commitment, past, present and future, to tackling climate change and delivering secure energy supplies.

Statoil: Statoil is an integrated technology-based international energy company primarily focused on upstream oil and gas operations. Headquartered in Norway, it has more than 30 years of experience from the Norwegian continental shelf, pioneering complex offshore projects under the toughest

conditions. Statoil aims to deliver long-term growth and continue to develop technologies and manage projects that will meet the world's energy and climate challenges in a sustainable way. Renewable energy is one of Statoil's major focus areas. The UK offshore wind market is key to the company's ambition to utilise its extensive experience from complex offshore oil and gas projects to generate value from offshore wind. Statoil are partners with Statkraft for the delivery of the Sheringham Shoal Round 2 offshore wind farm project.

Statkraft: Statkraft is Europe's largest generator of renewable energy, with a total installed capacity of more than 14,800MW. The Norwegian company develops and generates hydropower, wind power, gas power and district heating, and is a major player on the European energy exchanges. Statkraft opened its first wind farm in 2002 and now owns and operates three onshore wind farms in Norway with a total installed capacity of 244MW. In the UK, Statkraft has one hydropower plant and one wind farm in operation in Wales and planning consent for another four in Scotland with a combined capacity of around 200MW. Statkraft are partners with Statoil for the delivery of the Sheringham Shoal Round 2 offshore wind farm project.

Executive Summary

Forewind's delivery strategy has been structured around the objective of delivering 13GW of offshore wind farm projects at the Dogger Bank Zone by 2023.

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 first tranche, Tranche A, has been selected and identifies the area which will now go forward for geophysical survey and Environmental Impact Assessment (EIA).

The process to identify the footprint involved an examination of the relevant environmental and consenting issues associated with the zone, including input from various stakeholder meetings and the Stakeholder Workshops in April 2010. 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 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 together 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 first 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 factor has helped to identify the optimum location for Tranche A.

The Tranche A area which has been selected for development of the first projects at Dogger Bank is shown in the Figure A over the page. It is an area of approximately 2000km^2 in the south-west of the zone, the majority of which is in water depths of less than 30m LAT (Lowest Astronomical Tide). It represents an area with an equivalent probability of consenting to the rest of the zone, is capable of delivering the lowest cost of energy, and due to its large size offers significant flexibility in project design. The design and location of projects to be located in the tranche will be determined through interpretation of the Environmental Impact Assessment, further stakeholder dialogue and more detailed engineering considerations.

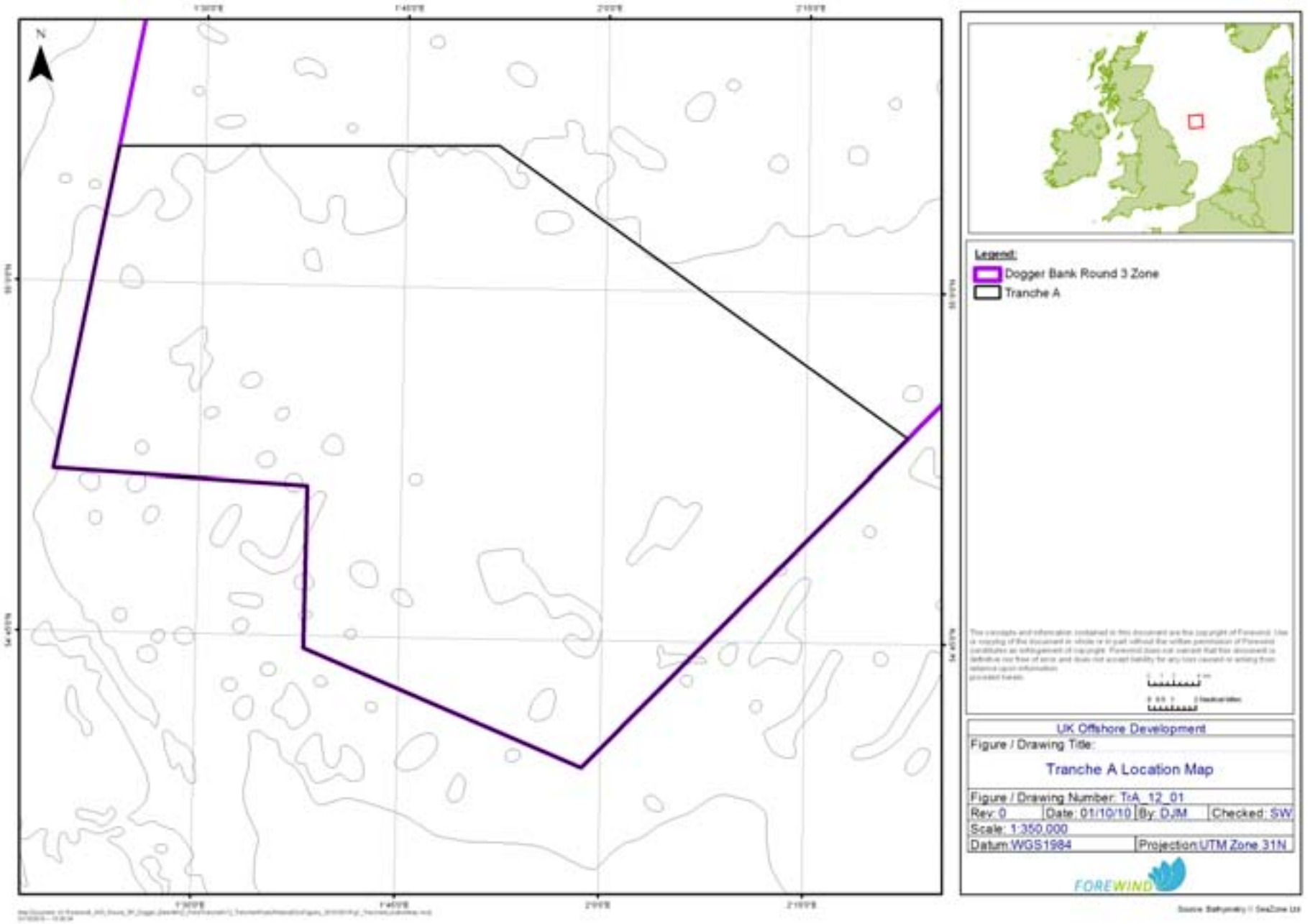

Figure A - Location of Tranche A

Contents

1. Introduction

1.1 About this document

This document has been developed to present “Tranche A”; the first area for offshore wind farm project development within the Round 3 Dogger Bank Offshore Wind Farm Zone.

It describes the approach taken by Forewind to identify Tranche A and refers to the Zonal Characterisation Document (ZoC) (www.forewind.co.uk) which presents information on the relevant planning considerations compiled to date as part of the Zone Appraisal and Planning (ZAP) phase of development. It also describes the relevant engineering and commercial challenges associated with the delivery of offshore wind farm projects in the Dogger Bank Zone.

