

**Beatrice Offshore Windfarm  
Environmental Statement Addendum**

**Annex 9A Physical Processes  
Consultation Marine Scotland Science**

Our ref: R/3888/13/DOL

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14 December 2012

Dear Sir or Madam,

**BEATRICE OFFSHORE WIND FARM ENVIRONMENTAL STATEMENT:  
REPLY TO THE COMMENTS OF MARINE SCOTLAND SCIENCE**

Please find attached our response to the comments provided by Marine Scotland Science (MSS) in relation to the Beatrice Offshore Wind Farm Environmental Statement.

Yours sincerely  
for ABP Marine Environmental Research Ltd



**David Lambkin**  
**Coastal Processes Advisor.**

[dlambkin@abpmer.co.uk](mailto:dlambkin@abpmer.co.uk)



MSS has provided a response (dated 2/7/12) in relation to the Beatrice Offshore Wind Farm Environmental Statement. The letter contains comments under the headings of each topic area. The following comments were received in relation to physical processes and geomorphology. No other comments were found under other topic headings that appear to relate to physical processes.

### **9 and 21 Physical processes and geomorphology**

*“Perhaps the most significant potential effects are related to the disturbance of seabed sediments. This is reflected in the ES with most of Section 9 focussing on these issues. Throughout the ES the level of impact and the sensitivity of the receptor in question are given, and a number of them repeated in Table 9.8. These assessments of the impact and sensitivity are considered to be appropriate throughout Section 9.*

*The good amount of attention paid to the potential cumulative effects was very welcome. The list of potential effects and reasoning behind the majority of them being scoped out early was good. The ES then focused on the developments occurring in and around the Moray Firth Round 3 site in an adequate level of detail.*

*The technical appendices submitted were all interesting, useful and extremely rigorous. They were very welcome as they helped explain some reasoning behind a number of the statements within the ES.*

*The multibeam echosounder data collected was processed into a bathymetry layer for the lease area. However, there is very little information presented on the survey method, standards and data processing. Also there is a reference to the collection of subsurface geophysical data recorded in section 9.2.5.2 para 20. Are these data included in the ES, does it include sub-bottom profiling information? This would be a very useful layer of information that would assist in the identification of the most appropriate foundation design for different parts of the lease area.*

*Can concerns over the potential for scour be taken into consideration at an engineering level i.e. factor in the extent of the predicted scour into the foundation design? What scour has been observed around the Beatrice wind turbines?”*

MSS (2/7/12)

From these comments, there appear to be four distinct questions and responses required. These are addressed in turn below.

**Question 1: Provide more information concerning the methodology, standards and data processing used in the geophysical survey (specifically in relation to the multibeam swath bathymetry and sub bottom geophysical data).**

As noted by MSS, a geophysical survey of the lease area was undertaken by Osiris in April and May 2010. The survey collected a standard range of parameter types to an industry standard specification, including:

- High resolution multibeam swath bathymetry (bathymetry);
- Side scan sonar data (seabed surface texture);
- Sub-bottom geophysical data (geological texture beneath the seabed surface); and
- Magnetometer data (to identify ferrous objects).

The survey methodology, standards, specifications and approach to data processing is described in the accompanying geophysical survey report. A copy of this report is provided with this letter.

We trust that the report provides the required level of information.

**Question 2: *Are (the sub-bottom geophysical) data included in the ES? (It is noted that) this would be a very useful layer of information that would assist in the identification of the most appropriate foundation design for different parts of the lease area.***

We confirm (as above) that sub-bottom geophysical data were collected. These data were also used to inform the ES. In relation to physical processes, the data were used to underpin the baseline characterisation, and also in the specification of the sediment plume modelling to obtain a realistic estimate of the proportion of different types of drill arisings (varying grain size composition) from the location of each foundation in the indicative layouts tested.

It is confirmed that (as with any offshore engineering project) the nature of the sub-seabed surface geology (which does vary across the lease area) will be an important consideration during foundation design. The ES baseline line description and the geophysical survey data will both inform the engineering design of the development.

