
Aberdeen Offshore Wind Farm (European Offshore Wind Deployment Centre)

Introduction to Environmental Statement Addendum and Rochdale Adjustments



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1 INTRODUCTION

1 This document forms an addendum to the *European Offshore Wind Deployment Centre (EOWDC) Environmental Statement (ES) August 2011*. EOWDC is also referred to as Aberdeen Offshore Wind Farm.

2 Contained within this addendum are new ornithological and marine mammal data, revised impact assessments taking account of new data, as well as a review of existing offshore wind farms in close proximity to golf courses, golf course visualisations from Menie Estate, Royal Aberdeen and Murcar Golf courses, and preliminary environmental R&D proposals.

1.1 The European Offshore Wind Deployment Centre Application

3 On 1st August 2011 Aberdeen Offshore Wind Farm Limited (AOWFL) applied to the Scottish Ministers under Section 36 of the Electricity Act 1989 (as amended) and a Marine Licence in terms of the Marine (Scotland) Act 2010 to construct, and operate an offshore wind farm and deployment centre off the coast of Aberdeen, known as the European Offshore Wind Deployment Centre.

4 The submission to ministers noted that further bird and marine mammal data would be submitted in the form of an addendum.

1.2 The European Offshore Wind Deployment Centre (EOWDC)

5 Aberdeen Offshore Wind Farm Limited (AOWFL) is proposing to develop an offshore wind farm and deployment centre off the coast of Aberdeen, known as the European Offshore Wind Deployment Centre (EOWDC) or Aberdeen Offshore Wind Farm.

6 The proposed project would combine a small commercially operated wind farm with a test and research centre, allowing manufacturers to test “first of run” wind turbines and innovative foundation solutions along with related operation and maintenance access logistics.

1.3 The Applicant

7 This application is being made by Aberdeen Offshore Wind Farm Limited (AOWFL). AOWFL is an established legal entity owned by Vattenfall Wind Power Ltd (VWPL) (75 %) and Aberdeen Renewable Energy Group (AREG) (25 %).

8 The project is being part-funded by a grant under the European Union [Economic Recovery Programme in the field of Energy]. Consortium members in this grant action are AOWFL, VWPL, AREG and Technip UK Ltd.

1.3.1 Vattenfall

9 VWPL’s ultimate holding company is Vattenfall AB (Vattenfall). Vattenfall is owned by the Swedish state. Vattenfall is Europe’s fifth largest generator of electricity and the continent’s largest producer of heat.

- 10 Vattenfall currently operates over 500 mega watts (MW) of onshore wind and almost 700 MW of offshore wind across northern Europe. This portfolio includes Kentish Flats Offshore Wind Farm and Thanet Offshore Wind Farm, both located off the UK's Kent coast.
- 11 Vattenfall constructed Ormonde Offshore Wind Farm off Barrow-in-Furness which in 2011. An application to build Kentish Flats Offshore Wind Farm Extension has been submitted and Vattenfall is also in partnership with ScottishPower Renewables to develop the Round 3 East Anglia Offshore Wind Farm. This project is expected to deliver around 7,200 MW of wind capacity which would provide clean electricity for the equivalent annual demand of around 4 million UK homes.
- 12 The north-east of Scotland is an important region for VWPL with the planned AOWF, the Clashindarroch onshore scheme approved for consent in December 2010, and the proposed Aultmore onshore scheme.

1.3.2 Aberdeen Renewable Energy Group (AREG)

- 13 AREG is an incorporated company representing the interests of over 170 member organisations. Established in 2001, AREG aims to ensure that Aberdeen City and Shire and its businesses play a major role in the energy revolution. AREG has been supported by the Energising Aberdeen Fund of Aberdeen City Council. The Fund represents a £22.25 million investment in the future of Aberdeen over five years by the Scottish Government.

