

**Document Release and Authorisation Record** J/1/6/1664 Job No: 12/J/1/06/1664/1354 Report No: 09/017/2012 Date: **Client Name:** Mainstream Renewable Power Ltd Client Contact(s): Zoe Crutchfield QA Name Signature Date 09/07/2012 **Project Manager** Alison Duncan Emma Heywood 09/07/2012 Assistant Project Manager BerEnow Report checked by **Bev Forrow** 09/07/2012 Andy Addleton 09/07/2012 Report authorised by





# **Table of Contents**

## Chapters

Non-Technical Summary

Chapter 1: Introduction

Chapter 2: Climate Change and the Need for the Project

Chapter 3: Regulatory and Policy Context

Chapter 4: Site Selection, Project Alternatives and Design Evolution

Chapter 5: Project Description

Chapter 6: The Approach to Environmental Impact Assessment

Chapter 7: Engagement and Commitments

Chapter 8: Geology and Water Quality

Chapter 9: Physical Processes

Chapter 10: Air Quality

Chapter 11: Nature Conservation

Chapter 12: Ornithology

Chapter 13: Marine Mammals

Chapter 14: Benthic Ecology

Chapter 15: Fish and Shellfish Ecology

Chapter 16: Commercial Fisheries

Chapter 17: Shipping and Navigation

Chapter 18: Military and Aviation

Chapter 19: Maritime Archaeology and Cultural Heritage

Chapter 20: Ordnance

Chapter 21: Seascape, Landscape and Visual Impacts

Chapter 22: Other Users

Chapter 23: Socioeconomics

Chapter 24: Summary of Environmental Impact Assessment

Chapter 25: Summary of Mitigation





## **Figures**

- Figure 1.1: The proposed Neart na Gaoithe offshore development and cable route
- Figure 4.1: Indicative substation locations
- Figure 5.1: Location of Neart na Gaoithe offshore wind farm
- Figure 5.2: Example met mast at Hornsea offshore wind farm (Source: SMart Wind)
- Figure 5.3: Typical floating LiDAR structure with mounted meteorological recording instruments (Source: Subsea World News 2011)
- Figure 5.4: Flow chart illustrating generic foundation installation sequence
- Figure 5.5: Circular hollow concrete gravity base (Source: Gravitas Offshore Ltd)
- Figure 5.6: Cruciform foundation with dimensions of 40 m by 7 m
- Figure 5.7: Components of a circular base gravity base foundation
- Figure 5.8: Dredging vessel suction dredger (Source: DEME Group)
- Figure 5.9: Seabed dredging by grab excavation for gravity base foundation (Source: Strabag Offshore Wind GmbH)
- Figure 5.12: Installation of scour protection around cruciform shaped gravity base foundation (Source: Strabag Offshore Wind GmbH)
- Figure 5.11: Schematic of vessel used for filling gravity base foundation (Source: DEME Group)
- Figure 5.10: Sheerleg barge Taklift transporting substation topside (Picture courtesy of CG. Copyright \*vanoordbv-mennomulder.com)
- Figure 5.13: Typical jacket foundation
- Figure 5.14: Anodes affixed to jacket members (source: Keystone)
- Figure 5.15: Transportation and installation vessel concept (Source: W3G Marine 2012)
- Figure 5.16: Jack-up barge installing seabed template (source: Fugro Seacore)
- Figure 5.17: Rock fragment dispersal process (Source: Fugro Seacore 2012)
- Figure 5.18: Drive-drill-drive installation sequence for each pile (Source: Fugro Seacore 2012)
- Figure 5.19: Grouted pile arrangement (Source: Fugro Seacore 2012)
- Figure 5.20: Components of a typical offshore wind turbine (Source: Siemens Wind Power)
- Figure 5.21: Wind turbine dimensions, adapted from Renew (2011)
- Figure 5.22: Indicative layout A which considers 3.6 MW and 4.1 MW turbines and 4 indicative substation locations (max of 2 will be used)
- Figure 5.23: Indicative layout B which considers 6 MW and 7 MW turbines and 4 indicative substation locations (max of 2 will be used)
- Figure 5.24: General sequence of wind turbine installation
- Figure 5.25: Turbine installation (Source: Repower)
- Figure 5.26: General sequence of substation installation
- Figure 5.27: Installed substation (Pictures courtesy of CG. Copyright ®vanoordbv-mennomulder.com)
- Figure 5.28: Cable plough (Source: Prysmian Group)
- Figure 5.29: Typical 220 kV 3-core subsea cable (Source: Prysmian Group)
- Figure 5.30: Cable lay vessel Giulio Verne (Source: Prysmian Group)
- Figure 5.31: Proposed beach landfall location
- Figure 5.32: Illustration of directional drilling process

- Figure 5.33: Beach excavations tracked excavators and barge mounted excavators (Source ETA Ltd)
- Figure 5.34: Marine growth prevention solutions (Source: FoundOcean Ltd)
- Figure 5.35: Zephyrus offshore support vessel (Source: SeaEnergy Plc)
- Figure 5.36: Example of offshore workboat (Source: Windcat Workboats)
- Figure 5.37: FTOWDG sites
- Figure 5.38: Inch Cape Indicative layout map
- Figure 5.39: Firth of Forth Round 3 Zone 2
- Figure 6.1: Steps within the EIA process
- Figure 6.2: Source-pathway-receptor model
- Figure 6.3: Conceptual EIA process model for screened in effects
- Figure 6.4: Other offshore wind farms planned in the Firths of Forth and Tay area
- Figure 7.1: Mainstream Renewable Power values
- Figure 7.2: Photograph showing community consultation event
- Figure 8.1: Regional bathymetry of proposed wind farm site and cable route. Source: UKHO Admiralty Chart 190
- Figure 8.2: High resolution swath bathymetry of proposed Neart na Gaoithe wind farm and vicinity. Source: EMU, 2009
- Figure 8.3: Bathymetry along proposed Thorntonloch cable route. Source: EMU, 2009
- Figure 8.4: Nearshore swath bathymetry data illustrating the outcropping folded bedrock near the proposed Thorntonloch cable route landing site. Source: EMU, 2009
- Figure 8.5: Regional seabed sediment distribution of proposed wind farm and cable route. Source: EMU, 2009
- Figure 8.6: Distribution and classification of surface sediment samples (based on BGS modified Folk, 1954) overlain on sidescan sonar mosaic from 2009. Sources: Sidescan sonar mosaic (EMU, 2009); Grab sample data (Appendix 14.1: Benthic Ecological Characterisation Survey)
- Figure 8.7: Textural (gravel-sand-mud) distribution of 54 seabed samples from the proposed offshore site. Classification is based on BGS modified Folk (1954). Source: Appendix 14.1: Benthic Ecological Characterisation Survey
- Figure 8.8: Representative seabed sediment photographs. (Left) Sandy gravel and boulders from areas of Wee Bankie, sample no. 35; (Middle) fine to very fine sand, sample no. 33; and (Right) Muddy sand, sample no. 31. Note: the difference between fine/very fine sand and muddy sand is difficult to distinguish visually. Source: Appendix 14.1: Benthic Ecological Characterisation Survey
- Figure 8.9: Interpreted seabed characterisation based on sidescan sonar, swath bathymetry and grab sample data Source: Appendix 14.1: Benthic Ecological Characterisation Survey and EMU, 2009
- Figure 8.10: Sidescan sonar mosaic overlain with seabed grab samples (left) and seabed characterisation (right) of proposed cable route. Source: EMU, 2009 and Appendix 14.1: Benthic Ecological Characterisation Survey
- Figure 8.11: Gravel-sand-mud triplot illustrating the muddy sandy surface of the 12 grab samples collected along proposed cable route. Rock outcrops are not included within this classification. Source: Appendix 14.1: Benthic Ecological Characterisation Survey
- Figure 8.12: Schematic of coastal sediment transport pathways. Source: HR Wallingford, 1998
- Figure 8.13: Regional Quaternary geology
- Figure 8.14: Total Quaternary sediment thickness (including Wee Bankie Formation) for Neart na Gaoithe. Source: EMU,
- Figure 8.15: Seismic (boomer) data example showing infilled valley incised into underlying bedrock. The infill sediments include the Forth and St Abbs Formation, collectively termed soft sediments, and the older underlying Wee Bankie Formation. Source: EMU, 2009