This report does not directly include consideration of the onshore points of connection or associated export cable routes associated with projects in Tranche A. Grid connection points will be determined by National Grid through the formal grid connection application process and once established a detailed substation siting and cable routing assessment will be undertaken to determine the location of the infrastructure associated with those projects as described in the Dogger Bank Project One Scoping Report (www.forewind.co.uk).

1.2 Background

Forewind’s delivery strategy has been structured around the objective of delivering up to 13GW of offshore wind farm projects at the Dogger Bank Zone by 2023. 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.

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.

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 – Area to be defined in 2011;
- Tranche C – Area to be defined in 2012; and
- Tranche D – Area also to be defined in 2012.

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.

In this way Forewind are 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 impact for the environment or stakeholders.

The work undertaken to identify Tranche A 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 at Dogger Bank
- Engineering Workstream – focussing on the relevant technical and commercial considerations of delivering offshore wind farm projects at Dogger Bank

Forewind were 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.

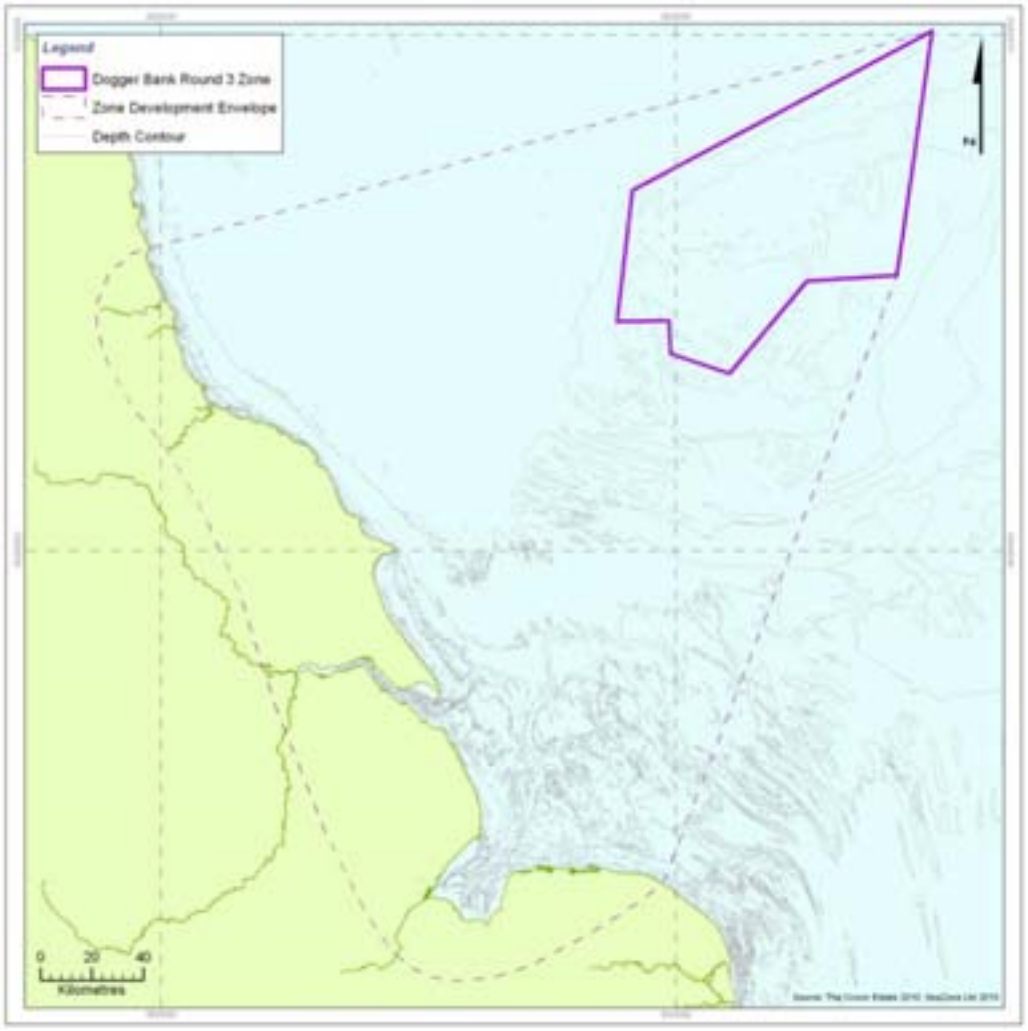

Figure 1-1: Dogger Bank Zone Development Envelope.

The approach adopted for defining Tranche A 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 engagement meeting and workshops)
- Undertake workstream-specific heat mapping
- Combine workstreams in order to identify preferred area for development

2. Methodology

In order to establish the factors that might influence the location of tranches for development Forewind initially set out to define the characteristics of a successful project. These characteristics were deemed to include – technical and commercial viability, safety, minimum disruption to the environment and to stakeholders and delivery in accordance with programme.

Each workstream was then asked to consider the factors which might influence these characteristics and whether these might be represented spatially to allow identification of an optimal area for the development of the first projects

The approach taken by each of the workstreams and the corresponding heat maps are described in the sections below.

2.1 Consent Workstream

The Consents Workstream sought to determine the relative "consentability" of areas within the Dogger Bank Zone.

The relative "consentability" is considered as the ability to achieve a formal development consent order (DCO) for any specific area of the zone, considering environmental constraints and stakeholder concerns identified through the ZAP process to date. The term 'environmental' is used to cover all aspects that would be considered within an EIA, and therefore includes physical attributes such as sediment transport, biological attributes such as benthic ecology, and human attributes such as shipping or commercial fisheries.

2.1.1 Data collection

From a consenting perspective, the first major component part of ZAP is to ensure that sufficient information, at a suitable scale, across any relevant environmental topic is available to be used to support the delineation of Tranches (at ZAP level) and subsequently support definition of projects (at EIA level). The broad topics considered relevant at ZAP level are presented below and described in further detail in the ZoC Document.

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

This information was gathered from many different sources including through consultation in stakeholder meetings and at the three stakeholder workshops held in Hull, Newcastle and London in April 2010. For some of these topics sufficient information exists to present the information spatially as shown in the figures included on the following pages. The data sources and information used to produce these figures are described in detail in the ZoC which is available on the Forewind website (www.forewind.co.uk).