1.3.3 Technip

- 14 Technip is a world leader in the fields of project management, engineering and construction offering innovative solutions to the global oil and gas industry.
- 15 With 23,000 employees, integrated capabilities and proven expertise in underwater infrastructure, offshore facilities and large processing units and plants on land, Technip is a key contributor to the development of sustainable solutions for the energy challenges of the 21st century.
- 16 Through its Aberdeen based operating centre, Technip provides best-in-class subsea products and services to oil and gas companies operating offshore UK, Denmark, the Netherlands and West Coast of Ireland. Further to its established subsea business, Technip is rapidly developing capability to support the growing offshore wind sector.

2 THE PROPOSED DEVELOPMENT UNDER THE APPLICATION SUBMITTED AUGUST 2011

- 17 This document introduces an adjustment to the Rochdale envelope as used for the ES submission in August 2011.
- 18 The adjustment is only relevant to wind turbine specifications. For clarity outlined below is a description of the proposed development as submitted (August 2011) A description of the adjusted Rochdale envelope is given in Section 3.
- 19 For a comprehensive project description including key Rochdale envelope parameters as used in the application as submitted in August 2011 please refer to Chapter 3 Description of the Proposed Project within the ES as submitted in August 2011.
- 20 The original application proposed to construct 11 wind turbines off Aberdeen Bay each with a maximum output of up to 10 MW per turbine and a maximum output for the wind farm of up to 100 MW. A summary of the key wind turbine specifications as submitted in August 2011 is provided in Table 1.1.

Parameter	4 MW	10 MW
Maximum Height of Nacelle (above LAT)	100 m	120 m
Maximum Rotor Diameter	120 m	150 m
Maximum Tip Height (above LAT)	160 m	195 m

- 21 Since the submission of the ES in August 2011 a number of wind turbine manufacturers have proposed to manufacture new wind turbines that fall marginally outside of the Rochdale envelope as submitted.
- 22 In order to maintain the project vision to: *Deploy new equipment...to improve the competitiveness of offshore wind energy production...and to increase the supply chain capabilities in Scotland, the wider UK and Europe*, AOWFL has made a strategic decision to modify the Rochdale envelope to enable the very latest wind turbines to be considered for the AOWF/EOWDC.
- 23 The Applicant still proposes to construct 11 wind turbines off Aberdeen Bay each with a nominal output of up to 7 MW and a maximum output for the wind farm of up to 77 MW. A summary of the new key wind turbine specifications is provided in Table 1.2.

3 ROCHDALE ENVELOPE ADJUSTMENT

3.1 Rationale for the Rochdale adjustment

- 24 In keeping with the concept of a demonstrator site, over recent months, AOWFL has engaged with global turbine suppliers who wish to demonstrate their next generation turbine technology at the EOWDC site. The project team have been in consultation with foundation manufacturers in order to further refine the options for the site.
- 25 Whilst the project team will not be able to finalise the foundation options until offshore geotechnical works take place and we have more detail on ground conditions, **we do not believe that monopile foundations will be used at the site**, however for flexibility purposes we have decided to retain the potential for up to (ie a maximum) of 4 monopiles at the site. This represents an improvement on the likely duration and scale of underwater and airborne noise emissions, however for precautionary assessment purposes we wish to retain the worse case airborne and underwater noise assessment (modelled on 11 monopiles) as outlined in the ES submission of August 2011.
- 26 With respect to turbine suppliers, AOWFL has commenced a formal commercial process to identify and refine the turbine supply options for the site. This process is at an early and confidential stage, whereby the manufacturers have provided turbine specifications but have not supplied commercial terms.
- 27 At the time of defining the Rochdale envelope (as submitted August 2011) the project engineers undertook consultation with the supply chain to understand their ambitions and likely details of their future wind turbines which were at an early stage of development. The results of this initial consultation were inevitably a reflection of the supply chain at the time and the stated ambitions of manufacturers at the time. Consequently a Rochdale envelope allowing for turbine tip heights of up to 195m, rotor radius of up to 75m and hub heights of up to 120m informed the project description (as submitted).
- 28 The overarching objective of the EU grant associated with the EOWDC, is to deploy new equipment, systems, processes and initiate R&D to improve the competitiveness of offshore wind energy production, whilst generating environmentally sound marketable electricity and to increase the supply chain capabilities in Scotland, the wider UK and Europe. The commercial evaluation of prospective turbine suppliers who can meet the EU requirements has revealed that a number of manufacturer's turbines marginally exceed the Rochdale envelope parameters (as submitted).