- Figure 8.16: Seismic (boomer) data example from proposed cable route showing Quaternary sediments overlying bedrock. 20 ms in vertical scale represents approximately 16 m. Source: EMU, 2009
- Figure 8.17: Regional solid geology
- Figure 8.18: Seismic (boomer) cross section from north end of the offshore site, showing erosional unconformity between Carboniferous and overlying Permian sedimentary rock. Note: 20 ms approximates to 16 m along vertical scale. Source: EMU. 2009
- Figure 8.19: Seismic (boomer) example of outcropping igneous dykes along southern end of the proposed cable route. The solid geology comprises folded Carboniferous bedrock. Source: EMU, 2009
- Figure 8.20: Regional coastal characterisation, illustrating location of cells and sub cells discussed in text. Source: Ramsey and Brampton, 2000a; Google Earth
- Figure 8.21: Seaward looking photograph of the Tyne Estuary showing forested Sandy Hirst Spit in the centre. Source: Hall, 2011
- Figure 8.22: Locations of designated bathing waters and shellfish waters in the vicinity of Neart na Gaoithe. Source: Scottish Government, 2011b
- Figure 8.23: Cumulative effect of the three offshore wind farm developments on 90th percentile wave height
- Figure 8.24: Cumulative effect of the three offshore wind farm developments to mean spring tide peak flood current speed (m/s)
- Figure 8.25: Cumulative difference in the exceedance of critical shear stress (%) based on the combined (currents plus waves) mean bed shear stress far field
- Figure 9.1: Geographic overview of the regional area of interest and model extents
- Figure 9.2: Metocean (oceanographic) monitoring locations
- Figure 9.3: Modelled 'high-impact' development layout for the Neart na Gaoithe, Inch Cape and Firth of Forth offshore wind farm developments
- Figure 9.4: Water level (m) and current velocity field (m/s) for a mean spring tide across the Neart na Gaoithe offshore wind farm
- Figure 9.5: Significant wave height (m) across the Neart na Gaoithe offshore wind farm
- Figure 9.6: Critical shear stress for entrainment (N/m2) regional (far-field) scale
- Figure 9.7: Critical shear stress for entrainment (N/m2) Neart na Gaoithe offshore wind farm (near-field) scale
- Figure 9.8: Baseline exceedance of the critical shear stress for entrainment (%) due to mean combined bed shear stress at the Neart na Gaoithe site
- Figure 9.9: Exceedance of the critical shear stress for entrainment (%) due to maximum combined bed shear stress at the Neart na Gaoithe site
- Figure 9.10: Regional water level (m) and current velocity field (m/s) for a mean spring tide across the Outer Firths area from the FTMS
- Figure 9.11: Regional significant wave height (m) across the Outer Firths area from the FTMS
- Figure 9.12: Intertidal area
- Figure 9.13: Deposition thickness due to dredging (sea surface release) after all material has settled
- Figure 9.14: Deposition thickness due to dredging (seabed release) after all material has settled
- Figure 9.15: Deposition thickness due to cable trenching Thorntonloch route offshore area: after all disturbed material has settled
- Figure 9.16: Deposition thickness due to cable trenching Thorntonloch route midpoint area: after all disturbed material has settled

- Figure 9.17: Deposition thickness due to cable trenching Thorntonloch route inshore area: after all disturbed material has settled
- Figure 9.18: Difference in mean spring tide high water level (m) due to development near-field
- Figure 9.19: Difference in mean spring tide low water level (m) due to development near-field
- Figure 9.20: Difference in mean spring tide high water level (m) due to development far-field
- Figure 9.21: Difference in mean spring tide peak flood current speed (m/s) due to development near-field
- Figure 9.22: Difference in mean spring tide peak ebb current speed (m/s) due to development near-field
- Figure 9.23: Difference in mean spring tide peak flood current speed (m/s) due to development far-field
- Figure 9.24: Difference in 50-percentile significant wave height (m) due to development near-field
- Figure 9.25: Difference in 99-percentile significant wave height (m) due to development near-field
- Figure 9.26: Difference in 99-percentile significant wave height (m) due to development far-field
- Figure 9.27: Difference in the exceedance of critical shear stress (%) due to development based on the combined (currents plus waves) maximum bed shear stress near-field
- Figure 9.28: Difference in the exceedance of critical shear stress (%) due to development based on the combined (currents plus waves) mean bed shear stress near-field
- Figure 9.29: Difference in the exceedance of critical shear stress (%) due to development based on the combined (currents plus waves) maximum bed shear stress far-field
- Figure 9.30: Suspended sediment concentration due to scouring around gravity bases 6 days after 'commencement'
- Figure 9.31: Suspended sediment concentration due to scouring around gravity bases 13 days after 'commencement'
- Figure 9.32: Deposition thickness due to scouring around gravity bases after all scoured material has settled
- Figure 9.33: Cumulative difference to mean spring tide high water level (m) due to the three developments
- Figure 9.34: Cumulative difference to mean spring tide peak flood current speed (m/s) due to the three developments
- Figure 9.35: Cumulative difference to 90-percentile significant wave height (m) due to the three developments
- Figure 9.36: Cumulative difference to exceedance of critical shear stress (%) due to the three developments based on combined (currents plus waves) maximum bed shear stress
- Figure 10.1: Annual mass emissions of NOX within Neart na Gaoithe and the surrounding area in 2007
- Figure 10.2: Annual mass emissions of SO2 within Neart na Gaoithe and the surrounding area in 2007
- Figure 10.3: Annual mass emissions of CO2 within Neart na Gaoithe and the surrounding area in 2007
- Figure 10.4: 2010 wind rose for RAF Leuchars meteorology site
- Human receptors include other sea users and Neart na Gaoithe offshore staff emissions will not be detectable onshore. The dispersive nature of offshore winds means concentrations of pollutants will return to background levels quickly.
- Figure 11.1: Special Protection Areas with potential connectivity to Neart na Gaoithe
- Figure 11.2: Special Protection Areas with potential connectivity to Neart na Gaoithe (continued)
- Figure 11.3: SACs with connectivity to the Neart na Gaoithe site (Source: SNH, 2010)
- Figure 12.1: Neart na Gaoithe location and study area
- Figure 12.2: Schematic diagram showing how barrier effects were estimated
- Figure 12.3: The hypothetical loss of seabird foraging habitat from the offshore site caused by disturbance from vessels
- Figure 12.4: Monthly estimated numbers of fulmars in the development & buffer areas in years 1 and 2
- Figure 12.5: Monthly estimated numbers of sooty shearwaters in the development & buffer areas in years 1 and 2
- Figure 12.6: Monthly estimated numbers of gannets in the development & buffer areas in years 1 and 2
- Figure 12.7: Monthly estimated numbers of little gulls in the development & buffer areas in years 1 and 2





