10 BENTHIC ECOLOGY

10.1 INTRODUCTION

1. This section of the ES Addendum presents an evaluation of the likely significant effects of the Amended Project on benthic ecology associated with the amendments presented in Section 4: Amended Project Description. In addition, this section presents a discussion of the effects which may occur as a result of the most likely scenario. The assessment has been undertaken by CMACS Ltd.

2. Specifically, this section of the ES Addendum assesses the effects associated with:

- The Amended OfTW Corridor;
- Changes to the OfTW cable installation timescales; and
- Changes to the jack-up vessel footprints associated with the Wind Farm.

3. This section of the ES Addendum is supported by the following documents from Volume 4: Technical Annexes of the Original ES:

- Annex 10A: Wind Farm Benthic Ecology Technical Report; and
- Annex 22A: Cable Route Benthic Technical Report.

4. This section presents an addendum to Section 10: Wind Farm Benthic Ecology and Section 22: OfTW Benthic Ecology of the Original ES. Where applicable, reference is made in this assessment to the Original ES.

5. This section includes the following elements:

- Consultation;
- Scope of Assessment;
- Baseline;
- Assessment Methodology;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Assessment of Cumulative Effects;
- Statement of Significance; and
- References.

10.2 CONSULTATION

6. Following the submission of the Original ES in April 2012 Beatrice Offshore Wind Farm Limited (BOWL) has received consultation responses, via Marine Scotland Licensing Operations Team (MS-LOT) from various statutory and non-statutory consultees. A summary of these responses in relation to benthic ecology is presented in Table 10.1. Reference is also provided as to where these issues are addressed within this ES Addendum, if applicable.

Table 10.1: Summary of Original ES Consultation Responses and Project Response

Consultee	Summary of Consultation Response	Project Response	Consultation Response Addressed
Scottish Natural Heritage (SNH)	SNH and Joint Nature Conservation Committee (JNCC) are currently discussing the benthic biotope classification across the Beatrice and Moray Firth Round 3 Zone. It is not clear to us whether the relevant consultants for each project have managed to liaise over this classification. We think that either SNH or JNCC will need to take an overview of the benthic biotope classification across both sites.	CMACS and EMU (consultants for Moray Firth Round 3 Zone) liaised extensively in production of the joint benthic biotope map. Extensive consultation between benthic ecologists of both consultancies took place between March and November 2011 to discuss biotope classifications, approaches to mapping, and in particular the best way to map the boundary area between the two surveys. Biotope shapefiles, benthic data and other information were shared between the two organisations, and after production of a number of preliminary maps each involving minor adjustments, the final joint benthic biotope map was agreed between the two consultancies.	Clarification provided to MS-LOT and SNH regarding this matter. No further information required in this ES Addendum.
Marine Scotland Science (MSS)	The developer has adequately addressed the key issues in a rigorous and appropriate manner.	Comment noted.	Not required. No further information required in this ES Addendum.

10.3 SCOPE OF ASSESSMENT

7. As shown in Section 10.2, there are no consultation responses which have required further material information or renewed assessment to be presented in this section. All consultation responses relating to benthic ecology have been dealt with outwith this ES Addendum, where required.

8. There are no amendments to methodologies or receptors which need to be presented in this section.

9. The further cumulative information relating to the Moray Firth Round 3 Zone does not require any amendment to the assessment of benthic ecology.

10. The scope of this section has therefore been determined by considering the changes to the Project presented in Section 4: Amended Project Description. Specifically, as stated in Section 10.1, the effects associated with:

- The Amended OfTW Corridor;

- Changes to OfTW cable installation timescales; and
- Changes to the footprint of the jack-up vessels.

11. Section 10.6 considers the effects on benthic ecology associated with the Amended Project. The conclusions of this assessment are supplemental to those of the Original ES and this Section must be read alongside Section 10: Wind Farm Benthic Ecology and Section 22: OfTW Benthic Ecology of the Original ES. Section 10.6.3 discusses the 'most likely' scenario.