3.2 Details of the Rochdale adjustment

- 29 Following the commercial evaluation of turbine suppliers, the project team require an adjustment to the tip height of up to 198.5m, and rotor radius of up to 86m as summarised in the Table 1.2 below.
- 30 Please note that these dimensions would only be applicable to specific wind turbine locations and do not represent wholesale adjustments to all 11 turbine

locations. Please also note that a minimum clearance of 22m aMHWS will be maintained for marine navigation.

Parameter	Rochdale Envelope as submitted	Rochdale envelope (as requested)	Differential
Tip Ht (aLAT)	Up to 195m	Up to 198.5m	3.5m
Hub Ht (aLAT)	Up to 120m	Up to 120m	Nil (likely reduction)
Rotor radius (diameter)	Up to 75m (150m)	Up to 86m (172m)	11m (22m)

- 31 At this stage it is not possible to anticipate the likely final outcome of commercial negotiations, however, given the strategic importance of the project with respect to future Round 3 and Scottish Territorial Waters projects it is crucial that the project maximises the demonstration opportunities both in terms of technologies and regulatory and consultee learning.
- 32 As would be the case with commercial offshore wind farm schemes, we are unable to finalise the exact scheme details during the pre-consent stage. In addition, the innovative and demonstrator nature of this scheme requires flexibility of approach compared to the more typical 'off the shelf' supply of foundations and turbines. Thus it is not possible to confirm which turbines and foundations will be present at each of the 11 locations until commercial contract award stage, though we of course aim to refine the options going forward with a view to short listing manufacturers.

3.3 Rochdale Envelope Adjustment – Assessment of Effects

- 33 Table 1.3 below indicates how the Rochdale Envelope adjustment has been considered in the Addendum. The August 2011 Environmental assessments which were not dependent on turbine information have not been re-assessed in the Addendum.

TABLE 1.3 Consideration of Rochdale Envelope Changes		
Chapter	Title	Comment
7	Offshore Ordnance	The Rochdale Envelope change will not affect the conclusions of the assessment as the location of the proposed development infrastructure has not changed.
8	Coastal Processes	The worst case foundation types were considered as part of the assessment (monopole foundations for increases in suspended sediment, and gravity foundations for seabed scour) and as a result, the reduction in the number of monopole foundations from 11 to a maximum of 4, will not affect the assessment of impacts. Following mitigation all impacts have been assessed as not relevant or negligible.
9	Marine Ecology, Intertidal Ecology and Sediment And Water Quality	The chapter refers to the worst case scenarios presented in Chapter 8 and as a result, the Rochdale Envelope change will not affect the conclusions of the assessment.
10	Ornithology	<p>AOWFL carried out an evaluation exercise which ranked the larger turbines under consideration in terms of their collision risk. The input parameters for the turbines were assessed on the basis of their sensitivity to influence the collision risk outputs. All the turbines were modelled to determine which turbine should be taken forward as the worst case turbine to model (produced the highest number of collisions given a density of flying birds).</p> <p>The outcome of this evaluation exercise was that the turbine identified as having the highest potential collision risk was selected as the turbine to be modelled. It should be recognised that this turbine did not have the largest diameter of swept area, but due to a combination of factors such as its higher rotational speed it was considered to result in the largest theoretical collision risk.</p> <p>Specific changes to the parameters modelled in the updated Rochdale include an increase in rotor diameter, decrease in max chord length, decrease in mean rotations per minute and inclusion of monthly time operational. Full details are provided in the Addendum Volume 2 Collision Risk Technical Note.</p> <p>The original collision risk modelling (CRM) was</p>