- Figure 12.8: Comparison of lesser black-backed gull monthly mean abundance in the development & buffer areas in years 1 and 2, with ESAS data from surrounding ICES rectangles and Regional Sea 1
- Figure 12.9: Monthly estimated numbers of herring gulls in the development & buffer areas in years 1 and 2
- Figure 12.10: Monthly estimated numbers of great black-backed gulls in the development & buffer areas in years 1 and 2
- Figure 12.11: Monthly estimated numbers of kittiwakes in the development & buffer areas in years 1 and 2
- Figure 12.12: Comparison of Arctic tern monthly mean abundance in the development & buffer areas in years 1 and 2, with ESAS data from surrounding ICES rectangles and Regional Sea 1
- Figure 12.13: Monthly estimated numbers of guillemots in the development & buffer areas in years 1 and 2
- Figure 12.14: Monthly estimated numbers of razorbills in the development & buffer areas in years 1 and 2
- Figure 12.15: Monthly estimated numbers of puffins in the development & buffer areas in years 1 and 2
- Figure 12.16: Monthly estimated numbers of little auks in the development & buffer areas in years 1 and 2
- Figure 13.1: Neart na Gaoithe study area
- Figure 13.2: Estimated construction periods for potential cumulative and in-combination projects and proposed piling period for Neart na Gaoithe
- Figure 13.3: Harbour porpoise distribution in North Sea and adjacent waters (Source Reid et al., 2003)
- Figure 13.4: Monthly number of harbour porpoises observed from boat-based surveys in year 1 and year 2
- Figure 13.5: Distribution of harbour porpoise observed from boat-based surveys in Year 1 and Year 2
- Figure 13.6: White-beaked dolphin distribution in North Sea and adjacent waters (Source: Reid et al., 2003)
- Figure 13.7: Total number of white-beaked dolphins observed from boat-based surveys
- Figure 13.8: Distribution of white-beaked dolphin from boat-based surveys at Neart Na Gaoithe
- Figure 13.9: Bottlenose dolphin distribution in North Sea and adjacent waters (Source: Reid et al., 2003)
- Figure 13.10: Distribution of bottlenose dolphin in East Grampian (Source: Anderwald and Evans, 2010)
- Figure 13.11: The average proportion of dolphin positive days in each month (+/- SE) for T-pod sites at Arbroath for the entire T-pod deployment period (Source: Quick and Cheney, 2011)
- Figure 13.12: The average proportion of dolphin positive days in each month (+/- SE) for T-pod sites at Fife Ness for the entire T-pod deployment period (Source: Quick and Cheney, 2011)
- Figure 13.13: Minke whale distribution in North Sea and adjacent waters (Source: Reid et al., 2003)
- Figure 13.14: Total number of minke whales recorded in study area each month in Year 1 and Year 2
- Figure 13.15: Distribution of minke whales from boat-based surveys in Year 1 and Year 2
- Figure 13.16: Distribution of unidentified dolphin species from boat-based surveys in Year 1
- Figure 13.17: Distribution of grey seals (a adults, b pups) from colonies in northern and eastern Scotland and northeast England (Source Sparling et al., 2011)
- Figure 13.18: The locations of grey seal adults (a) and pups (b) in theFirth of Forth and Firth of Tay area in 2011 (Source Sparling et al., 2011)
- Figure 13.19: Grey seal density in the Firth of Forth and Firth of Tay area (Source Sparling et al., 2012)
- Figure 13.20: Grey seal density in the Neart na Gaoithe offshore site (Source Gordon, 2012) Figure 13.21: Total number of grey seals recorded from boat-based surveys across two years
- Figure 13.22: Grey seal sightings at Neart Na Gaoithe from boat-based surveys
- Figure 13.23: Firth of Tay and Eden Estuary harbour seal population Source: Sparling et al., 2011)
- Figure 13.24: The locations of tagged adult harbour seals (2001 2008) that have occurred within 100 km of the Firth of Forth and Firth of Tay area (different colours are presented for each individual) (Source: Sparling et al., 2011)

- Figure 13.25: The locations of adult harbour seals in 2001 2008 (a) and in 2011 (b) in the Firth of Forth and Firth of Tay area (Source: Sparling et al., 2011)
- Figure 13.26: Harbour seal density surface in the Firth of Forth and Firth of Tay area (Source: Sparling et al., 2012)
- Figure 13.27: Harbour (common) seals observed at Neart na Gaoithe from boat-based surveys
- Figure 13.28: Total number of harbour seals recorded from boat-based surveys across two years
- Figure 13.29: Summary of the main seasonal sensitivities of the regularly occurring marine mammals in the Firth of Forth and Firth of Tay area
- Figure 13.30: SEL contours based on 'drive only' scenario
- Figure 13.31: Cumulative SEL contours based on 'drive only' scenario
- Figure 13.32: Hearing thresholds of harbour porpoise (Source: Thomsen et al., 2006)
- Figure 13.33: Hearing threshold results for harbour porpoise based on 'drive-drill-drive' scenario of 2.5 m piles
- Figure 13.34: Hearing threshold results for harbour porpoise based on the installation of 3.5 m piles (drive only)
- Figure 13.35: Cumulative noise modelling results for harbour porpoise
- Figure 13.36: Bottlenose dolphin and harbour porpoise hearing thresholds (Source: Kongsberg, 2010)
- Figure 13.37: Noise modelling results for bottlenose dolphin based on 'drive-drill-drive' scenario of 2.5 m piles
- Figure 13.38: Noise modelling results for bottlenose dolphin based on the installation of 3.5 m piles (drive only)
- Figure 13.39: Noise modelling contours from 90 dBht to 70 dBht for bottlenose dolphin based on the installation of 3.5 m piles (drive only)
- Figure 13.40: Firth of Tay developments cumulative noise modelling results for bottlenose dolphin
- Figure 13.41: Noise modelling results for baleen whale based on 'drive-drill-drive' scenario of 2.5 m piles
- Figure 13.42: Noise modelling results for baleen whale based on the installation of 3.5 m piles (drive only)
- Figure 13.43: Hearing thresholds for harbour seals (Source Thomsen et al., 2006)
- Figure 13.44: Noise modelling results for Seals based on 'drive-drill-drive' scenario of 2.5 m piles
- Figure 13.45: Noise modelling results for grey seals based on 'drive only' scenario of 3.5 m piles
- Figure 14.1: Neart na Gaoithe baseline survey array and benthic ecology study area (see Appendix 14.1: Benthic Ecology Survey Report)
- Figure 14.2: MESH predictions of habitats for the Firth of Forth region.
- Figure 14.3: Biotopes identified by the offshore site characterisation.
- Figure 14.4: Sites identified as areas of potential stony or cobble reef (indicated as VP, i.e., Video of Potential cobble reef).
- Figure 14.5: Biotope map for the intertidal area of the export cable route, as characterised from the site specific survey
- Figure 14.6: Predicted MESH habitats within the south east Scotland offshore region.
- Figure 15.1: Survey locations for scientific beam trawl (see Appendix 14.1: Benthic Ecology Characterisation Survey for further information).
- Figure 15.2: Distribution of spawning areas for pelagic species within the study area in the regional context (data from Ellis et al., 2012; Coull et al., 1998).
- Figure 15.3: Distribution of spawning areas for pelagic species within the study area in the national context (data from Ellis et al., 2012; Coull et al., 1998).
- Figure 15.4: Distribution of nursery areas for pelagic species within the study area in a regional context (data from Ellis et al., 2012: Coull et al., 1998).
- Figure 15.5: Distribution of nursery areas for pelagic species within the study area in a national context (data from Ellis et al., 2012; Coull et al., 1998).