10.4 BASELINE

10.4.1 STUDY AREA

12. The Study Areas for the assessment of effects on benthic ecology for the Original Wind Farm and the Original OfTW Corridor were presented in Section 10.2 and Section 22.2 of the Original ES respectively. The Wind Farm Study Area remains unchanged. The OfTW Study Area has been changed to reflect the Amended OfTW Corridor. An additional 3.71 km^2 area has been added to the eastern side of the northern end of the Original OfTW Corridor near the Wind Farm Site, located on the Smith Bank (see Figure 10.1 for location).

13. Therefore, the geographical scope has now changed to incorporate this additional 3.71 km^2 into the OfTW assessment.

10.4.2 BASELINE CONDITIONS

14. The baseline conditions for the Wind Farm Study Area remain unchanged from those detailed in Section 10.3 of the Original ES, and in Annex 10A of the Original ES. The baseline conditions relating to the OfTW Study Area were presented in Section 22.3 of the Original ES with full information provided in Annex 22A of the Original ES.

15. Further geophysical and geotechnical survey data collected by Gardline Geosurvey Ltd in 2007 on behalf of Ithaca Energy has been utilised for the additional area created by the amendment to the Original OfTW Corridor. Geophysical survey data was collected over an area measuring 2 kilometres (km) x 2 km within the additional area using multi-beam echo sounder, sidescan sonar and sub-bottom profiler. It should be noted this survey was not undertaken specifically for the Amended Project and does not cover the entirety of the additional area but does cover the majority of it. The survey also supplied further seabed imagery and benthic data covering a representative proportion upon which to base the amended assessment.

16. Environmental samples were collected at 10 locations within the additional area using a day grab. Seabed imagery and video footage were attained using still photography and drop down camera at these locations. One core penetration test (CPT) was also taken to determine the geotechnical engineering properties of sub seabed sediments and stratigraphy and the log provided for assessment.

17. The geophysical survey data shows the same uniform fine sand and shell habitat as recorded for the Original OfTW Corridor at this northern end and also for the surrounding area of Smith Bank as discussed in the original assessment for the

OfTW and the Wind Farm Site assessment. This habitat was identified as being extensive at the northern end of the Original OfTW Corridor and was fully included in the Original ES assessment.

18. Overall the baseline conditions for the Amended OfTW Study Area are unchanged for the purposes of this assessment.

19. Therefore, there is no change to the benthic receptors or the sensitivity of these receptors.

10.5 ASSESSMENT METHODOLOGY

20. The assessment methodology remains unchanged from that presented in Section 10.2 and Section 22.2 of the Original ES for the Wind Farm and the OfTW respectively.

10.5.1 WORST CASE SCENARIO

10.5.1.1 Wind Farm

21. Disturbance of the seabed will occur during placement of the turbines, offshore substation platforms (OSPs), meteorological masts and associated supports and scour protection, and during the laying of the inter-array cables and associated scour protection.

22. The anticipated disturbance is likely to arise in three main ways each of which is discussed below. These are:

- A 'temporary zone of influence' that has been identified in the Rochdale Envelope (see Section 7: Project Description of the Original ES) as an area of disturbance at each of the installations that extends beyond the permanent zone of influence (the footprint of installations on the sea bed);
- Depressions in the seabed caused by jack-up vessel legs and large anchors associated with installation activities; and
- Ploughing, trenching or jetting activities associated with the laying of inter-array cables.

23. The scenario that gives the largest estimated areas of disturbance is that of 277 turbines supported on gravity bases, gravity bases to the three OSPs, and with an associated 350 km of inter-array cables. For the Wind Farm worst case, the only aspect of disturbance to the benthic environment that is amended from that presented in Section 10: Benthic Ecology of the Original ES is the size of the footprint of the jack-up vessels.

24. Jack-up vessels will be used for placement of gravity bases and other parts of the structures, piling activities, and scour protection. There are typically four to six legs on each vessel, and these will each create temporary depressions in the seabed that have been described and assessed in Section 9: Wind Farm Physical Processes and Geomorphology of the Original ES.

25. As discussed in Section 4: Amended Project Description, two vessel deployments will be required for placement and erection of each turbine and OSP structure.