**Question 3: *Can concerns over the potential for scour be taken into consideration at an engineering level i.e. factor in the extent of the predicted scour into the foundation design?***

Scour may affect the integrity and stability of a foundation, depending upon its design. For the purposes of EIA, the worst case scenario assessed with regards to scour is the absence of scour protection. The use of scour protection does however remain an engineering option, indeed, consideration of scour potential is a requirement of the relevant design codes. Therefore, the potential for scour will be included in the detailed engineering design of foundations.

**Question 4: *What scour has been observed around the Beatrice wind turbines?***

No specific monitoring data is available to date in relation to the Beatrice wind turbines (which are mounted upon jacket foundations in approximately 45m water depth).

A summary of monitoring and scour depths observed around wind farm foundations (typically monopiles) in other UK wind farms is, however, provided in:

- HR Wallingford, Cefas and ABPmer, 2007. Dynamics of scour pits and scour protection - Synthesis report and recommendations. (Sed02). For DTI. November 2007.

The report provides a summary figure (Figure 1) of the observed individual depths of scour. It is noted that the values shown are from wind farms in the UK which:

- Do not use scour protection;
- Have used relatively slender (approximately 4 to 5m diameter) monopile foundations;
- Are in relatively shallower water depths (typically less than 10mLAT, up to 25 mLAT) compared to the Beatrice lease area (35 to 55 mLAT) and so are potentially more exposed to wave action.

All sites are assumed to experience a degree of tidal forcing that would lead to near equilibrium depths of scour, however, scour depth is known to vary between the 'equilibrium' (maximum) and lesser levels with time.

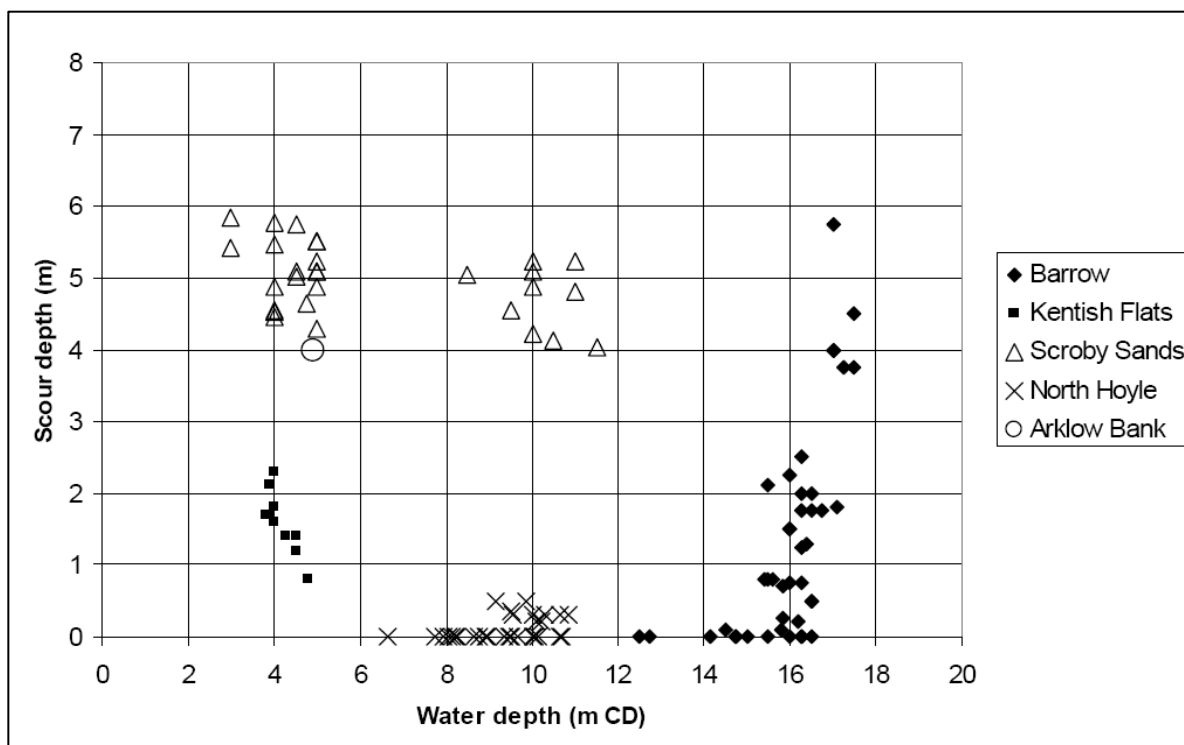


Figure 1. Scour Data for Wind Farms with No Scour Protection. From HR Wallingford *et al.* (2007).