- Figure 15.6: Distribution of spawning areas for demersal species within the study area in a regional context (data from Ellis et al., 2012; Coull et al., 1998).
- Figure 15.7: Distribution of spawning areas for demersal species within the study area in a national context (data from Ellis et al., 2012; Coull et al., 1998).
- Figure 15.8: Distribution of nursery areas for demersal species in the study area in a regional context (data from Ellis et al., 2012; Coull et al., 1998).
- Figure 15.9: Distribution of nursery areas for demersal species in the study area in a national context (data from Ellis et al., 2012; Coull et al., 1998).
- Figure 15.10: Distribution of nursery areas for demersal species in the study area in a regional context (data from Ellis et al., 2012; Coull et al., 1998)
- Figure 15.11: Distribution of nursery areas for demersal species in the study area in a national context (data from Ellis et al., 2012; Coull et al., 1998) 15-18
- Figure 15.12: Sandeel catch records (Marine Scotland, 2011a, pers. comm.)
- Figure 15.13: Suitability of sediment within the offshore works area for sandeel, as described in Greenstreet et al. (2010) (see Appendix 14.1: Benthic Ecology Survey Report).
- Figure 15.14: Distribution of breeding areas for elasmobranchs species in the study region (data from Coull et al., 1998; Ellis et al., 2010).
- Figure 15.15: Total herring catch per 30 minutes trawl (Winter 2009)
- Figure 15.16: Total herring catch per 30 minutes trawl (Winter 2010)
- Figure 15.17: Total herring catch per 30 minutes trawl (Winter 2011)
- Figure 15.18: Total juvenile herring catches per 30 minute trawl (Winter 2010)
- Figure 15.19: Total juvenile herring catches per 30 minute trawl (Winter 2011)
- Figure 15.20: Presence of cod within the study area (Marine Scotland 2007, 2008 and 2009 data (Marine Scotland, 2011a, pers. comm.))
- Figure 15.21: Presence of cod during the site specific survey
- Figure 15.22 Distribution of Nephrops spawning grounds within the South coast of Scotland (Coull et al., 1998)
- Figure 15.23 Distribution of Nephrops spawning grounds within the North Sea (Coull et al., 1998)
- Figure 15.24 Distribution of Nephrops nursery grounds within the South coast of Scotland (Coull et al., 1998)
- Figure 15.25 Distribution of Nephrops nursery grounds within the North Sea (Coull et al., 1998)
- Figure 15.26: Megafauna burrows (presumably Nephrops) distribution recorded within the Neart na Gaoithe study area during the site specific survey (EMU, 2009)
- Figure 15.27: Outputs of the noise modelling predictions of herring response to pile driving noise (Subacoustech, 2012) superimposed onto herring nursery grounds (Ellis et al., 2012; Coull et al., 1998).
- Figure 15.28: Outputs of the noise modelling predictions of herring response to pile driving noise (Subacoustech, 2012) superimposed onto herring spawning grounds (Ellis et al., 2012; Coull et al., 1998).
- Figure 15.30: Outputs of the noise modelling predictions of dab response to pile driving noise (Subacoustech, 2012)
- Figure 15.31 Outputs of the noise modelling predictions of salmon response to pile driving noise (Subacoustech, 2012)
- Figure 15.32 Outputs of the noise modelling predictions of trout response to pile driving noise (Subacoustech, 2012)
- Figure 15.33 Outputs of the noise modelling predictions of sandeel response to pile driving noise (Subacoustech, 2012)
- Figure 15.34: Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact ranges for Herring for the installation of simultaneous piles at Neart na Gaoithe and Inch Cape superimposed onto herring spawning grounds (Coull et al., 1998)

- Figure 15.35: Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact ranges for Herring for the installation of simultaneous piles at Neart na Gaoithe and Inch Cape superimposed onto herring nursery grounds (Ellis et al., 2012; Coull et al., 1998)
- Figure 15.36: Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact ranges for Herring for the installation of simultaneous piles at Neart na Gaoithe and Firth of Forth superimposed onto herring spawning grounds (Coull et al., 1998)
- Figure 15.37: Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact ranges for Herring for the installation of simultaneous piles at Neart na Gaoithe and Firth of Forth superimposed onto herring nursery grounds (Coull et al., 1998; Ellis et al., 2012).
- Figure 15.38 Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact ranges for Herring for the installation of simultaneous piles at Neart na Gaoithe, Inch Cape and Firth of Forth superimposed onto herring spawning grounds (Coull et al., 1998)
- Figure 15.39: Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact ranges for Herring for the installation of simultaneous piles at Neart na Gaoithe, Inch Cape and Firth of Forth superimposed onto herring nursery grounds (Ellis et al., 2012; Coull et al., 1998)
- Figure 15.4: Distribution of nursery areas for pelagic species within the study area in a regional context (data from Ellis et al., 2012; Coull et al., 1998).
- Figure 15.40: Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact for Dab for the installation of simultaneous piles at Neart na Gaoithe, Inch Cape and Firth of Forth
- Figure 15.41: Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact for Salmon for the installation of simultaneous piles at Neart na Gaoithe, Inch Cape and Firth of Forth
- Figure 15.42: Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact for sandeel for the installation of simultaneous piles at Neart na Gaoithe, Inch Cape and Firth of Forth
- Figure 15.43: Contour plot showing the estimated 130, 90 and 75 dBht peak to peak impact for Trout for the installation of simultaneous piles at Neart na Gaoithe, Inch Cape and Firth of Forth
- Figure 16.1: Commercial fisheries study area (not including salmon and sea trout fisheries)
- Figure 16.2: Salmon and sea trout fisheries study area
- Figure 16.3: Landings values by species (average 2000-2009) in the national study area (Source: MMO)
- Figure 16.4: Top 20 fishing ports recording landings from ICES rectangle 41E7
- Figure 16.5: Landings values by vessel length (average 2000-2009) in the regional study area (Source: MMO)
- Figure 16.6: Regional Nephrops fishing grounds as identified (through consultation) by a sample of Nephrops fishermen
- Figure 16.7: Satellite tracking (VMS) density (number of position plots) of UK over-15 m vessels in 2009, Nephrops gear only (Source: Marine Scotland)
- Figure 16.8: Commercial landings (including catch locations and weight) of shellfish (Nephrops and scallops) for vessels over 15 m, 2009 (Source: Marine Scotland)
- Figure 16.9: Principal creeling grounds in the regional study area as identified (through consultation) by a sample of creelers
- Figure 16.10: Satellite (VMS) density (no. of position plots) of UK over-15 m vessels in 2009, scallop dredge gear only (Source: Marine Scotland)
- Figure 16.12: Annual reported catch of salmon and sea trout by method (average 2000-2009) (Source: Marine Scotland Science)
- Figure 16.13: Annual catch (no. of individuals) by species in salmon fishery districts within the regional study area (average 2000-2009 (Source: Marine Scotland Science)