		<p>updated with further bird survey results and the adjusted turbine information. In addition, SNH requested the use of a new revised SNH collision risk methodology. In summary, this study shows a reduction in collision risk using the larger turbines, primarily due to the slower rpm of the rotors. The amendments to the CRM are provided in an updated Technical Note which forms part of Volume 2 Addendum.</p> <p>The results of the updated CRM, and accompanying updated baseline marine mammal and ornithological reports are included in Volume 2, likewise updated ornithological impact assessment and updated Habitats Regulations Assessment are included in Volume 2. A summary of the results is presented in a revised ornithological ES chapter.</p>
11	Bats	The assessment has not changed as the location of the proposed development infrastructure has not changed and the predicted impacts were assessed as negligible.
12	Marine Mammals	Changes to the turbine parameters will not affect marine mammals. In respect of turbine foundation options, we do not believe that monopile foundations will be used at the site, however for flexibility purposes we have decided to retain the potential for up to (ie a maximum) of 4 monopiles at the site. This represents an improvement on the likely duration and scale of underwater noise emissions, however for precautionary assessment purposes we wish to retain the worse case underwater noise assessment (modelled on 11 monopiles) as outlined in the ES submission of August 2011.
13	Electro-magnetic Fields	Refers to Chapters 9, 12 and 22 for the assessment of effects. No alteration to impacts is predicted due to alterations in turbine tip height and rotor diameter.
14	Statutory Designations and Conservation	Chapter presents baseline information rather than an impact assessment and is therefore not considered further.
15	Shipping and Navigation	Minimum blade tip clearances of the wind turbines remain a minimum of 22 m above MHWS. The Rochdale Envelope change will not affect the conclusions of the assessment as the location of the proposed development infrastructure has not changed. The overall effect was assessed as Low.
16	Aviation	NATS have confirmed that the Rochdale adjustment does not alter the need for mitigation. Technical radar mitigation studies have and will continue to take

		account of the Rochdale adjustment. AOWFL anticipate signing a 'windfarm mitigation contract' with NATS which will result in a suspensive condition relating to both NATS and the CAA helicopter route.
17	MoD	SERCO have undertaken a mitigation study into the best mitigation options to modify Buchan defence radar. SERCO have confirmed that the Rochdale adjustment does not alter the findings of their report nor the impacts on the defence radar. AOWFL anticipate signing a 'windfarm mitigation contract' with MOD which will result in a suspensive condition.
18	Marine and Maritime Archaeology	The Rochdale Envelope adjustment will not affect the conclusions of the assessment which considered a gravity base foundation for turbine 8 as a worst case.
20	Cultural Heritage	The Cultural Heritage chapter refers to elements of the SLVIA which have been re-presented in the Addendum. It is not considered that the minor change to the maximum tip height within the Rochdale Envelope would change the assessment of impacts presented in the original ES.
21	Commercial Fisheries	The Rochdale Envelope change will not affect the conclusions of the assessment as the location of the proposed development infrastructure has not changed and the predicted impacts are related to the location of infrastructure considered as obstacles.
22	Salmon and Sea Trout	The assessment considers 11 monopiles as the worst case effect from the Rochdale envelope. The reduction in the number of monopile foundations from 11 to a maximum of 4, will likely reduce the magnitude of effects from those predicted. The assessment of effects is 'negligible' or 'negligible to minor' for all predicted effects.
23	Socio-economics, recreation and Tourism	The Rochdale Envelope adjustment will not affect the conclusions of the assessment.
24	In Air Noise	Piling driving activities during the construction phase were identified as the only worst case noise emissions. The only impact assessed as greater than negligible (minor). A reduction in the number of piled foundations proposed, from 11 of the turbine foundations to 4 is therefore likely to reduce the magnitude of the impact predicted in the original ES. As piling is still proposed for up to 4 turbine foundations, the existing assessment is still considered to present the worst case scenario.