Figure 1 indicates a wide degree of variability in the observed scour depth, both between and within sites. The maximum depth observed is however less than the maximum predicted depth (approximately 1.3 times the monopile diameter, as used in the present study). Local scour depths around the relatively smaller diameter corner posts of jacket foundations (e.g. the Beatrice Demonstrator) are estimated on

the same basis as monopile foundations and so are expected to be smaller than the range shown above.

Differences in scour depth are primarily attributable to differences in seabed type. The seabed in North Hoyle and parts of Barrow wind farms appear more erosion resistant with little or no mobile sediment veneer. Kentish Flats and other parts of Barrow wind farm have an intermediate erosion resistance (or thickness of mobile sediment present). Scroby Sands and Arklow Bank wind farms are located in mobile sand bank environments and so exhibit the larger depths of scour.

Figure 1 shows that, in practice, scour depths are limited by the presence of erosion resistant soils (e.g. gravels, or consolidated clays) at some depth below the mobile sediment surface, the depth of scour being essentially limited to the thickness of the mobile sediment veneer. As such, a spatially varying limitation on scour depth (for unprotected foundations) would also be expected in parts of the Beatrice offshore wind farm due to the presence of erosion resistant tills in close proximity (within 0.5 m) to the seabed surface.

**Beatrice Offshore Windfarm  
Environmental Statement Addendum**

**Annex 9B Physical Processes  
Consultation Surfers Against Sewage**

**David Lambkin**

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**From:** David Lambkin  
**Sent:** 14 December 2012 12:46  
**To:** 'Andy Cummins'  
**Cc:** 'Jonathan Wilson'; 'Campaign Intern'  
**Subject:** RE: Beatrice Offshore Wind Farm

Andy,

Thank you also for your time and comments during this consultation process on behalf of Surfers Against Sewage and other groups.

We are pleased that your comments have been addressed to your satisfaction and that you have no further comment or objection to the proposed Beatrice offshore wind farm development.

Your note regarding monitoring is forwarded here to the developer.

Kind Regards,  
David.

**Dr David Lambkin | Senior Consultant | ABPmer**  
**Quayside Suite | Medina Chambers | Town Quay | Southampton | SO14 2AQ |**  
**Direct: 023 8071 1874 | Tel: 023 8071 1840 | Email: dlambkin@abpmer.co.uk**

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**From:** Andy Cummins [mailto:andy@sas.org.uk]  
**Sent:** 14 December 2012 12:41  
**To:** David Lambkin  
**Cc:** 'Jonathan Wilson'; 'Campaign Intern'  
**Subject:** RE: Beatrice Offshore Wind Farm

David, thank you for consulting Surfers Against Sewage (SAS) on the Beatrice proposal.

The modelling investigating potential impacts on the 3 principal points raised; impacts on the wave resource from swell interaction with offshore turbines, impacts on the wave resource from swell interaction with the cable (including installation and removal) and cumulative impacts from the aforementioned from multiple offshore renewable developments. The findings raise no reason to object.

However, SAS would call for these models to be validated with real world wave data and measured against a robust baseline dataset. Surfers Against Sewage believe this would not only be a responsible position for the developer to adopt but also be a proactive step in helping communities support future offshore renewables where appropriate.



**Andy Cummins**  
 Campaign Director  
 Direct no: 01872 555952 Main office: 01872 553001  
 Mobile: 07711 767548



**Protecting surfers, waveriders, waves and beaches**  
 Wheal Kitty Workshops, St Agnes, Cornwall TR5 ORD



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**From:** David Lambkin [mailto:dlambkin@abpmer.co.uk]  
**Sent:** 13 December 2012 12:58  
**To:** andy@sas.org.uk  
**Cc:** Jonathan Wilson; Campaign Intern  
**Subject:** RE: Beatrice Offshore Wind Farm

Dear Andy,

Thank you for your reply. As discussed on the phone, I am pleased to provide the further information you request below.