- Figure 16.14: Seasonality of the catch (average 2000-2009) by the rod-and-line fishery (including catch and release) (Source: Marine Scotland Science)
- Figure 16.15: Annual variation (2000-2009) of catches by the rod-and-line fishery (including catch and release) (Source: Marine Scotland Science)
- Figure 16.16: Annual net fisheries catch by region (average 2000-2009) and distribution of net fisheries in Scotland (Source: Marine Scotland Science)
- Figure 17.1: Overview of formal safety assessment
- Figure 17.2: Survey vessel tracks within 10 NM of Neart na Gaoithe
- Figure 17.3: Navigational features in proximity to Neart na Gaoithe
- Figure 17.4: AIS and radar tracks by ship type (August to October 2010: 29 days)
- Figure 17.5: Average number of ships per day passing and intersecting Neart na Gaoithe (November 2009 to May 2010)
- Figure 17.6: Coastal AIS survey tracks by ship type (July 2011: 31 days)
- Figure 17.7: Average number of ships per day passing and intersecting Neart na Gaoithe (November 2010 to July 2011)
- Figure 17.8: AIS and radar fishing vessel tracks (August to October 2010: 29 days)
- Figure 17.9: Chart of UK and non UK fishing vessel positions by type (2009)
- Figure 17.10: AIS and radar recreation vessel tracks (August to October 2010: 29 days)
- Figure 17.11: Recreation data for Neart na Gaoithe (RYA, 2010)
- Figure 17.12: MAIB data by type within 10 NM of Neart na Gaoithe
- Figure 17.13: RNLI data (2001-2010) by type within 10 NM of Neart na Gaoithe
- Figure 17.14: SAR helicopter bases relative to Neart na Gaoithe
- Figure 17.15: RNLI bases relative to Neart na Gaoithe
- Figure 17.16: Navigational features relative to the export cable route
- Figure 17.17: AIS data (29 days) relative to the export cable route
- Figure 17.18: Anchored vessels recorded on AIS data (approximately 29 days) relative to the export cable route
- Figure 17.19: Anchored vessels recorded on AIS data November 2010 to July 2011 (approximately 109 days) relative to the export cable route
- Figure 17.20: AIS fishing data (approximately 29 days) relative to Thorntonloch Cable route
- Figure 17.21: AIS recreation data (approximately 29 days during August October 2010) relative to the export cable route
- Figure 17.22: MAIB data (2001 2010) by type within 10 NM of Neart na Gaoithe export cable route
- Figure 17.23: RNLI data (2001 2010) by type within 10 NM of Neart na Gaoithe export cable route
- Figure 17.24: Risk ranking matrix
- Figure 17.25: Detailed plot of survey tracks by ship type on impacted routes (August to October 2010: 29 days)
- Figure 17.26: Current and anticipated mean route positions relative to indicative Layout A
- Figure 18.1: Locations of RAF Leuchars, the proposed wind farm boundary and the RAF Leuchars PAR safeguarding zone
- Figure 18.2: Locations of NERL en-route radars in relation to the proposed wind farm boundary
- Figure 18.3: The location of VTS radar station in the Firth of Forth in relation to the proposed wind farm boundary
- Figure 18.4: Meteorological radar stations
- Figure 18.5: MOD safeguarding map for meteorological radars, also showing the location of the proposed wind farm boundary
- Figure 18.6: Locations of the two closest CAA licensed airports in relation to the proposed wind farm boundary

- Figure 18.7: Location of MCA VHF communications and AIS base stations
- Figure 18.8: European LORAN-C coverage map. The LORAN-C coverage area is shown in grey (Source: LORAN-C, 2011)
- Figure 18.9: Locations of the closest UK DGPS transmitters in relation to the proposed wind farm boundary
- Figure 18.10: Location of the proposed wind farm and the nearest mobile phone base station
- Figure 18.11: Location of Angus and Craigkelly transmitters and the proposed wind farm boundary
- Figure 18.12: Main public broadcast transmitter sites, also showing the location of the proposed wind farm boundary
- Figure 18.13: MOD LFA safeguarding map showing the location of the proposed wind farm boundary
- Figure 18.14: Locations of PEXA in the vicinity of the proposed wind farm. The boundaries of X5613, X5614, X5641, X5642 and D609 are approximate
- Figure 18.15: Location of Neart na Gaoithe and other proposed Firth of Forth wind farms
- Figure 18.16: Estimate of the RAF Leuchars PSR BoC in the vicinity of the proposed Firth of Forth wind farms. The colour shows the minimum detection height, based on radar LoS, in metres AMSL
- Figure 18.17: Proposed wind farms in the Firth of Forth overlaid on UK ATS airspace classifications chart (CAA, 2011)
- Figure 18.18: Simplified side on representation of infill radar
- Chapter 19: Maritime Archaeology and Cultural Heritage
- Figure 19.1: Location of the offshore site and export cable route with study area buffers
- Figure 19.2: Cultural heritage assets within the study area
- Figure 19.3: Wrecks and obstructions from the Seazone dataset in the wind farm site and 1 km buffer
- Figure 19.4: Geophysical anomalies identified in the wind farm site, 1 km buffer
- Figure 19.5: Wrecks and obstructions within the cable corridor
- Figure 19.6: Geophysical anomalies identified in the cable corridor
- Figure 19.7: Location of key onshore receptors (labelled) considered for setting impacts
- Table 19.1: Definition of archaeological potential ratings
- Figure 20.1: Minefields chart for the Neart na Gaoithe site (Source: UKHO)
- Figure 20.2: Armament training area map in 1945 (Source: UKHO)
- Figure 20.3: Modern military practice areas
- Figure 20.4: Wreck locations within the offshore works study area
- Figure 21.1: Guide to levels of significance of landscape and visual impacts
- All other figures in appendix
- Figure 22.1: Study area for other marine users with summary of activity
- Figure 22.2: Sailing activity in relation to the offshore site and export cable route
- Figure 22.3: Recreational watersports and designated bathing waters in the study area
- Figure 22.4: Dive sites and wrecks (Source: SeaZone Solutions and Finstrokes.com)
- Figure 22.5: Mariculture sites in the study area
- Figure 23.1: The study area
- Figure 23.2: Population breakdown, 2009. Source: Mid-year population estimates (ONS, 2011b)
- Figure 23.3: Dependency ratio, 2009. Source: Mid-year population estimates (ONS, 2011b)
- Figure 23.4: Actual and projected population change, 1981 2033. Source: Mid-year population estimates (ONS, 2011b)
- Figure 23.5: Breakdown of employment by industry sector, 2009. Source: Business Register and Employment Survey (ONS, 2011d)





- Figure 23.6: Structure and employment change within the study area, 1998-2008. Source: Annual Business Inquiry employee analysis (ONS, 2011e)
- Figure 23.7: Net change in business stock, 2004-2009. Source: Business Demography 2009 (ONS, 2011f)
- Figure 23.8: JSA claimant rate as a percentage of working age population, January 1992 to March 2011 Source: Claimant count with rates and proportions (ONS, 2011c)
- Figure 23.9: Working age population broken down by level of qualifications, 2009. Source: Annual Population Survey (ONS, 2011a)
- Figure 23.10: Employment in tourism as a % of total employment in the study area, 2008. Source: Annual Business Inquiry (ONS, 2010d)
- Figure 23.11: Predicted study area employment by year low case scenario. Note: Indirect jobs also include induced
- Figure 23.12: Scotland (including study area) predicted employment by year low case scenario. Note: Indirect jobs also includes induced
- Figure 23.13: Predicted study area employment by year high case scenario. Note: Indirect jobs also includes induced
- Figure 23.14: Scotland (including study area) predicted employment by year high case scenario. Note: Indirect jobs also includes induced