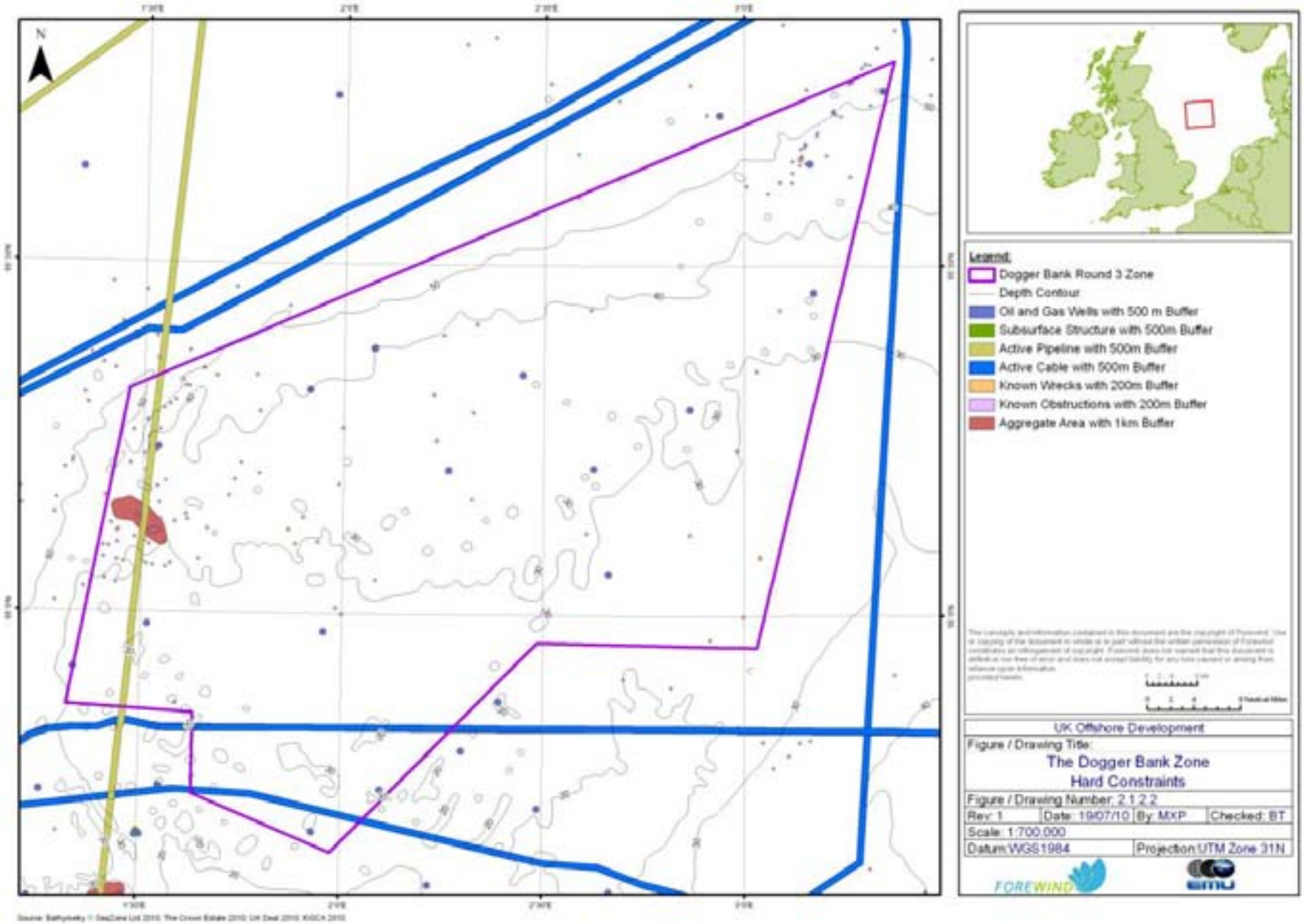

Figure 2.1 - Hard Constraints

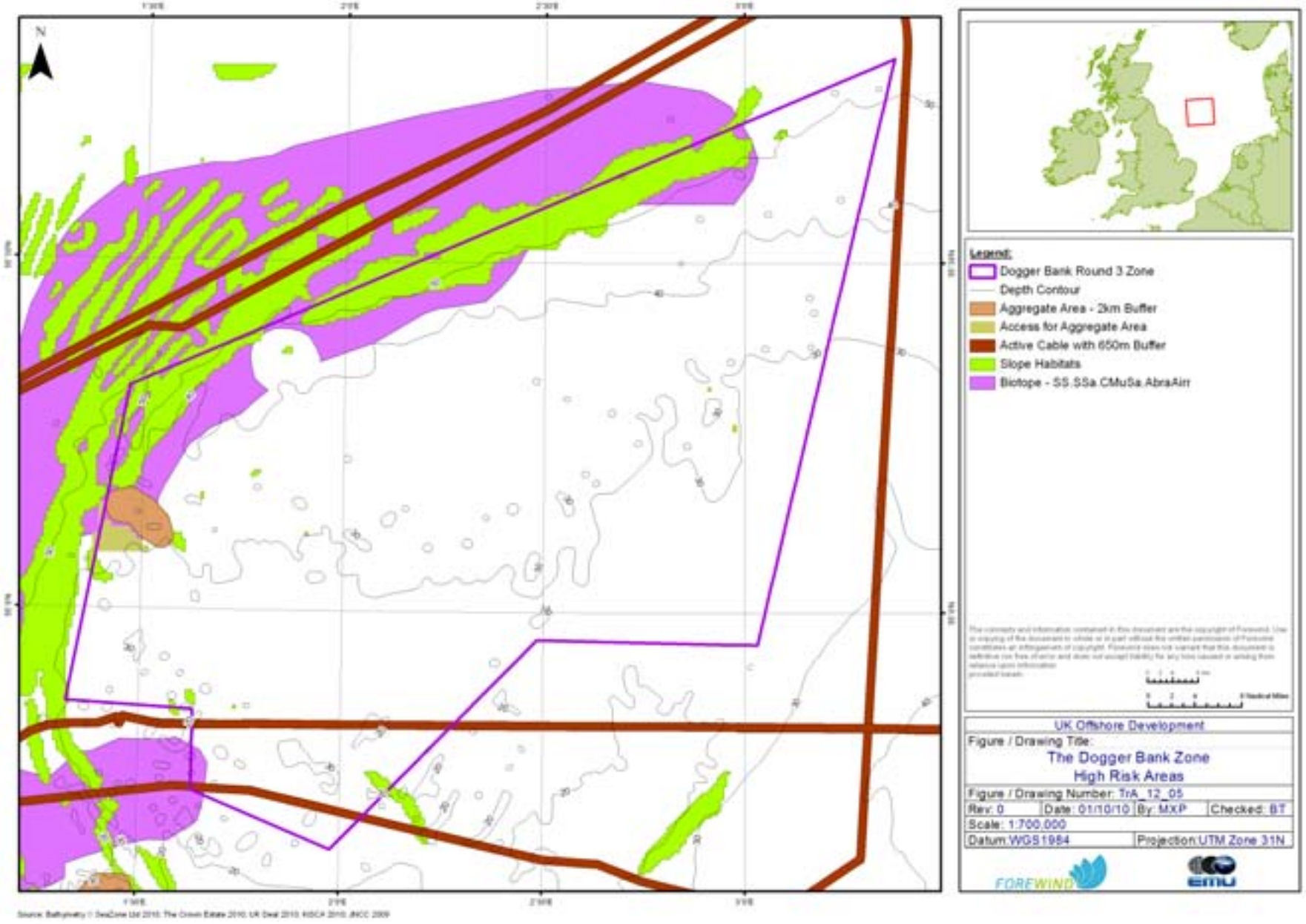