25	Energy Use and Emissions	The Rochdale Envelope adjustment will not affect the conclusions of the assessment as the generation capacity of the proposed development has not changed.
26	Electromagnetic Interference	No effects were identified. The Rochdale Envelope adjustment will not alter this assessment.
27	Other Marine Uses	All of the receptors identified have been predicted to receive negligible effects and the Rochdale Envelope adjustment will not alter this assessment.

3.4 Volume 1: Landscape and Visual Considerations

- 34 Following a comprehensive review of consultation responses, including Marine Scotland, SNH, Aberdeen City Council and Aberdeenshire Council we have given substantial consideration to landscape and visual design principles in addition to the work carried out in earlier phases. We have translated and refined these principles further into 3 Rochdale Envelope Scenarios (described below). Specifically, SNH's list of 'proposed conditions' included a request for a design statement to form any condition of grant of consent, and consequently we have undertaken a 'look ahead' review of all potential turbines under consideration to understand the implications of SNH's proposed condition of consent.
- 35 In defining these principles we have attempted to maintain a good visual balance and cohesiveness of views of the wind farm from the closest receptors. It should be noted that the final scheme design is constrained by the following key factors:
- Wind resource and spacing constraints within and between turbine rows. These constraints are particularly important for a demonstration site due to the need for 'clean' wind to demonstrate generation capacities.
 - A preference to site the same type of turbine on the same cable 'string' due to electrical grid connection constraints.
 - Maximum of 4 export cables from the wind farm.
 - Practicalities associated with different types of installation vessel and installation methods for different foundations.
 - Practicalities associated with crane lifting capacities for turbine towers and rotors which impact on vessel types and availabilities.
- 36 Since the landscape and visual meeting held with Marine Scotland on the 1st March 2012 and evaluation of the 3rd party independent landscape and visual review, the project team has worked very hard across engineering disciplines to meet SNH's request to consider landscape and visual design principles recognising that this request related to the 'as submitted August 2011'

Rochdale envelope, and would still pertain to the proposed minor adjustments in tip and rotor height.

- 37 The team aimed to meet the following objectives through this process:
- Objective 1: The closest shoreward array (Turbines 1-3) should be relatively consistent in tip height to maintain design integrity in views from the immediate coastline
 - Objective 2: The closest shoreward array (Turbines 1-3) should be populated with the smallest tip heights and rotor diameter. The variation in turbine heights will aim to work with perspective, rather than against, with the tallest turbines located further out to sea and a gradation to the lowest turbines located closest to the coastline.
 - Objective 3: The largest turbines should be placed on locations 7, 8, 9, 10 or 11.
 - Objective 4: Turbines 3, 6, 9, and 11 should increase in size from shoreward to seaward with the smallest being at turbine no 3, and largest at location 11.
 - Objective 5: Minimum heights are as important as maximum heights when considering design principles.
- 38 In defining these principles we have taken account of recognised aesthetic design principles. These include a commitment to having a clear and legible arrangement that works with the gentle sweep and alignment of the coastline. The detailed design considerations will also be mindful of a range of broader aesthetic considerations such as scale, proportion, visual balance and harmony, the effects of perspective and the perception of distance, visual framing, changing visual context and visual contrasts.
- 39 Many of these considerations are either directly mentioned or implied within SNH's 2009 publication '*Siting and Designing windfarms in the landscape*'. Whilst this design document is focused upon onshore development it does include a brief section on the coast (para 4.50 – 4.54) and some of the design principles contained within this document can, and will be, usefully applied to the detailed design stage for the EOWDC. None of these generally subtle design refinements outweigh though the principal source of effects which essentially arise from the number and size of the turbines as already set out within the ES.
- 40 It is worth re-iterating that at the project scoping stage, we prepared examples of wireframes showing different turbine sizes. Within the application we submitted 6 wireframes showing different wind turbine heights within the array (Figures TH1-3) and we also included the following text (Appendix 19.1: Section 1.1):