26. As a result of new information on the size of jack-up legs, outlined in Section 4: Amended Project Description, the pits are each expected to be up to 200 m^2 in area. As previously, they are expected to be composed of largely the same material as was previously present. Initial avalanching of loose sediment around the edges of the pit will leave a flat bottomed depression approximately 16 m diameter at the top and 9.5 m diameter at the base, with a maximum depth of 2 m and to return to being within the natural range for the local bedforms and other bed features over a period of eighteen months to twelve years, not accounting for storm activity. Assuming six legs and two deployments per vessel, the anticipated disturbance due to the jack-up legs over the whole Wind Farm Site has been revised up from 0.101 km^2 (approximately 0.075%) to 0.679 km^2 (approximately 0.517%). This increase is as a result of the increase in area from the larger jack-up legs.

27. The deployments would be spread over an anticipated period of three years, which means that some scour pits are likely to have fully recovered (in terms of both sediment and biota) before others have been created.

28. The disturbed area of seabed for each structure is unchanged and is estimated as 0.562 km^2, or 0.428% of the seabed in the Wind Farm Site. This is assumed mainly to involve disturbance associated with activities such as the seabed preparation that is required for gravity bases in particular, and ancillary disturbance during dumping of rocks or other scour protection.

29. Anchor dredge marks have also been described in Section 9: Wind Farm Physical Processes and Geomorphology of the Original ES. Pits caused by anchors are anticipated to be far smaller than those caused by jack-up legs and expected to fill in over shorter periods, although there will in some cases be additional small scale disturbance caused by the anchor dragging before it bites. The number of deployments required is not known but it is assumed here to be broadly similar to number of jack-up vessel leg deployments, resulting in an affected area far smaller than that of the jack-up legs, assumed here to be approximately 1%, and lasting for shorter periods.

30. In relation to the activities associated with the laying of the inter-array cables, there is no change i.e. disturbed area worst case consists of a trench up to 3 m across following jetting/trenching over the 325 km of the potentially buried cable route (additional adjacent areas will be subject to deposition of sediments suspended during the installation but this was assessed separately). This equates to a disturbed area of 0.975 km^2 or 0.74% of the Wind Farm Site. It should be noted that 50% of this area is already assessed as having been permanently lost beneath rock, or concrete mattresses.

10.5.1.2 OfTW

31. A description of the Amended OfTW Corridor and changes to the cable laying timescales from the Original ES is presented in Section 4: Amended Project Description.

32. The Original ES presented a worst case cable laying and protection scenario of 240 days. Since the submission of the Original ES further information has become

available relating to the construction processes for the Project. Consequently, this ES Addendum has considered a revised worst case cable laying scenario of 140 days per year for three years, plus an additional 90 days per year for cable protection operations. This increases the time on site for these construction vessels and therefore is assessed in terms of the potential effects on benthic ecology in Section 10.6.

10.5.2 MOST LIKELY SCENARIO

10.5.2.1 Wind Farm

33. The most likely scenario for the Wind Farm, as outlined in Section 4: Amended Project Description is for the construction of 140 turbines installed using pin pile foundations with tubular jackets, accompanied by two OSPs. This is a reduction from 277 turbines and three OSPs in the worst case scenario. This would result in a permanent zone of influence on the seabed of 445,585 m^2 (140 turbines, three met masts and two AC OSPs on pin pile foundations). In addition, the jack-up vessels used to install piled foundations are likely to have a total footprint of 900 m^2 per vessel, assuming 150 m^2 per leg for a six legged vessel, compared to 1,200 m^2 per vessel in the worst case. These jack-up vessels would be used at the 145 foundation installations across the Wind Farm Site, assuming two vessels per installation.

10.5.2.2 OfTW

34. The most likely scenario for the Amended OfTW Corridor does not alter the spatial extent of potential effects. Although the maximum depth of the cable trench is 1.7 m rather than the 2.5 m in the worst case scenario, the width remains at 3 m. The installation occurs over a two year period in the most likely scenario rather than three years in the worst case scenario. The most likely scenario in relation to installation time is expected to be 187 days of installation in Year 1, and 100 days of installation in Year 2, resulting in 287 days in total over two years. Additionally, cable protection is anticipated to take 128 days in year one and 64 days in year two, giving a total protection time of 192 days over two years.