Figure 2-2: High Risk Areas

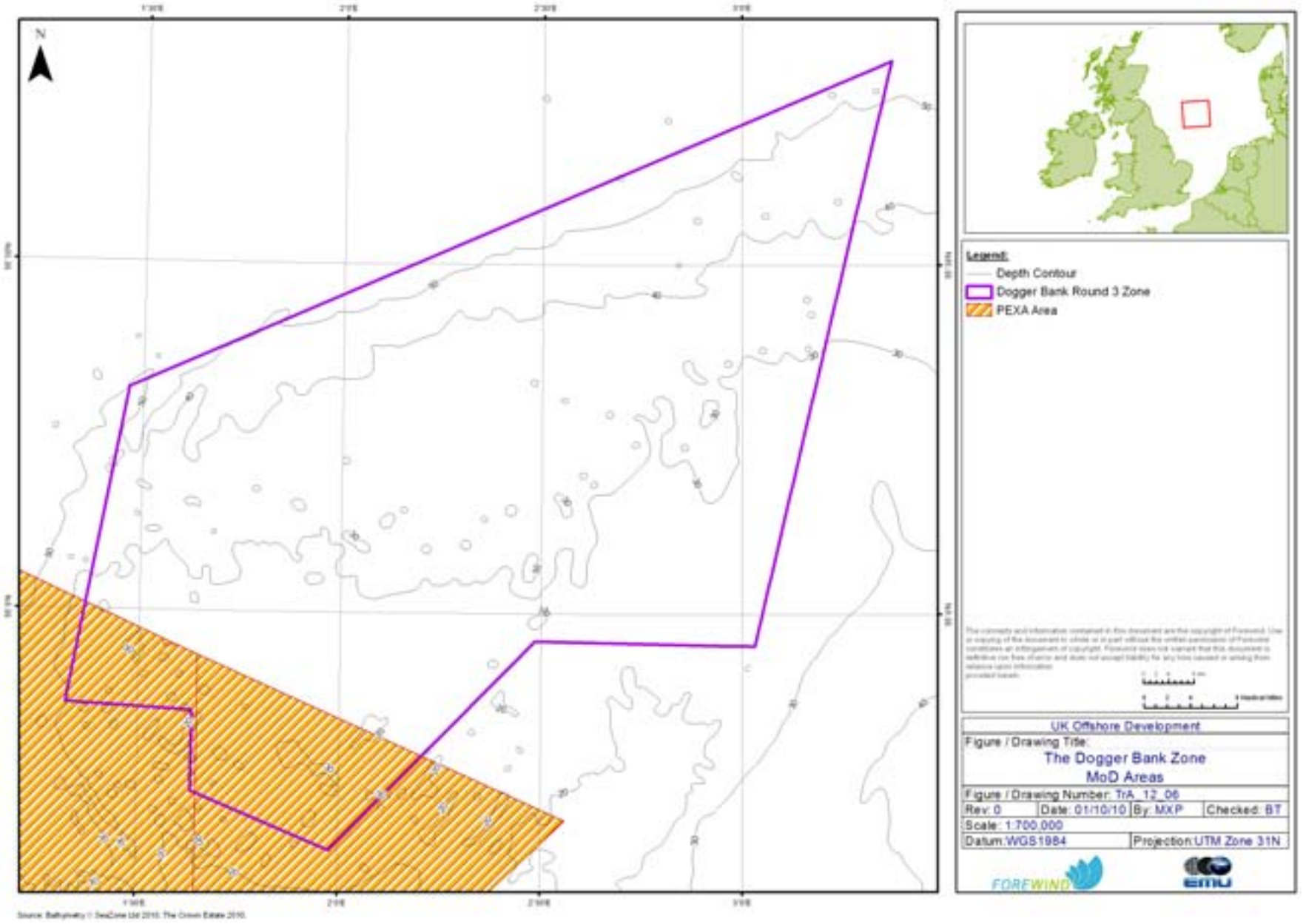

Figure 2-3: MoD Practise and Exercise Areas (PEXA)