"The scheme has undergone numerous iterations since 2005 in terms of location and number of turbines which are discussed in the Environmental Statement (ES). The nature of the deployment centre is that it will comprise first of run turbines which may result in turbines of

different heights. For the purposes of the SLVIA (e.g. ZTV, photomontages) the dimensions of the turbines have been agreed with the consultees to be assessed at the worst case scenario which is eleven 10 MW turbines with a hub height of 120 m and blade tip height of 195 m above lowest astronomical tide (LAT). As with all developments, there will need to be an allowance for micro-siting which in this case may be up to 100m for each turbine. It is not envisaged that the final mix of turbine heights will result in a height difference that is greater than 20-35 m between turbines. Any differences may be noticeable at closer distances and the assessment will take this into consideration. Please see Volume 3 of the ES for a figure showing a detailed layout.”

Further explanation on turbine height differences and interpretation of the wireframes showing different turbine heights is included in Appendix 19.2: Section 5.1. The conclusion of this section is that “the potential height variations would not increase the significance of impacts already identified in the assessment of the worst case scenario.”

- 41 Our August 2011 ES submission examined whether the inclusion of turbines of two contrasting hub and blade tip heights would meaningfully alter the findings of the SLVIA and the results were outlined in Appendix 19.2: Section 5.1. As noted in that appendix, “potential height variations would not increase the significance of impacts already identified in the assessment of the worst case scenario.” Experience indicates that changes in height of 20-35m between turbines rarely translate through into a meaningful or demonstrably noticeable difference in terms of magnitude or significance of effect.
- 42 As the maximum tip height change is only 3.5m we believe, and the experience of our landscape assessors confirms, that this minor potential uplift in blade tip height will not be perceptible over the distances involved, particularly in the seaward array (rows).
- 43 In assessing an adjustment to the turbine parameters, we have strived to maintain a balance of adjustment relative to the original scheme and the identified classification of environmental visual effects. **That is to say that we have identified design principles which result in no material increase in environmental effects over and above those already outlined in the August 2011 Environmental Statement submission.**
- 44 We have translated the objectives/principles into zoning of turbine dimensions by row location, and can confirm that none of the larger turbines would be located on the shoreward array of turbines (locations 1-6). The largest turbines would be located in locations 7, 8, 9, 10 or 11 (known as Row C in Scenario 3). The smallest turbines would be located on turbines 1, 2, 3 and potentially turbine 6 (Row A). The mid row B would contain turbines between the smallest and largest turbines.
- 45 As we cannot prejudge the outcome of commercial negotiations and our assessment of innovative content (the latter being a requirement of the EU grant) at this stage we are unable to confirm the relative proportion of larger/mid range/smallest turbines as to do so would restrict commercial negotiations. Consequently we have assessed the likely maximum versus minimum number of the larger turbines which could be present in the final scheme proposal. Whilst we cannot confirm that larger turbines will

definitively be present on the scheme, we have to allow for all size ranges to be present, without limiting those size ranges to one supplier.