10.6 ASSESSMENT OF POTENTIAL EFFECTS

10.6.1 WORST CASE SCENARIO

10.6.1.1 Wind Farm

Construction Phase: Disturbance of the Sea Bed as a Result of Wind Farm Construction

35. The majority of the organisms within each jack-up leg pit are assumed to be killed, whereas with anchor marks this is very unlikely; the majority of animals will simply be displaced, although some infauna may end up exposed at the surface, or buried more deeply than previously, while some epifauna (which are not abundant in the Wind Farm Site) may end up being buried.

36. Exposed animals may or may not be able to rebury before being predated upon. They may also be relocated by water movements but given the relatively uniform nature of the sediments, the majority would be expected to be deposited in areas that are still suitable habitat for them. A proportion of buried animals will survive if they are mobile species (as most are in the majority of the area). Time taken for

pits created by jack-up legs to completely return to the natural bedform variability within the area following disturbance can be expected to be in the period of eighteen months to twelve years, although initial avalanching following removal of the jack-up leg will leave a flat bottomed depression approximately 16 m diameter at the top and 9.5 m diameter at the bottom, with a maximum depth of 2 m, (which is anticipated to be suitable for recolonisation by benthic organisms) quoted in Section 9: Wind Farm Physical Processes and Geomorphology, whereas the anchor marks may be more variable as there may be a variable degree of dragging and associated disturbance before the anchor bites, and associated recovery times are likely to be more rapid.

37. While some, mostly epifaunal, organisms are expected to be killed by the passage of the plough, jet or trenching machinery, the majority will be displaced, of which some, particularly the more mobile fauna, are likely to survive.

38. Affected areas are likely to have a variable degree of reduction in faunal richness and diversity. Faunal communities are likely to recover more rapidly than the timescales quoted for the infilling of the pits or trenches, and is likely to be in the period of a few months to a few years. Due to the sandy nature of most of the area, recovery is expected to be towards the lower end of this range in most cases. Recovery of the faunal communities will start immediately by migration of animals from adjacent areas (Royal Haskoning and Bomel Ltd, 2008), new settlement of larvae, and some regrowth of damaged colonial organisms such as hydroids, bryozoans, sponges and dead man's fingers. Commencement of recovery of the faunal communities will not be dependent upon the complete filling in of any pits or trenches but will proceed in tandem with that process, and some will have recovered completely before others have been created.

39. The PomB biotope is expected to be particularly tolerant of many of these disturbances, and the MedLumVen biotope to be the least tolerant as described in Section 10.3.5 of the Original ES on sensitivities, but even this latter biotope can be expected to recover fully over periods of a few years. Details of the sensitivity and recovery of these biotopes is provided in Section 10.3.5.4 (*PomB*) and Section 10.3.5.3 (*MedLumVen*) of the Original ES. The MoeVen biotope, which is considered to be of high importance, has a high ability to recover from such effects, as outlined in Section 10.3.5.1 of the Original ES. Thus, for all of the benthic communities present, seabed disturbance is considered to be an effect of very small magnitude. Given the elevated (high) importance of the MoeVen biotope due to its consideration as a PMF, the effects on MoeVen are considered to be moderate and therefore likely significant effects in terms of the EIA Regulations, although the high ability of this biotope to recover from such effects (within a six month period (Durkin 2008)) should be noted. For the MedLumVen biotope (medium importance) a negative effect of minor significance, and for the PomB biotope and circalittoral fine sand biotope complex (low importance) a negative effect that is of negligible significance. These effects are therefore not likely significant effects in terms of the EIA Regulations. Thus, the significance of this effect is unchanged from the Original ES.

10.6.2 WORST CASE SCENARIO

10.6.2.1 OfTW

Construction Phase: Disturbance of the Sea Bed as a Result of Cable Laying Processes

40. This assessment focuses on direct effects to benthic habitats and species as a result of OfTW cable installation. Effects will occur from the ploughing, trenching or jetting activities used to lay the cable and from anchors used by the installation vessels.