#### 1 – All Relevant Locations Considered?

- Smaller more frequent waves correspond to an incoming wave condition of 0.5-1m. Reductions to the annual mean wave condition (which is of similar height) are limited to 0.01m at 5 venues and up to 0.02m at one venue. Reductions are clearly very small in absolute terms (maximum 2% relative effect) and are within the levels of confidence that can be expected of such models.
- No effects > 0.01m were modelled at any venue for the specific wave conditions in the guidance (2m, 10s; 3m, 12s; 4m, 14s; 4m, 16s). The assessment includes two years of data and so also accounts for a range of other height and period combinations.
- Slightly greater maximum reductions of 0.01 to 0.04 relate to the annual extreme wave condition, which varies between 4 and 6m for the 18 locations, i.e. a maximum of 1% of the significant wave height.
- I would suggest that the above effects would not be noticeable or measurable at any of the named surfing locations.
- **On this basis, I suggest that this comment can be closed?**

#### 2 – Cable Landfall

- Thank you for your comments, They are copied to the developer here.
- **I trust that this is a satisfactory conclusion and I suggest that this comment can be closed.**

#### 3 – Cumulative Impacts

- I am pleased to say that the same modelling assessment has already been carried out considering the worst case scenario for the Beatrice wind farm in conjunction with a worst case scenario for the proposed Telford, Stevenson and MacColl wind farms. The results are reported in section 9.7.3.5 of the Beatrice Environmental Statement (ES). The cumulative impact sections of the ES consider all proposed developments that have a bearing on the assessment being undertaken. There were no other proposed developments identified in the Moray Firth that would affect surfing waves from the present day baseline. I have copied the ES assessment text relating to surfing venues below. The baseline is the same as for the Beatrice development alone.
- The results are clearly very similar to the findings for the Beatrice wind farm alone. The proportional impact on wave height remains no more than 1-2% at the named surfing venues.
- Only a small additional impact is caused by the three other wind farms due to their relative location in the Moray Firth (the same reason that Beatrice alone leads to relatively small impacts). Essentially, the typical coming directions of waves through the area do not tend to pass through the wind farms before reaching

the named surfing venues.

- **On this basis, I suggest that this comment can be closed?**

%%

**Copy of Beatrice ES Section 9.7.3.5, subsection ‘Recreational Surfing Venues’**

370. This assessment of potential changes to the wave regime is based upon the analysis of wave model results with and without the [Beatrice, Telford, Stevenson and MacColl wind farm] GBS and Jacket schemes present over a representative two year period. Time series of wave conditions have been extracted from the model results immediately offshore of the identified surfing beaches in the study area. The same statistical and frequency analysis has been applied to each data set to obtain baseline values (previously listed in Section 9.3.3) and the difference in either the statistics of key events, or the frequency of occurrence of other event types resulting from the presence of the schemes.

371. Jackets were found to have no effect greater than 0.01m wave height or greater than 0.1 s wave period at any venue.

372. GBS foundations were found to have no effect greater than 0.01 m wave height or greater than 0.1 s wave period at ten out of eighteen venues. Of the remaining eight venues, effects were typically limited to a 0.01 to 0.02 m decrease (up to a maximum of 0.05 m at Lossiemouth, Banff Beach and Sunnyside Bay) in wave height, but no effect on wave period or the frequency of occurrence of any representative conditions.

373. A small magnitude of change within the range of natural variability is therefore assessed to arise in areas of low sensitivity. The resulting effect is negligible and therefore not significant in terms of the EIA Regulations.

%%

Thank you again for your time and comments Andy.

I trust that you will find the above to be an acceptable conclusion to your questions on behalf of the Moray Firth surfing community.

**Please can you indicate if you are now happy for us to consider your comments to be closed.**

Kind Regards,  
David.