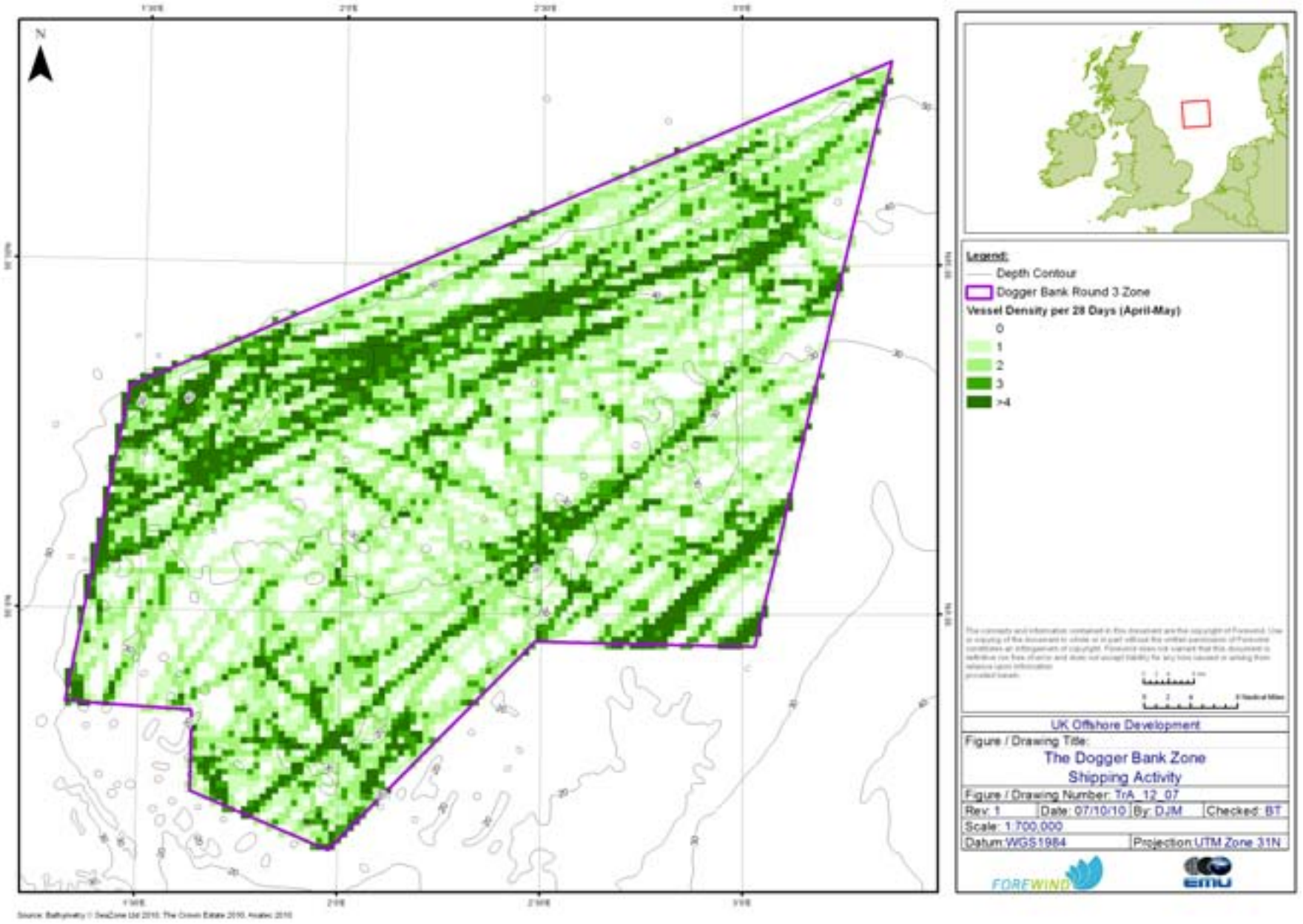

Figure 2-4: All Vessel Activity

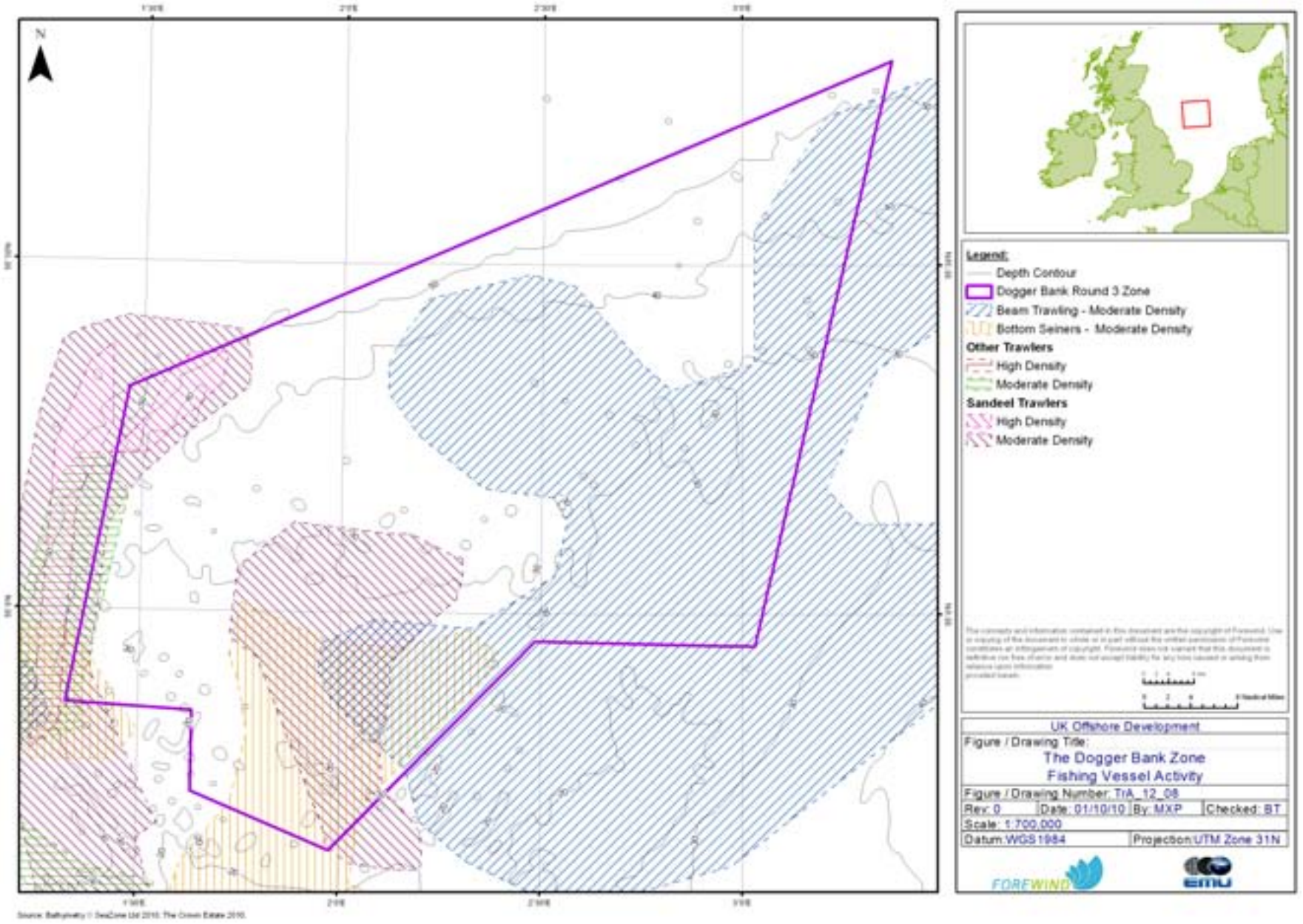

Figure 2-5: Fishing Vessel Activity

Figure 2-6: Fish Spawning Activity

2.1.2 Heat mapping

Using this information a consentability heat map, identifying areas with the greatest concentrations of constraints, was produced in order to present a comprehensive view of the spatial constraints across the zone.

To convert the individual topic constraints into the heat map model, the zone was divided into 1 km^2 grid cells. Each cell was then given an attribute or a rank in accordance with the data that occurred within it.

The heat map itself was based on an outranking method. This means that if an issue in a particular cell did not meet the necessary requirements it was removed from further consideration.

The preliminary requirements before ranking were:

- Is it a hard constraint?
- Is it consentable by the end of 2013?

Hard constraints

A hard constraint was defined as any issue which definitely prevents development within that space. This included:

- Infrastructure, including live cables and pipelines (with suitable buffers);
- Aggregate licence areas (with 500 m buffer);
- Wrecks (with 200 m buffer);
- Oil and gas subsea wells and surface structures;
- International Maritime Organisation routes.

Not all these were present within the zone, but, where appropriate, were considered hard constraints within the wider ZDE if applicable for the cable route options.

Consentability

Forewind is aiming to achieve its first consent by the end of 2013. Further consideration was then given to whether these constraints would prevent the gaining of consent within this timeframe.

The constraints were then ranked according to the risk of not gaining consent. As studies are at an early stage, broad categories of risk were used:

- Over 50% - although possible, it is more likely that consent will be refused due to this issue;
- 1-50% - it is likely consent will be given, but additional work will be required to gain consent;
- 0% - not likely to become an obstacle to consent.

Once each issue was ranked according to risk, the rankings were combined to determine the final consentability heat map. This process incorporated the worst rank of issue, as well as the number of issues of a particular rank within that cell.