41. The jetting tool is assessed as being the worst case scenario and the area of zone of effect from the jet tool has been calculated as 12 m² (unchanged from the Original ES). This area of zone of effect is the same for the trenching tool. The percentage of habitat this will affect within each of the identified areas of habitat along the Amended OfTW Corridor has been calculated below in Table 10.2. This was calculated by overlaying the site-specific habitat data with the geophysical data obtained for the Amended OfTW Corridor. Sedimentary boundaries were described and areas calculated using drawn polygons in ArcGIS (v10). Any difference in calculations from that presented Table 22.3 in Section 22.5.1 of the Original ES, are highlighted in bold Table 10.2.

Table 10.2: Approximate Percentage of Habitat Affected by Installation of Cables within the Amended OfTW Corridor

Habitat	Area of Habitat within Amended OfTW Corridor	Area Affected by Installation	Percentage of Habitat within Amended OfTW Corridor Affected
Sand and shell fragments	24,837,933 m² (north end of corridor) **3,710,000m² (additional area in northern part of corridor)** 5,663,631 m² (south end of corridor)	(31,100 x12)x3= 1,119,600 m²	**3.27%** (Original assessment calculation = 3.67%)
Burrowed mud	17,333,887 m²	(16,500 x12)x3= 594,000 m²	3.43%
Encrusted cobble and pebble interspersed with sand	9,095,609 m²	(9000 x12)x3= 324,000 m²	3.56%
Fine sand	2,206,651 m²	(2,100 x12)x3= 75,600 m²	3.43%

(Figures based upon three trenches and a zone of influence of 12 m² for the installation tool)

42. The percentage of habitat directly affected by the OfTW cable installation process is considered as being very low. The percentage of habitat lost is calculated as the percentage of that habitat type directly lost through construction of the cable, from the total amount of that habitat type within the Amended OfTW Corridor. Surveys have identified that these same habitats are also present in adjacent areas outwith the Amended OfTW Corridor, although these have not been quantified and hence are not taken into account in the percentages. The percentages therefore represent

the loss of that habitat type within the Amended OfTW Corridor, but these percentages would be much lower were the extent of the habitat type outwith the Amended OfTW Corridor also quantified, and included in the calculations.

43. The additional area of 3.71 km^2 created as a result of the amendment to the Original OfTW Corridor has resulted in a small decrease in the overall percentage of the sand and shell habitat within the Amended OfTW Study Area being affected by the construction of the cable route, although it should be noted that this isn't a decrease in the overall effect.

44. Physical damage to habitats and species would be experienced with presumed loss of epifauna and infauna from the affected areas. Following the disturbance of the sediments from the cable laying process, the subtidal habitats would be expected to recover with recolonisation of the disturbed sediments occurring via recruitment of macrofaunal species from adjacent undisturbed areas. Once the sediment stabilises, further species would then be expected to colonise allowing the eventual recovery of the biotope. The recovery of these subtidal areas by recruitment from the surrounding biotopes would be expected to be relatively rapid. The area of encrusted cobble towards the inshore end of the Amended OfTW Corridor would experience a greater magnitude of effect than the soft sediment areas which would be expected to recover relatively rapidly, although any seapens within affected areas of the burrowed mud habitat would be expected to be lost.

45. The monitoring programmes at several UK offshore wind farms have been completed e.g. North Hoyle, Rhyl Flats, Burbo Bank (RWEnpower Renewables, DONG Energy). These have all shown that the dominant species present before construction remain common post-construction with sites along export cable routes exhibiting no likely significant adverse effects on the benthic habitats.

46. The effect of cable laying activities is limited to a small area within the Amended OfTW Corridor and the spatial effect is assessed as being within the Amended Study Area. The Original OfTW Study Area has increased marginally to form the Amended OfTW Study Area which has resulted in a decrease in total percentage of habitat affected.