#### **Tables**

- Table 1.1: Registered office and contact address for NnGOWL
- Table 2.1: Annual emissions comparison
- Equation 1: Homes supplied
- Table 3.1: Overview of key legislation and consents required for the Neart na Gaoithe offshore works development
- application
- Table 3.2: Scottish territorial water development sites identified in the Plan and respective maximum site capacities
- Table 4.1: Rejected foundation types
- Table 4.2: Wind turbine options following selection against a number of alternatives
- Table 5.1: Site co-ordinates
- Table 5.2: Co-ordinates for centre line of cable corridor
- Table 5.3: Indicative offshore construction schedule
- Table 5.4: Gravity base foundation parameters
- Table 5.5: Maximum anticipated durations of each stage
- Table 5.6: Dimensions for the key design elements of the jacket foundations supporting turbines
- Table 5.7: Jack-up platform details
- Table 5.8: Drill Drive and Drive only scenarios for piling driving noise assessments
- Table 5.9: Turbine specifications
- Table 5.10: Turbine rating against site capacity
- Table 5.11: Maximum estimated turbine oils and fluids volumes
- Table 5.12: Indicative substation locations
- Table 5.13: Offshore substation parameters
- Table 5.14: Summary of major plant items on offshore substation
- Table 5.15: Offshore substation foundation parameters
- Table 5.16: Inter-array cable burial and design parameters
- Table 5.17: Physical specifications of 3-core 220 kV export cable
- Table 5.18: Export cable specification
- Table 5.19: Offshore HVAC cable installation dimensions
- Table 5.20: Co-ordinates of transition pits location
- Table 5.21: Safety zones
- Table 5.22: Option 1 Use of an SOV based strategy
- Table 5.23: Shore based operations
- Table 5.24: Inch Cape Rochdale Envelope (information provided by Inch Cape)
- Table 5.25: Seagreen Rochdale Envelope (information provided by Seagreen)
- Table 6.1: Example Rochdale Envelope scenarios
- Table 6.2: Definitions of impacts
- Table 6.3: Magnitude of effect relative to the project site
- Table 6.4: Vulnerability definitions
- Table 6.5: Level of significance related to magnitude of effect and vulnerability of receptor

- Table 6.6: The process in action
- Table 6.7: Example mitigation and reassessment process for residual environmental impacts
- Table 7.1: Strategic commitments and requirements from the Plan and accompanying HRA and SEA relevant to Neart na
- Gaoithe (Source: Marine Scotland, 2011a, Marine Scotland, 2011b; Marine Scotland, 2011c)
- Table 7.2: Overview of requirements for this ES from the Neart na Gaoithe Scoping Opinion
- Table 7.3: Overview of engagement carried out for specific topics within this ES
- Table 8.1: List of key water quality studies and data sources for the Firth of Forth region
- Table 8.2: List of key bathymetric and geological studies and data sources for the Firth of Forth region
- Table 8.3: Strategic and site level commitments and requirements physical environment
- Table 8.4: Main Quaternary units present within the offshore site and cable route. Source: Gatliff et al., 1994
- Table 8.5: Soft-sediment thicknesses along the proposed export cable route. Source: EMU, 2009
- Table 8.6: Littoral processes and transport within coastal sub cells 1a d and 2a. Source: DECC, 2004
- Table 8.7: Sediment chemistry analysis for the offshore site, coloured cells indicate concentrations that exceed Canadian
- ISQGs. Source: Appendix 14.1: Benthic Ecology Characterisation Survey
- Table 8.8: Standards for coastal and transitional waters under the Bathing Water Directive (76/160/EEC)
- Table 8.9: Impact assessment conclusions for export cable route for impact of accidental spillage (construction) on water quality/designated waters
- Table 8.9: Impact assessment conclusions for impact of export cable installation for coastline (directional drilling)
- Table 8.10 Impact assessment conclusions for export cable route for impact of increased SSC (construction) on water quality/designated waters
- Table 8.10: Impact assessment conclusions for impact of export cable installation on coastline (trenching cable plus rock armouring)
- Table 8.11: Impact assessment conclusions for export cable route for impact of increased SSC (construction) on water quality/designated waters (nearshore)
- Table 8.11: Impact assessment conclusions for impact of export cable installation for coastline (trenching cable plus rock cutting)
- Table 8.12: Impact assessment conclusions for export cable route for impact of increased SSC (operation and maintenance) on water quality/designated waters (nearshore)
- Table 8.12: Impact assessment conclusions for impact of export cable operation on coastline (rock armouring over cables)
- Table 8.13: Impact assessment conclusions for offshore site for impact of contaminated sediment disturbance on water quality/designated waters
- Table 8.13: Mitigation and residual impacts for impact of accidental spillage on water quality/designated waters
- Table 8.14: Impact assessment conclusions for offshore site for impact of accidental discharge on water quality/designated waters
- Table 8.14: Impact assessment summary for geology and water quality
- Table 8.15: Impact assessment conclusions for export cable route for impact of contaminated sediment disturbance (construction) on water quality/designated waters
- Table 9.1: Data sources used in the physical processes assessment
- Table 9.2: Details of metocean survey locations and deployment times
- Table 9.3: Strategic and site level commitments and requirements physical processes
- Table 9.4: Summary of assessment topics and techniques applied





- Table 9.5: Summary of modelled parameters and finalised Rochdale Envelope
- Table 9.6: Summary of inputs for the gravity base preparation impact assessment
- Table 9.7: Summary of particle size distribution information (EMU, 2010a) applied in the modelling of dredged material
- Table 9.8: Summary of particle size distribution information (EMU, 2010a) applied in the cable burial modelling
- Table 9.9: Summary of cable burial modelling inputs
- Table 9.10: Projections applied in the future (changing) climate scenario
- Table 9.11: Summary of predicted near-field, far-field and cumulative changes due to the proposed development(s)
- Table 10.1: Strategic and site level commitments and requirements air quality
- Table 10.2: Rochdale Envelope worst (realistic) case parameters for air quality
- Table 10.3: Magnitude of effect category definitions for air quality
- Table 10.4: Vulnerability of receptor category definitions for air quality
- Table 10.5: Total modelled annual mass emissions within Neart na Gaoithe
- Table 10.6: Firth of Forth visibility data 1981 2010
- Table 10.7: Annual Neart na Gaoithe construction emissions
- Table 10.8: Impact assessment conclusions for construction phase for air quality
- Table 10.9: Annual Neart na Gaoithe operational emissions
- Table 10.10: Equivalent annual emissions for equivalent GWh
- Table 10.11: Impact assessment conclusions for operation and maintenance phase for air quality
- Table 10.12: Annual Neart na Gaoithe decommissioning emissions
- Table 10.13: Impact assessment conclusions for air quality
- Table 11.1: Strategic and site level commitments and requirements Nature Conservation
- Table 11.2: Overview and examples of consultation undertaken for nature conservation topics
- Table 11.2: SPAs with potential connectivity to Neart na Gaoithe
- Table 11.3: SACs near the Neart na Gaoithe offshore works area with potential for connectivity given future development of the site, including connecting features (Sources: JNCC, 2011; SNH, 2010)
- Table 11.4: Natura 2000 sites with connectivity to the Neart na Gaoithe development with additional designations
- Table 11.5: Nature Conservation MPA search features recorded in the Neart na Gaoithe offshore works area or historically recorded in the area (Source: Marine Scotland et al., 2011)
- Table 11.6: Bat species of high vulnerability to the development and information on likely interaction with the project
- Table 12.1: Strategic and site level commitments and requirements
- Table 12.2: Summary of key consultations undertaken on ornithological impacts
- Table 12.3: Relevant assessment scenarios considered during the impact assessment
- Table 12.4: Scales of spatial and temporal magnitude
- Table 12.5: Criteria for assessment of sensitivity of bird populations
- Table 12.6: Determining factors for nature conservation importance
- Table 12.7: Significance criteria used
- Table 12.8: Comparison of seabird numbers in offshore site and buffer area in years 1 and 2 (raw numbers, all sea states)
- Table 12.9: Comparison of non-seabird numbers in offshore site and buffer area in years 1 and 2 (raw numbers, all sea states)
- Table 12.10: Flight heights of birds in the study area in years 1 and 2 (November 2009 to October 2011)