This was achieved by using three numbers to represent the issues in each cell: number of high risk, number of moderate/low risk, and number of negligible risk. Each number had two digits, and when

put together formed a six digit number. For instance, if there were 2 high risk factors, 13 moderate/low risk factors, and 6 negligible risk factors within a cell, the resultant number was 021306. The heat map was then based on this six digit number. Any value above 010000 was shaded red, between 000100 and 009999 shaded amber, and below 000099 shaded green. Within these colours, there were shades to indicate how high a number, and therefore how many risk factors, were present. The overall process in shown in Figure 2-7:

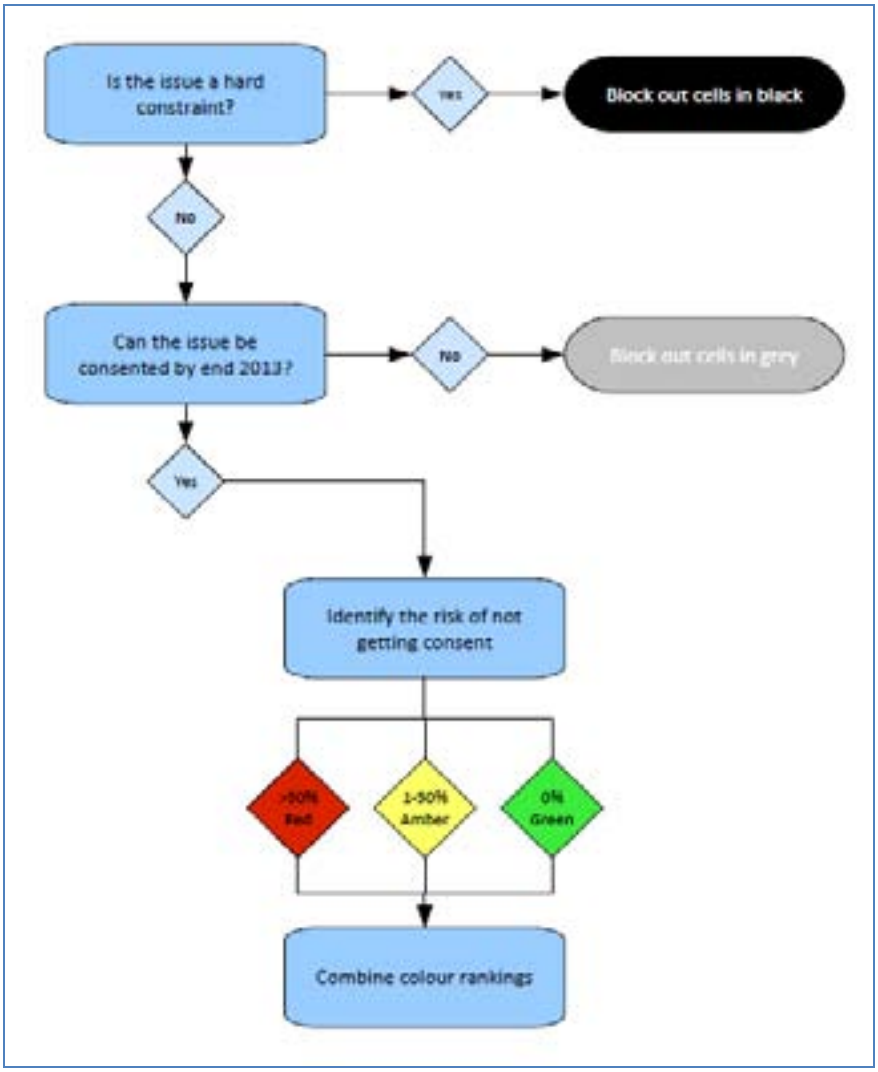

Figure 2-7 – Model to produce heat maps

The final consentability heat map is presented in Figure 2-8 overleaf.

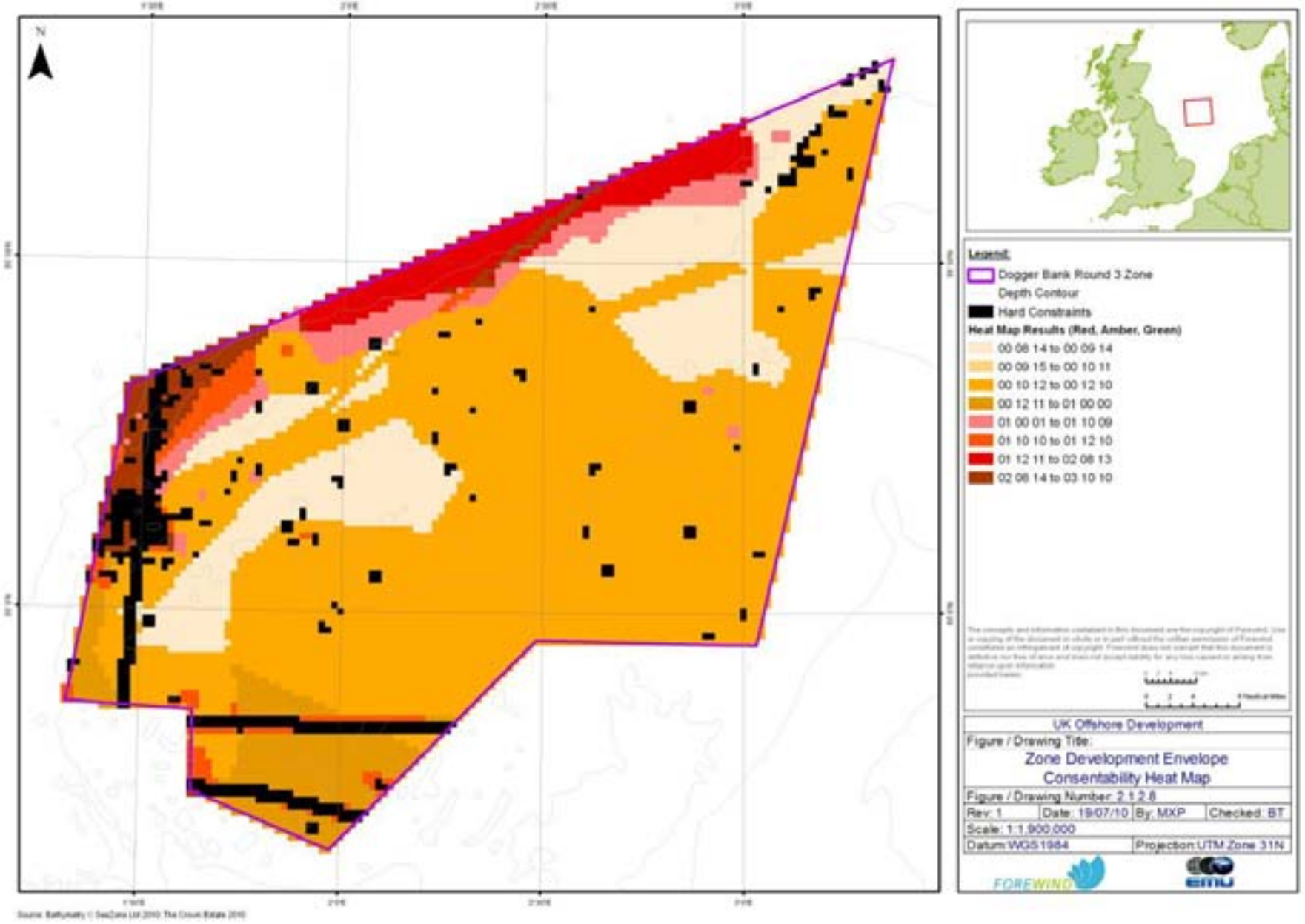

Figure 2-8 – Consentability Heat Map

2.1.3 Strategic Consenting Considerations

Cumulative Impacts

The phased approach to development of the Dogger Bank Zone means that cumulative impacts must be assessed on the basis of the 'Building Block' approach. Under this approach, tranches or projects which are identified at a similar time, or which are at more advanced stages of development, will be considered in terms of cumulative impact. This means that cumulative impacts will be a consideration for the identification of Tranche B, C and D but have not been a determining consideration for the location of Tranche A.