47. The effect of cable laying activities is expected to be temporary due to the rapid installation methods and will affect a limited area of the biotopes (see Table 10.2). The overall magnitude of this effect is therefore assessed as being small. Rapid colonisation by species from undisturbed habitat is expected to occur and the benthic habitats present are likely to recover rapidly and have been assessed as being of low sensitivity. The burrowed mud habitat supporting seapens (as recorded at the centre of the cable route) is identified as a Priority Marine Feature (PMF) and seapens are sensitive to direct physical disturbance. The area of encrusted cobble at the inshore part of the cable may also be potential Annex I habitat of the Habitats Directive. The sensitivity of these receptors has therefore been assessed as being of medium sensitivity. As there is no change in the area of any habitat type lost as a direct result of the amendment to the Original OfTW Corridor, the overall assessment is a negative effect of minor significance, and is therefore not a likely significant effect in terms of the EIA Regulations. This is

unchanged from the original assessment presented in Section 22.5 of the Original ES.

Construction Phase: Effects of Elevated Noise Levels on Benthic Species

48. Marine invertebrates lack the anatomical features of fish or marine mammals which allow them to 'hear'. Instead, marine invertebrates respond to sound stimuli through the use of sensory organs known as chordotonal organs, which are an internal mechanoreceptor. These organs sense pressure, movement, and tension detecting vibrations that may be associated with sound.

49. Sound has few behavioural or physiological effects unless the organisms are very close (within metres) to a powerful noise source such as pile driving or seismic survey. For example, seismic exploration source noise levels are known to be in the order of 250 dB re 1µPa @ 1 m (Richardson et al, 1995) and it has been previously observed that noise sources of this intensity may have an effect upon marine invertebrates within ten metres of the source (McCauley, 1994; Brand and Wilson, 1996). Examples of these effects include polychaete species withdrawing to the bottom of their burrows or retracting their palps into their tubes, and bivalve species withdrawing siphons. The noise generated by the installation of the cables will not exceed noise levels generated by seismic exploration levels which initiate a reaction within tens of metres (cable trenching measured at North Hoyle gave a Source Level of 178 dB re 1 µPa @ 1) (Nedwell et al, 2004). The magnitude of this effect is assessed as being negligible. Noise will be generated intermittently as the OfTW cable installation processes is carried out over a three year period with jetting only occurring for a 150 day period during these three years.

50. The effects of noise generated during the OfTW cable installation are expected to have a negligible magnitude with a highly localised and temporary disturbance to benthic invertebrate species, which have a low sensitivity to this disturbance. This effect is assessed as being of negligible significance. This is unchanged from the Original ES.

10.6.3 CONSIDERATION OF THE MOST LIKELY SCENARIO

10.6.3.1 Wind Farm

51. The most likely scenario involves the construction of 140 turbines on pin pile foundations, compared to the worst case scenario of 277 turbines on the much larger gravity based foundations, a reduction in OSPs from three to two, and the use of jack-up vessels with smaller legs.

52. Most, if not all of the effects on benthos that have been assessed are theoretically likely to be reduced in the most likely scenario compared to the worst case, but only in the case of permanent habitat loss and seabed disturbance are the differences considered to be sufficient to warrant discussion here. The differences arise through the smaller number of foundations, the smaller area of pin pile foundations compared to gravity bases, the reduction in the required distance of inter-array cabling and the smaller footprint of jack-up vessels.

53. Permanent loss of habitat is considerably reduced with the most likely scenario. The estimated total permanent habitat loss beneath turbine foundations and

associated scour protection is greatly reduced at 0.445 km², (0.34% of the Wind Farm Site) compared to a figure of 3.307 km² (2.52%) for the worst case scenario.

54. Due to the smaller total length of inter-array cable required for the most likely scenario, there would also be a reduction in anticipated associated losses due to cable protection from circa 0.4875 km² (0.371% of the Wind Farm Site) in the worst case scenario to circa 0.398 km² (0.31%) (both estimates based conservatively on 50% of cable length requiring protection).