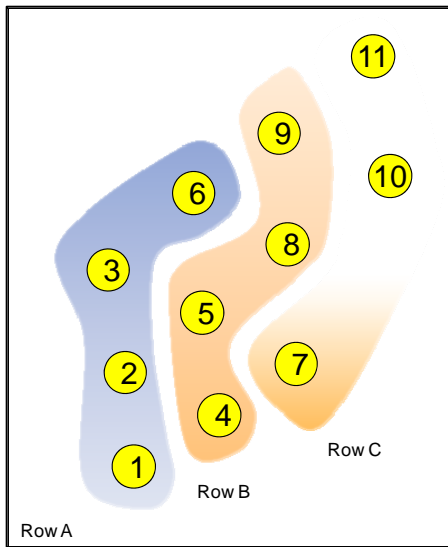
- 46 It should be noted that from an engineering perspective, hub heights are the most uncertain relative to the site metocean characteristics (and impact on transition piece dimensions and thus tower heights) as well as wind resource. Whilst we have relative certainty on potential rotor diameter size ranges available, there is less certainty at this stage on tip heights and hub heights.
- 47 Taking all considerations into account, we believe that the preliminary Rochdale design proposals shown in Table 1.4 meet the SNH request to give consideration to landscape and visual design principles. In translating this request into 'turbine zoning' scenarios we have sought to retain some flexibility with regard to supplier selection and engineering considerations.

TABLE 1.4 Preliminary zoning scenarios to inform further landscape and visual Rochdale envelope:

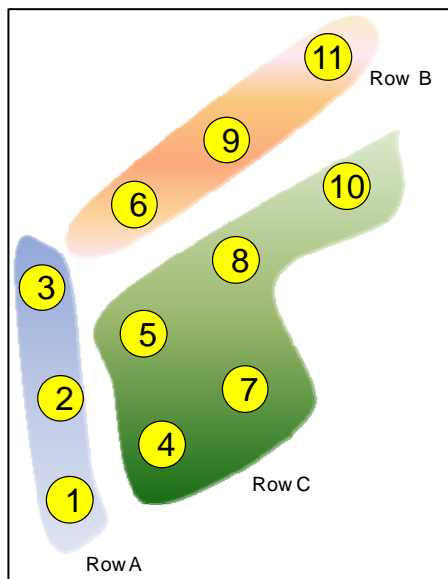
Parameter	Tip height range	Maximum Hub ht (provisional)	Rotor diameter range
Row A	158 -180.5m	90 - 110m	128 - 135m
Row B	181 -190.5m	90 - 115m	150 - 165m
Row C	191 -198.5 m	90 - 120m	165 - 172m

- 48 We have attempted to present the zoning diagrammatically below. These scenarios are not definitive but we believe represent a Rochdale envelope in terms of landscape and visual effects, which includes the maximum and minimum likely scenarios with respect to the balance of the larger/mid range and smaller turbines. These scenarios have been used to re-assess the likely adjusted Rochdale envelope effects in order to demonstrate whether there are levels of perceptible change compared to the original Rochdale envelope as submitted.

Rochdale Envelope Scenario 1:

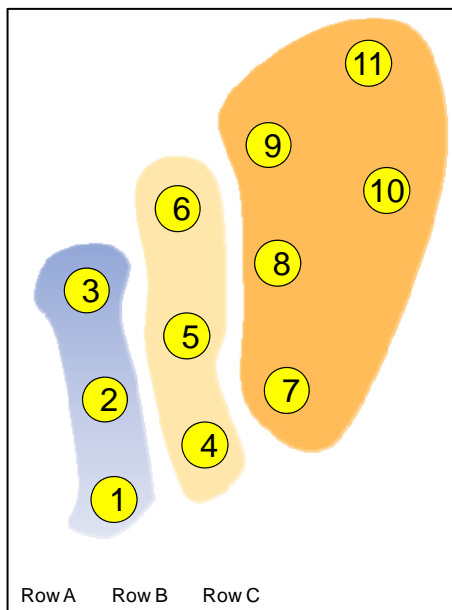


Rochdale Envelope Scenario 2:¹



¹ Please be aware that location no 5 has specific wind constraints and may require a mid range turbine rather than a larger turbine.