- Table 12.11: The mean estimated number of fulmar present during the breeding period and non-breeding periods, and this value as a percentage of the (at-sea) receptor population potentially at risk of displacement
- Table 12.12: Summary of impacts on the regional breeding population of fulmar
- Table 12.13: The mean estimated number and percentage of the sooty shearwater population potentially at risk of displacement from marine areas during the autumn passage period (August to October)
- Table 12.14: Summary of impacts on the regional autumn passage population of sooty shearwaters
- Table 12.15: The mean estimated number of gannet receptor populations present (on the sea and flying)
- Table 12.16: The effect of collision risk modelling predicted collision mortality on the adult mortality rate (AMR) of the regional breeding gannet population
- Table 12.17: Summary of impacts on the regional population of gannets in the breeding season
- Table 12.18: Summary of impacts on the regional population of gannets in the non-breeding season
- Table 12.19: Summary of cumulative impacts for the three proposed offshore wind farms in south-east Scotland on the regional population of breeding gannet based on most adverse turbine arrays.
- Table 12.20: The mean estimated number and percentage of the at-sea little gull population potentially at risk of displacement from marine areas during the post-breeding/passage (August to October)
- Table 12.21: The indicative effect of CRM predicted collision mortality on the adult mortality rate (AMR) of little gull populations. Results are presented for most adverse (128 x 3.6 MW turbines) and the least adverse (64 x 7 MW turbines) wind farm designs evaluated, and for two values of overall avoidance rate (OAR)
- Table 12.22: Summary of impacts on the regional autumn passage population of little gull
- Table 12.23: Summary of CIA for the three proposed offshore wind farms in south-east Scotland on the regional autumn passage population of little gull
- Table 12.24: The mean estimated number of lesser black-backed gull present (on the sea and flying) during the breeding period (attending colonies, April to August), and this value as a percentage of the (at-sea) receptor population potentially at risk of displacement
- Table 12.25: The effect of CRM predicted collision mortality on the adult mortality rate (AMR) of the regional breeding lesser black-backed gull population
- Table 12.26: Summary of impacts on the regional population of lesser black-backed gulls in the breeding season
- Table 12.27: Summary of CIA for the three proposed offshore wind farms in south-east Scotland on the regional population of breeding lesser black-backed gull
- Table 12.28: The mean estimated number of herring gull present during the breeding period and the non-breeding period, and the value as a percentage of the (at-sea) receptor population potentially at risk of displacement
- Table 12.29: The effect of CRM predicted collision mortality on the adult mortality rate (AMR) of the regional breeding herring gull population
- Table 12.30: Summary of impacts on the regional breeding population of herring gull
- Table 12.31: Summary of cumulative impacts for the three proposed offshore wind farms in south-east Scotland on the regional population of breeding herring gull
- Table 12.32: The mean estimated number of great black-backed gulls present during the breeding period and the non-breeding period, and the value as a percentage of the (at-sea) receptor population potentially at risk of displacement
- Table 12.33: The effect of CRM predicted collision mortality on the adult mortality rate (AMR) of the regional breeding great black-backed gull population
- Table 12.34: Summary of impacts on the regional breeding population of great black-backed gull
- Table 12.35: Summary of cumulative impacts for the three proposed offshore wind farms in south-east Scotland on the regional population of breeding great black-backed gull across the whole year





- Table 12.36: The mean estimated number of kittiwake present (on the sea and flying)
- Table 12.37: The effect of CRM predicted collision mortality on the adult mortality rate (AMR) of the regional breeding kittiwake population
- Table 12.38: Summary of impacts on the regional breeding population of kittiwake
- Table 12.39: Summary of cumulative impacts for the three proposed offshore wind farm in south-east on the regional population of breeding kittiwake
- Table 12.40: The mean estimated number and percentage of the Arctic tern population potentially at risk of displacement from marine areas during the autumn passage period (August September)
- Table 12.41: Summary of impacts on the regional autumn passage population of Arctic terns
- Table 12.42: Summary of CIA for the three proposed offshore wind farms in south-east Scotland on the regional autumn passage population of Arctic tern
- Table 12.43: The mean number of guillemot present in the offshore site and 1 km buffer in each period of the year and this figure expressed as the percentage of the (at-sea) receptor population. (The periods are defined as follows: colony attendance, April to June; chicks-on-sea, July and August; post-breeding, September and October; and winter, November to March)
- Table 12.44: Summary of impacts on the regional population of guillemots in the breeding season
- Table 12.45: Summary of impacts on the regional population of guillemots in the post-breeding and non-breeding periods
- Table 12.46: Summary of CIA for the three proposed offshore wind farms in south-east Scotland on the regional population of breeding guillemot
- Table 12.47: The mean number of razorbill present in the offshore site and 1 km buffer in each period of the year and this figure expressed as the percentage of the (at-sea) receptor population
- Table 12.48: Summary of impacts on the regional breeding population of razorbill
- Table 12.49: Summary of impacts on the regional post-breeding and non-breeding period populations of razorbill
- Table 12.50: Summary of CIA for the three proposed offshore wind farms in southeast Scotland on the regional population of breeding razorbill
- Table 12.51: The mean number of puffin present in the offshore site and 1 km buffer in each period of the year and this figure expressed as the percentage of the (at-sea) receptor population. (The periods are defined as follows: colony attendance, April to August; post-breeding, September and October; and winter, November to March.)
- Table 12.52: Summary of impacts on the regional population of puffins in the breeding and post-breeding periods
- Table 12.53: Summary of cumulative displacement effects on the regional puffin population
- Table 12.54: The mean estimated number and percentage of little auk populations potentially at risk of displacement from marine areas during the non-breeding period (November to February)
- Table 12.55: Summary of impacts on the regional wintering population of little auk
- Table 12.56: Summary of CIA for the three proposed offshore wind farms in south-east Scotland on the regional population of little auks in the non-breeding (winter) period
- Table 12.57: Predicted number of collisions per year for 15 species of geese and waders
- Table 13.1: Summary of national and international legislation and guidance relevant to marine mammals
- Table 13.2: Favourable Conservation Status (FCS) used in this assessment
- Table 13.3: SACs with qualifying Annex II species that could potentially be affected by the Neart na Gaoithe development (JNCC, 2010b)
- Table 13.4: Survey effort for the study area in Year 1 and Year 2
- Table 13.5: Strategic and site level commitments and requirements