Dogger Bank possible Special Area of Conservation (pSAC)

The Dogger Bank pSAC covers a significant proportion of the offshore wind farm zone, extending northwards to the start of the slope habitat and the deeper water area which the consentability heat map identifies as having the highest concentration of constraints and which is therefore not considered an appropriate location for the first projects at Dogger Bank.

Given that the pSAC itself should not preclude development, it was determined that its location would not be a determining factor in the selection of the area for Tranche A.

International Sites of Community Importance (SCIs)

The Dogger Bank Offshore Wind Farm Zone is adjacent to Dutch and German SCIs which have been designated as important areas for sandbank habitat and the harbour porpoise. Forewind will liaise with stakeholders to ascertain what consideration these areas should be given in their project development phase.

2.2 Engineering Workstream

The Engineering Workstream included consideration of safety concerns, costs (including the influence of water depth, distance from shore, wind resource, operational and maintenance costs, grid connection and foundation costs) and strategic considerations with regards to future tranche requirements in order to establish a relative cost of energy across the Zone.

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. The location and physical characteristics of Dogger Bank present new challenges to the delivery and operation of projects there. 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 ongoing investment in the industry and to reduce costs to the consumer.

Note that it is not possible to provide full details of the information considered during this process as it is commercially sensitive and has been provided by suppliers and/or development partners in confidence. The relevant considerations have been outlined below in order to provide information on

the range of factors that it has been necessary to assess in order to establish the optimum area for development from an engineering perspective.

2.2.1 Cost of Energy Mapping

A number of factors were incorporated into a relative cost of energy map which is presented in Figure 2-9, These include –

Cost of capital, capital cost of construction including the variation in foundation with water depth, the variation in connection cost with distance to shore, the cost of operations and maintenance (including consideration of metocean characteristics), gross energy production (using wind resource estimations), availability and losses.

The factors which most significantly influenced the cost of energy were the variation in foundation cost with water depth, the effect of distance from shore on connection costs and the changes in wind speed and hence energy capture across the zone..

2.2.2 Health & Safety

Relevant HSE considerations were identified as -

- Water Depth and Diving Activity Associated with Foundation Options and Cable Crossings
- Distance to Shore
- Array Layout – Shipping/Navigation/Fishing/Recreational Sea Users
- Helicopter Access
- Inclement Wave Climate
- O&G Surveys – Manoeuvrability of Vessels outside Forewind's Control
- Unfavourable Seabed Conditions – High Stress on Jack-Up Barges
- Live Exposed Cables
- Satellite Black Spots
- Fishing and Trawling Activities
- Carbon Capture and Storage/Natural Gas
- Submarine Activity
- PEXA Activity

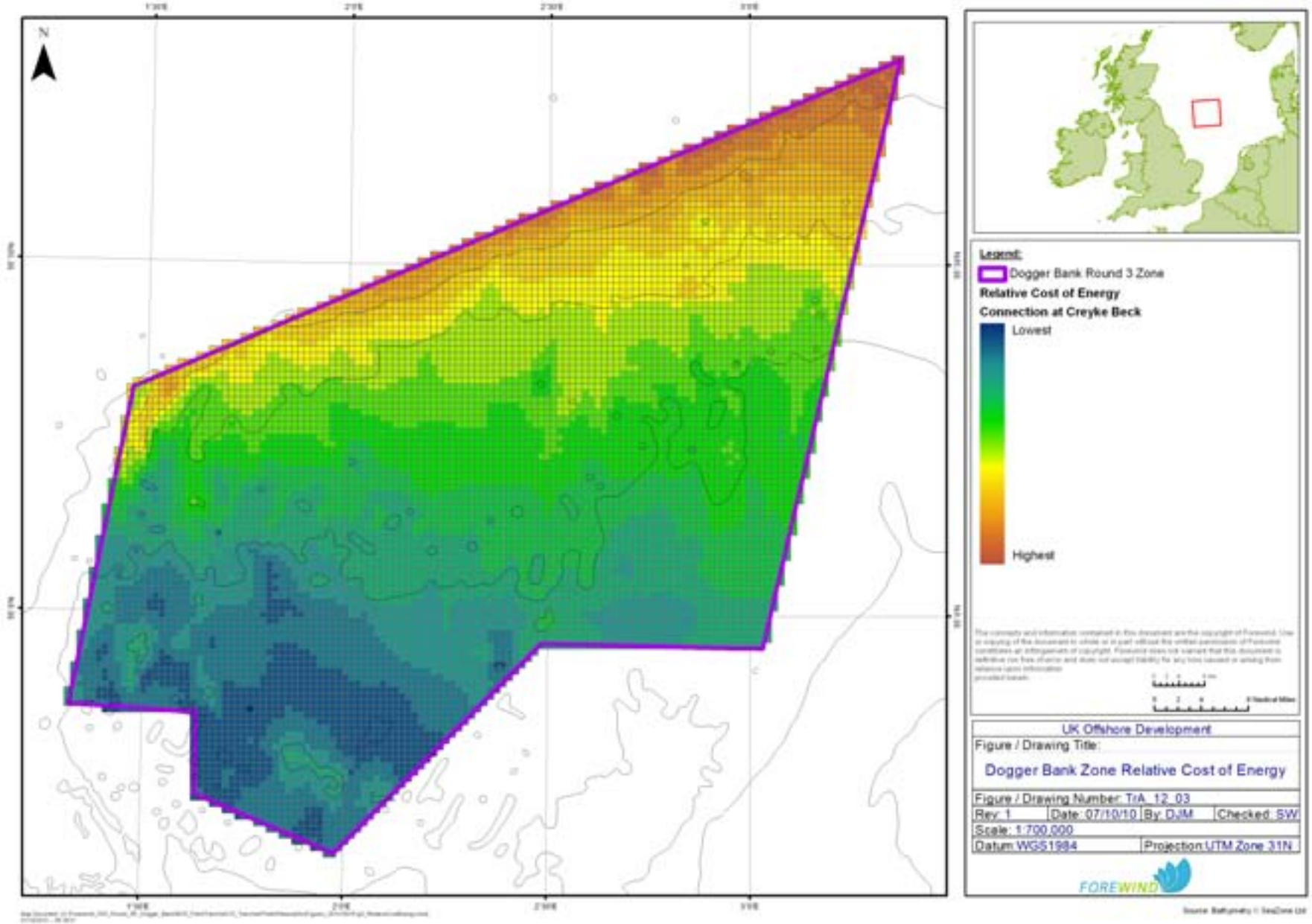

Figure 2-9 – Relative Cost of Energy

2.2.3 Strategic Design Considerations

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

Compatibility with Subsequent Tranches

Tranche A should ideally allow maximum flexibility in the design of subsequent Tranches B, C and D. The current proposal fulfils this by offering a logical and simple progression for subsequent development of the zone; with minimal restrictions on future options and no stranded areas.