Rochdale Envelope Scenario 3:



- 49 We have concluded that in landscape and visual terms, these adjustments represent a non material adjustment. Volume 1 of the addendum provides supporting evidence for this statement and includes the following:
- figures showing ZTVs (Zone of Theoretical Visibility) of the adjusted tip heights (198.5m) compared with the previous tip heights (up to 195m).
 - representative visualisations including wireframes and photomontages at various locations illustrating the former and adjusted Rochdale tip height changes.
 - representative visualisations including wireframes and photomontages at various locations illustrating the above 3 zoning scenarios.
 - a supporting statement which discusses the results of the above additional landscape and visual work.
- 50 Lastly and unrelated to the Rochdale adjustment, we have also included an additional visualisation of Girdle Ness lighthouse as requested by statutory consultees; visualisations from a number of golf courses in the vicinity; and a study into golf courses and Round 1 offshore wind farms .

3.5 Volume 2: Ornithological and Marine Mammal Considerations

- 51 Within the ES submission in August 2011 AOWFL outlined that additional boat based bird and marine mammal data would be presented in the form of a formal addendum. Therefore we have also completed considerable assessment work using additional bird and marine mammal survey data.
- 52 Taking account of the Rochdale adjustment we have also updated the ornithological collision risk assessment using the recently supplied information from turbine manufacturers. Consequently we have a better understanding of the turbine characteristics which form input parameters to the collision risk modelling (for instance pitch angle, rpm and rotor widths) as well as better wind resource models with which to assess turbine availability.
- 53 Therefore we have revised the original collision risk modelling (CRM) utilising the updated survey results, and recently revised SNH methodology, and have updated the CRM with the larger turbine information. In summary, this study shows a reduction in collision risk using the larger turbines, primarily due to the slower rpm of the rotors. The amendments to the CRM are provided in an updated Technical Note which forms part of Volume 2 Addendum.
- 54 The results of the updated CRM, and accompanying updated baseline marine mammal and ornithological reports are included in Volume 2, likewise updated ornithological impact assessment and updated Habitats Regulations Assessment are included in Volume 2. Lastly a summary of the results is presented in a revised ornithological ES chapter.

4 STRUCTURE OF THIS ES ADDENDUM

Due to the volume of additional material the Addendum is split into two volumes as listed below.

Volume 1 ES Addendum: Rochdale Adjustments, R&D proposals and Landscape & Visual Assessment

1. AOWFL Addendum June 2012 Addendum Application Letter to Marine Scotland
2. AOWFL Addendum June 2012 Introduction to Addendum and Rochdale Adjustment (*this document*)
3. AOWFL Addendum June 2012 R&D Proposals & Responses

4. AOWFL Addendum June 2012 Golf Course and Offshore Wind farm Study
5. AOWFL Addendum June 2012 Golf Course Visuals- Photomontages
6. AOWFL Addendum June 2012 Golf Course Visuals - Wireframes

7. AOWFL Addendum June 2012 Supporting Statement to Rochdale Adjustment
8. AOWFL Addendum June 2012 Rochdale Visuals - Height Study
9. AOWFL Addendum June 2012 Rochdale Visuals - Zoning Scenarios
10. AOWFL Addendum June 2012 ZTV – Comparative ZTV on Bareground
11. AOWFL Addendum June 2012 ZTV – Comparative ZTV of Blade Tips with Obstructions in Aberdeen
12. AOWFL Addendum June 2012 ZTV - Comparative ZTV of Blade Tips with Obstructions

13. AOWFL Addendum June 2012 Additional Visual – Girdle Ness Lighthouse

Volume 2 ES Addendum : Ornithology and Marine Mammals

1. AOWFL Addendum June 2012 Revised Ornithological Collision Risk Modelling Technical Note
2. AOWFL Addendum June 2012 Revised Ornithology ES Chapter
3. AOWFL Addendum June 2012 Revised Habitats Regulations Assessment
4. AOWFL Addendum June 2012 Revised Appendix B Bird Distribution Figures
5. AOWFL Addendum June 2012 Revised Ornithological Baseline and Impact Assessment
6. AOWFL Addendum June 2012 Revised Marine Mammal Baseline