**Dr David Lambkin | Senior Consultant | ABPmer**  
**Quayside Suite | Medina Chambers | Town Quay | Southampton | SO14 2AQ |**  
**Direct: 023 8071 1874 | Tel: 023 8071 1840 | Email: [dlambkin@abpmer.co.uk](mailto:dlambkin@abpmer.co.uk)**

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**From:** Campaign Intern [<mailto:pow@sas.org.uk>]  
**Sent:** 13 December 2012 11:17  
**To:** David Lambkin  
**Cc:** [andy@sas.org.uk](mailto:andy@sas.org.uk)  
**Subject:** RE: Beatrice Offshore Wind Farm

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Dear David Lambkin,

Thank you for the summary of concerns raised by SAS and your efforts to show that these concerns have been considered in the EIA.

### 1 – All Relevant Locations Considered?

It is pleasing to see that you have considered the wave reduction height at each of the surfing locations considered. The list of 18 surfing locations seems to be satisfactory and represents the surfing locations used in the area. SAS are also waiting to hear back from the Scottish Surfing Federation (SSF) who will be able to confirm this. There is just one thing to clarify about the values stated in the ES for wave reduction: At 8 of the 18 locations considered, there is found to be a reduction of less than 0.01m wave height. At the remaining 10 venues, wave height reductions were generally limited to 0.01 – 0.02m, with a maximum of 0.04m at Cullen Bay. At which incident wave heights are these values calculated at? i.e. Are they at the most frequent wave height (0.5-1m) or are they at the most significant observed wave heights. As you can appreciate 0.04m reduction of a 0.5 wave is a nearly 10% reduction whereas 0.04m reduction of a 5m wave is more like 1%. If you could just clarify this point that would be great.

### 2 – Cable Landfall

It is pleasing to hear that the cable landfall will not interfere with the waves, the long shore sediment transport or the natural evolution of coastal morphology.

It is urged by SAS that the offshore end of the Horizontal Directional Drilling is exited as far offshore as possible and that it is confirmed to have no significant impact on the wave quality.

Restricted access to the local area is obviously undesired by surfers and SAS would like to request that the time period for this is kept to an absolute minimum during construction.

### 3 – Cumulative Impacts

There is however one more concern that SAS wishes to raise. This is the effect on wave quality that may occur from the cumulative impacts of other offshore developments in the area. SAS is aware of one group of developments in negotiation, this is the development of three offshore wind farms by Moray Offshore Renewables Ltd (MORL) being referred to as the Telford, Stevenson and MacColl wind farms, each proposing a capacity of up to 500MW. SAS requests modelling to determine the combined effect of these projects on the surfing quality at the surf spots mentioned in the EIA. SAS also urges the inclusion of any other local developments in the modelling.

Regards,

Sophie Stevens  
Campaign Intern

Surfers Against Sewage  
Direct Line : 01872 555 945



Protecting surfers, waveriders, waves and beaches  
Wheal Kitty Workshops, St Agnes, Cornwall TR5 0RD

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**From:** Andy Cummins [<mailto:andy@sas.org.uk>]  
**Sent:** 04 December 2012 16:42  
**To:** Campaign Intern  
**Subject:** FW: Beatrice Offshore Wind Farm

**Andy Cummins**

Campaign Director

Direct no: 01872 555952 Main office: 01872 553001

Mobile: 07711 767548

**Protecting surfers, waveriders, waves and beaches**

Wheal Kitty Workshops, St Agnes, Cornwall TR5 ORD



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Surfers Against Sewage

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**From:** David Lambkin [<mailto:dlambkin@abpmer.co.uk>]**Sent:** 04 December 2012 13:38**To:** Andy Cummins**Subject:** RE: Beatrice Offshore Wind Farm

Hi Andy,

It was very good to speak with you yesterday and today. Thank you for your time.

I hope that the following information will help to close out your remaining questions.

Your comments or concerns seemed to essentially come down to two points:

1. Whether all relevant surfing locations have been included in the assessment.
2. Whether the cable landfall will significantly interfere with the quality of surfing waves or access to surfing locations.