55. Whilst the anticipated losses are considerably reduced under the most likely scenario, the assessment is unchanged.

56. The most likely scenario also entails a number of reductions in likely sediment disturbance compared to the worst case scenario. These would be:

- A greatly reduced temporary zone of influence around each structure during construction through the change in foundation type and number, from circa 0.562 km², (0.428% of the seabed in the Wind Farm Site) for the worst case to circa 0.174 km² (0.132%);
- Reduced disturbance due to jack-up vessel legs and anchors due to the need for deployments at only 140 turbine locations instead of 277, and the use of smaller vessels; from circa 0.665 km² (0.506%of the seabed in the Wind Farm Site) for the worst case as assessed in this ES Addendum, to circa 0.252 km² (0.192%); and
- A reduced amount of disturbance due to cabling activities, due to the shorter total length of inter array cables to be buried or protected where feasible (260 km compared to 325 km), from circa 0.975 km² (0.74% of the seabed in the Wind Farm Site) for the worst case to circa 0.78 km² (0.60%).

57. The overall effect, however, is considered to be very small (as for the worst case scenario), and so the significance of the effects is unchanged compared to the worst case scenario.

10.6.3.2 OfTW

58. Section 9: Physical Processes and Geomorphology of this ES Addendum has suggested a 32% decrease in sediment volume released during the OfTW cable installation under the most likely scenario, resulting in a subsequent 32% decrease in the thickness of any sediment deposition. The assessment of the OfTW for the effect of increased suspended sediments and subsequent deposition from cabling activities on benthic species and habitats was considered to be of minor significance. The most likely scenario is not considered to change this conclusion even though the most likely scenario may result in a reduced effect.

59. Noise will be generated intermittently as the OfTW cable installation processes is carried out over a two year period with jetting only occurring for a 93 day period during these two years. Whilst this represents a shorter timescale, the effects of noise on benthic fauna are considered unlikely to be reduced from the worst case scenario.

10.7 MITIGATION MEASURES AND RESIDUAL EFFECTS

60. Mitigation measures remain unchanged from those outlined in Section 10.5 and Section 22.6.1 of the Original ES.

61. Residual effects remain unchanged from those outlined in Section 10.6 and 22.6.2 of the Original ES.

10.8 ASSESSMENT OF CUMULATIVE EFFECTS

62. Cumulative effects for benthic ecology are presented in Section 10.9 of the Original ES. Cumulative effects remain unchanged from those presented in Section 10: Wind Farm Benthic Ecology of the Original ES with the exception of the increased disturbance to the MoeVen biotope during Wind Farm construction. As this is identified as a likely significant effect as a result of the increased jack-up vessel footprints, it is considered that a likely significant effect could therefore occur with the addition of this to the effects of the Moray Firth Round 3 Zone. However, given the limited extent of MoeVen within the Moray Firth Round 3 Zone, this represents a precautionary approach to this assessment.

10.9 STATEMENT OF SIGNIFICANCE

63. As the findings of the assessment in the Original ES remain unchanged, the statement of significance remains unchanged from that presented in Section 10.10 and Section 22.9 of the Original ES.

10.10 REFERENCES

64. References remain unchanged from those presented in Section 10.11 and Section 22.10 of the Original ES, with the exception of the following further sources:

65. Brand, A.R., Wilson, U.A.W.(1996) *Seismic surveys and scallop fisheries: A report on the impact of a seismic survey on the 1994 Isle of Man queen scallop fishery*. Report to a consortium of oil companies by Port Erin Marine Laboratory, University of Liverpool, Port Erin, Isle of Man.

66. Gardline Geosurvey Ltd (2007) UKCS 12/26c. Polly Rig Site, Habitat Assessment and Environmental Baseline Survey. Survey Report.

67. McCauley, R.D. (1994) *Seismic surveys*. In *Environmental Implications of offshore oil and gas development in Australia- The findings of an Independent Scientific Review*, (eds. J.M. Swan, J.M. Neff, & P.C. Young), Sydney: APEA.

68. Nedwell J R, Langworthy J, Howell D (2004) *Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore windfarms, and comparison with background noise.* Subacoustech Report Reference: 544R0424, November 2004, To: COWRIE, The Crown Estate, 16 Carlton House Terrace, London, SW1Y 5AH

69. Richardson, W.J., Greene, C.R., Malme, C.I. and Thomson, D. (1995) *Marine Mammals and Noise*. Academic press Ltd, London.

70. Royal Haskoning and Bomel Ltd (2008) *Review of cabling techniques and environmental effects applicable to the offshore windfarm industry*. Technical report published by BERR in association with Defra, January 2008.

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