Forewind should also consider export cable access to subsequent tranche areas within its ongoing design of Tranche A. The predicted routes for export cables from subsequent tranches to likely onshore connection points do pass through the Tranche A area. Forewind therefore plans to design in flexible cable access routes to address this issue during the design of Tranche A.

Sterilisation of Areas

Forewind should avoid sterilising areas for further development when siting Tranche A and should be aware of this when defining the Tranche boundary. The sterilisation of area can be difficult in terms of stakeholder management, leaving areas which are too small for further development and which pose difficulties in cable management for inter array and export cables.

Operational Cost Benefit of Clustering

Projects in close proximity to one another are likely to have lower operational costs through a greater potential for synergies, cost savings and economies of scale. Projects developed in isolated locations will reduce these opportunities, and may disrupt the efficient development of later projects.

More than one Discrete Area per Tranche

Forewind should not assume that having one discrete area for the location of each Tranche will be optimal. It may be that a Tranche comprised of more than one area (i.e. a number of smaller parts in different areas of the zone) provides the best opportunities for development in consenting, engineering and grid terms.

Export Cable Exit Point

Given the uncertainties surrounding the potential grid connection points Forewind should give due regard to all locations when defining the Tranche A boundary.

3. Tranche A Selection

For the Consents Workstream, the information collated for the Zone Characterisation Document 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 together 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 first 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 factor has helped to identify the optimum location for Tranche A.

In line with these considerations the area presented in Figure 3-1 was determined to be the optimum location for Tranche A and the development of the first Dogger Bank Offshore Wind farm Projects. The area has been overlaid onto the cost of energy map and the areas of hard constraints.

Tranche A is 2000 km2 and lies in the south west corner of the Dogger Bank zone. Forewind will seek to develop approximately three similar sized offshore wind farm projects up to 1.4GW each within this area. It was chosen after stakeholder consultations, consideration of safety and examinations of environmental and consenting issues related to the zone.

Key features are that it:

- is reasonably free of geographically specific consenting issues
- will produce the lowest cost of energy
- has water depths generally less than 30m LAT
- offers maximum design flexibility

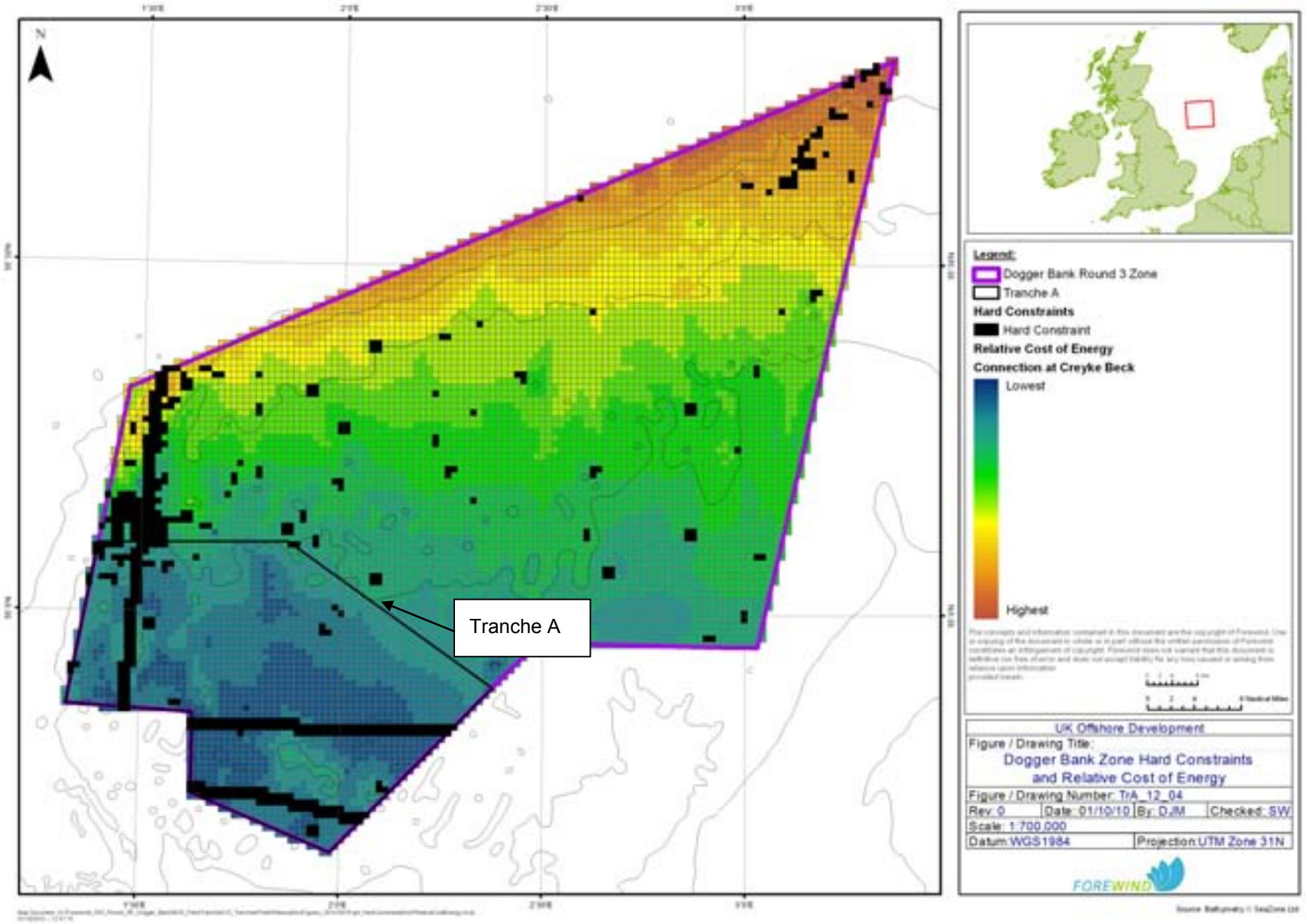

Figure 3-1 – Tranche A with Constraints and Cost of Energy

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