**1 – All Relevant Locations Considered?**

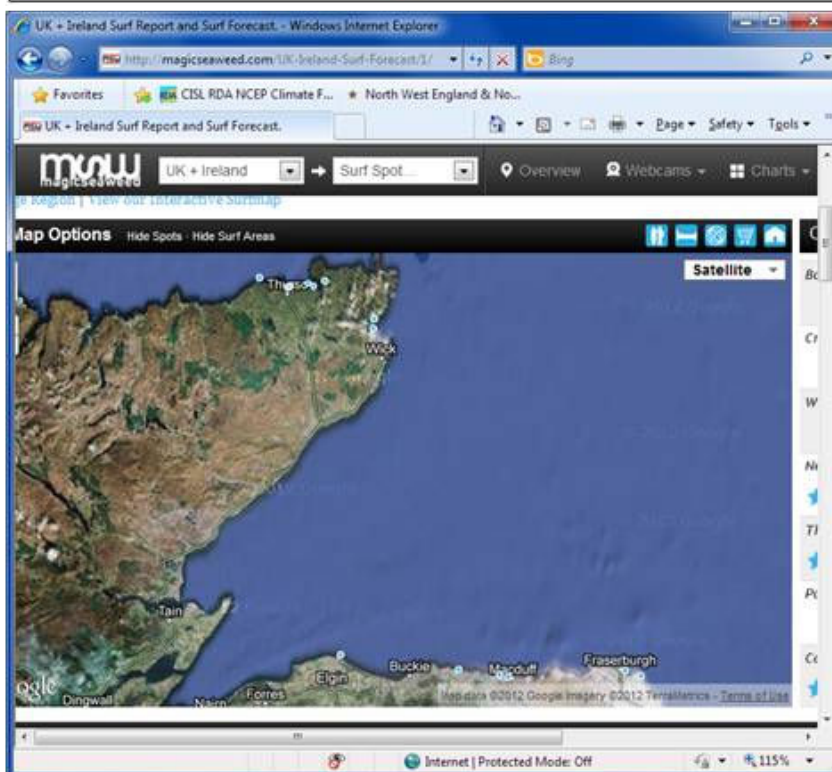
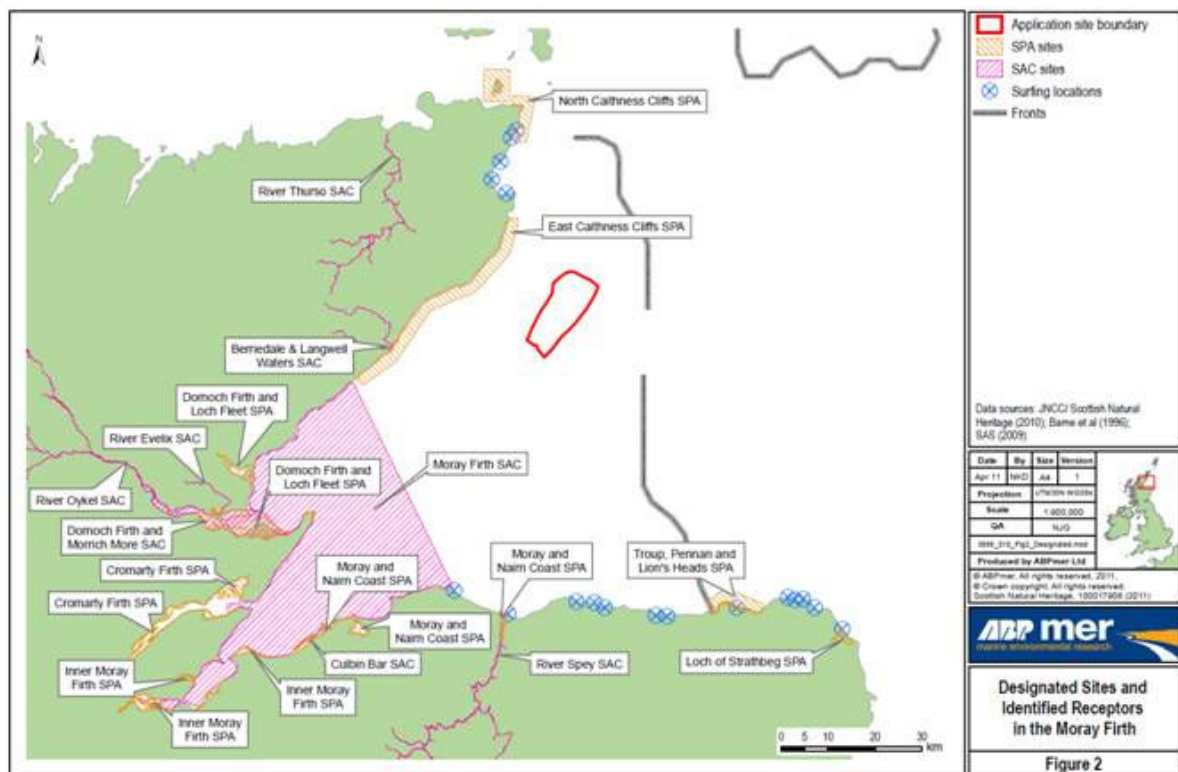
You have asked for the opportunity to consult with a small number of respected individuals in the local surfing community to confirm that all key surfing venues have been considered. We would welcome further comments, however, in the interest of a timely conclusion please can you also consider the information below and provide a provisional response if you feel that is supported and appropriate.

You appreciate our interest in a timely resolution and we agreed to try and limit your consultation to two weeks (ideally feeding back on or before Friday 14<sup>th</sup> Dec).

We are pleased that you appreciated our use of your recommended methodology. You did not think that the choice of methodology should be a concern to other groups.

We will give further consideration to recognised and relevant surfing venues if they are not presently included in the assessment. As shown below, I trust that there should not be any major omissions. Please note that effects of the wind farm on waves do not extend outside of the Moray Firth.

For reference, the figure [below left] shows the locations assessed in the ES (blue circles with crosses, as identified in the Stormrider Guide for Europe) and the figure [below right] shows surf spots presently highlighted on Magic Seaweed. The assessment provided in the ES is shown to include all of (and more than) the surf spots presently identified on Magic Seaweed.



Ideally, we would like to consider the above as a demonstration that all relevant locations have been assessed. If you agree, could we (provisionally) close this comment now?

If you wish to continue with the further consultation **I have prepared another email with extracted baseline and impact assessment information to assist with your discussions**, including:

- The baseline text and tables relevant to surfing (pages 25 and 26) including the list of named surf spots assessed.
- Figure 2 (also copied above) showing the locations of the assessed surf spots.
- The impact assessment, essentially summarised as:
  - No change (i.e. <1cm) predicted to surfing wave heights at 8 out of 18 of the assessed locations.
  - The remaining 10 locations are predicted to experience a typically very small effect of 1 to 2cm (up

to a maximum of 4cm) reduction in wave height during larger characteristic wave events (3 to 4 m) but only if the larger foundation types are used.

- It is more likely at this point that the smaller 'jacket' type foundations will be used, which were assessed to produce no measurable effects (<1cm) at any venue.
- The results are consistent, so that the same level of effect can be reasonably predicted to apply also to other locations nearby to those already assessed.

Following any further feedback from other surfers and provided that no other recognised surf locations are highlighted that fall outside of the assessment already provided, **I intend to consider this comment as closed.**

## **2 – Cable Landfall**

I understand that your main concerns in relation to the cable landfall are that there might be a physical change to the beach or the seabed that would affect the quality of surfing waves or access to the beach. We discussed that the method being proposed for the cable landfall in this particular case will avoid most of your concerns by design.

Further details of the landfall and an impact assessment on coastal processes can be found in Annex 9D of the Physical Processes section of the ES. Please find a copy attached.

The cable landfall at Spey Bay is located in a Site of Special Scientific Interest (SSSI) and so is already subject to an elevated level of monitoring and protection from any disruption to the beach morphology and related coastal processes. As we discussed, to avoid any direct impacts to the beach, a drilled underground conduit will be used to transit the cable from onshore to nearby offshore. The intention of this process is that there will be no physical presence of the cable or cable protection measures on the beach or in the intertidal or near-intertidal zones. The cable conduit cannot be infinitely long and so will re-emerge underwater at a distance from the beach that will be beyond the near-inter-tidal region (probably several hundred meters or more from the beach) but may still be within the area where (larger) waves touch the seabed, depending on the size of the wave and how steeply shelving the seabed is in that area. From that exit point, the cable may then be buried (so will not interact at all with waves) or may receive a carefully designed and applied amount of surface protection (e.g. metal casing or rock armour). The cable route heads offshore (generally in line with the incoming waves) and so cable protection will only present a minor local modification to the water depth, a few meters in width, and so is unlikely to be 'felt' by the larger longer waves with wave lengths of tens or hundreds of meters, causing no modification to them.

There will therefore be limited or no possibility for the cable landfall to interfere with waves, longshore sediment transport or the natural evolution of coastal morphology either during installation of the landfall or at the landfall during the operational lifetime of the wind farm.

Access for surfing may however be restricted in a local area (but not to the beach as a whole) during cable installation for safety reasons. This might affect a relatively narrow area (order of hundreds of meters from the operation) in one part of one beach and only for a relatively short period of time (around 2 to 6 weeks).

You also asked about information informing the design of the landfall. Baseline bathymetric surveys have been carried out to inform the EIA and to inform the engineering design of the landfall. Some natural variation in the beach morphology over time is inevitable and will be accounted for in the landfall design. The proposed method of cable landfall has already been assessed to present no significant impact to coastal morphology at the landfall site with this in mind. Any further detailed designs will have to demonstrate compliance with this requirement as part of the consent process.

I trust that this adequately covers the various questions raised in your response letter and unless you have any further questions, **I intend to consider this comment as closed.**

***So that we can transparently wrap up stakeholder concerns, please can you reply to acknowledge when your concerns have been addressed to your satisfaction.***

If you have any other related questions or if you would like any more information, please let me know.

Kind regards,

David.

**Dr David Lambkin | Senior Consultant | ABPmer**  
**Quayside Suite | Medina Chambers | Town Quay | Southampton | SO14 2AQ |**  
**Direct: 023 8071 1874 | Tel: 023 8071 1840 | Email: [dlambkin@abpmer.co.uk](mailto:dlambkin@abpmer.co.uk)**

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**From:** Andy Cummins [<mailto:andy@sas.org.uk>]  
**Sent:** 03 December 2012 15:18  
**To:** David Lambkin  
**Cc:** Adam Fulford; 'Jonathan Wilson'  
**Subject:** RE: Beatrice Offshore Wind Farm

Hi David, I just tried to reach you on your direct line (spoke with Adam). If I don't catch you later today I'm in most of the week (except Thursday).

Looking forward to catching up ASAP.

**Andy Cummins**  
 Campaign Director  
 Direct no: 01872 555952 Main office: 01872 553001  
 Mobile: 07711 767548



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 Wheal Kitty Workshops, St Agnes, Cornwall TR5 ORD



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**From:** David Lambkin [<mailto:dlambkin@abpmer.co.uk>]  
**Sent:** 30 November 2012 11:49  
**To:** [andy@sas.org.uk](mailto:andy@sas.org.uk)  
**Cc:** Adam Fulford; Jonathan Wilson  
**Subject:** Beatrice Offshore Wind Farm

Dear Andy,

My name is David Lambkin. I am leading on the contributions made by ABPmer, on behalf of SSE Renewables, to the Beatrice Offshore Wind Farm Environmental Statement.

I work closely with Adam Fulford, with whom you have liaised on several other projects in the recent past.

I have been considering your comments provided in relation to recreational surfing and I would like to talk through a few things on the phone please.

I understand from your colleagues that you are back in the office on Monday? I shall try to call again on Monday but if a convenient time arises before then, please can you give me a call on the numbers below.

Kind Regards,

David.

**Dr David Lambkin | Senior Consultant | ABPmer**  
**Quayside Suite | Medina Chambers | Town Quay | Southampton | SO14 2AQ |**  
**Direct: 023 8071 1874 | Tel: 023 8071 1840 | Email: [dlambkin@abpmer.co.uk](mailto:dlambkin@abpmer.co.uk)**

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