- Table 13.6: Summary of non Forth and Tay Offshore Wind Developers Group consultation undertaken on marine mammals
- Table 13.7: Rochdale Envelope used to assess the potential impacts on marine mammals
- Table 13.8: Definition of magnitude of effect
- Table 13.9: Vulnerability of receptor
- Table 13.10: Significance of impact definitions for marine mammals
- Table 13.11: Comparison of marine mammal numbers in the offshore site and buffer area in Year 1 (all sea states)
- Table 13.12: Comparison of marine mammal numbers in offshore site and buffer area in Year 2 (all sea states)
- Table 13.13: Numbers of marine mammals recorded in the offshore site in Year 1
- Table 13.14: Numbers of marine mammals recorded in the buffer area in Year 1
- Table 13.15: Numbers of marine mammals recorded in the offshore site in Year 2
- Table 13.16: Numbers of marine mammals recorded in the buffer area in Year 2
- Table 13.17: Visual sightings, acoustic detections and density estimates for harbour porpoise (Source: Gordon, 2012)
- Table 13.18: Grey seal pup production estimates for breeding colonies on the northeast coast of England and southeast coast of Scotland for the last decade (Source: Sparling et al., 2011)
- Table 13.19: Total counts of grey seals hauled-out during monthly aerial surveys in April-September 2008 (Source: Sparling et al., 2011)
- Table 13.20: The number of harbour seals counted on the southeast coast of Scotland (Sparling et al., 2011)
- Table 13.21: Minimum estimates of the UK harbour seal population from most recent surveys in each seal management area (Sparling et al., 2011)
- Table 13.22: The number of harbour seals in the Firth of Forth and Eden Estuary SAC since 2000 (Source: Sparling et al., 2011)
- Table 13.23: Source level noises from pile driving activities at offshore wind farms
- Table 13.24: Operating noise recorded at offshore wind farms (Source: Nedwell et al., 2007a)
- Table 13.25: Sound exposure levels for cetaceans and pinnipeds (Source: Southall et al., 2007)
- Table 13.26: Main prey items for marine mammals recorded within the study area
- Table 13.27: Significance of potential impacts on cetaceans from electromagnetic fields
- Table 13.28: 'Drive-drill-drive' and 'drive only' jacket foundation installation scenarios at Neart na Gaoithe
- Table 13.29: Auditory exposure criteria for marine mammals (Source: Southall et al., 2007)
- Table 13.30: Potential area of cumulative impact at which PTS may occur basedon M-weighted SEL modelling
- Table 13.31: Outputs from noise modelling undertaken for Neart na Gaoithe
- Table 13.32: Cumulative impact outputs from noise modelling undertaken for Neart na Gaoithe based on 'drill-drive-drill' scenario
- Table 13.33: 'Drive-drill-drive' scenario predicted piling duration for each jacket foundation with drilling requirements
- Table 13.34: 'Drive only' scenario predicted piling duration without drilling requirements
- Table 13.35: Hearing ability of harbour porpoise (Source: Thomsen et al., 2006)
- Table 13.36: Significance of potential impacts on harbour porpoise from pile driving
- Table 13.37: Predicted number of harbour porpoises displaced from pile driving operations
- Table 13.38: Significance of potential impacts on harbour porpoise from operating noise
- Table 13.39: Significance of potential impacts on harbour porpoise from vessel noise
- Table 13.40: Significance of potential cumulative impacts on harbour porpoise from operating noise





- Table 13.41: Predicted number of harbour porpoises cumulatively impacted from pile driving operations
- Table 13.42: Predicted number of white-beaked dolphin impacted from pile driving operations
- Table 13.43: Significance of potential impacts on white-beaked dolphin from pile driving
- Table 13.44: Significance of potential impacts on white-beaked dolphin from operating noise
- Table 13.45: Significance of potential impacts on white-beaked dolphin dolphin from vessel noise
- Table 13.46: Significance of potential cumulative impacts on white-beaked dolphin from construction
- Table 13.47: Significance of potential impacts on bottlenose dolphin from pile driving
- Table 13.48: Significance of potential impacts on bottlenose dolphin from operating noise
- Table 13.49: Significance of potential impacts on bottlenose dolphin from vessel noise
- Table 13.50: Significance of potential cumulative impacts on bottlenose dolphin from pile driving
- Table 13.51: Predicted number of bottlenose dolphin cumulatively impacted by Forth of Tay developments from pile driving operations
- Table 13.52: Significance of potential impacts minke whale from pile driving
- Table 13.53: Predicted number of minke whale impacted from pile driving operations
- Table 13.54: Significance of potential impacts on minke whale from operating noise
- Table 13.55: Significance of potential impacts on minke whale from vessel noise
- Table 13.56: Significance of potential cumulative impacts minke whale from pile driving
- Table 13.57: Significance of potential impacts on harbour seals from pile driving
- Table 13.58: Significance of potential cumulative impacts on harbour seals from pile driving
- Table 13.59: Predicted number of grey seals displaced from pile driving operations
- Table 13.60: Significance of potential impacts on grey seals from pile driving
- Table 13.61: Significance of potential cumulative impacts on grey seals from pile driving
- Table 13.62: Significance of potential impacts on seals from vessel noise
- Table 13.63: Significance of potential impacts on marine mammals from drilling noise
- Table 13.64: Significance of potential impacts on marine mammals from vessel collisions
- Table 13.65: Significance of potential impacts on seals from impacts with ducted propellers
- Table 13.66: Significance of potential impacts on cetaceans from cable laying
- Table 13.67: Summary of potential marine mammal impacts and mitigation
- Table 14.1: Strategic and site level commitments and requirements
- Table 14.2: Rochdale Envelope worst (realistic) case parameters for benthic ecology
- Table 14.3: Magnitude of effect (modified categories from Wilhelmsson et al., 2010).
- Table 14.4: Assessment of receptor vulnerability (modified categories from MarLIN, 2011)
- Table 14.5: Cumulative (other developments) Rochdale Envelope worst (realistic) case parameters for benthic ecology
- Table 14.6: Species of conservation importance recorded by the site specific grab sampling survey at Neart na Gaoithe
- Table 14.7: Intertidal habitat overview for the Thorntonloch cable route landfall
- Table 14.8: Impact assessment of direct habitat disturbance from construction on biotopes in the offshore site
- Table 14.9: Impact assessment of increase in SSC and sediment settlement from construction on biotopes in the offshore site
- Table 14.10: Impact assessment of habitat disturbance from construction on biotopes in the export cable route (subtidal)

- Table 14.11: Impact assessment of increased SSC and sediment settlement/smothering from construction on biotopes in the export cable route (subtidal)
- Table 14.12: Impact assessment of habitat disturbance from construction on biotopes in the export cable route (intertidal)
- Table 14.13: Impact assessment of increased SSC and sediment settlement/smothering from construction on biotopes in the export cable route (intertidal)
- Table 14.14: Impact assessment of habitat loss in the operational stage of the offshore site on benthic ecology
- Table 14.15: Impact assessment of change in hydrodynamic conditions in the operational stage of the offshore site on benthic ecology
- Table 14.16: Impact assessment of introduction of new substrate in the operational stage of the offshore site on benthic ecology
- Table 14.17: Impact assessment of permanent habitat loss in the operational stage of the export cable route on benthic ecology
- Table 14.18: Impact assessment of introduction of new substrate in the operational stage of the export cable route on benthic ecology
- Table 14.19: Impact assessment of EMF in the operational stage of the export cable route on benthic ecology
- Table 14.20: Impact assessment of heating effects in the export cable route during operation for benthic ecology
- Table 14.21: Summary of the impact assessment, mitigation and cumulative impact assessment
- Table 15.1: Summary of major data sources reviewed
- Table 15.2: Strategic and site level commitments and requirements
- Table 15.3: Rochdale Envelope worst (realistic) case parameters for the fish and shellfish ecology receptors
- Table 15.4: Magnitude of effect parameters in relation to fish and shellfish ecology (modified from Wilhelmsson et al., 2010 to incorporate additional characteristics).
- Table 15.5: Vulnerability of receptor parameters for fish and shellfish ecology (modified from MarLIN, 2011 to incorporate additional characteristics)
- Table 15.6: Cumulative (other developments) Rochdale Envelope worst (realistic) case parameters for fish and shellfish ecology receptors
- Table 15.7: Seasonal sensitivities and conservation importance for key pelagic species
- Table 15.8: Seasonal sensitivities and conservation importance for key demersal species
- Table 15.9: Seasonal sensitivities and conservation importance for key elasmobranch species
- Table 15.10: Seasonal sensitivities and conservation importance for key diadromous species
- Table 15.11: Summary of ecological aspects of fish and shellfish species of the southeast Scotland region
- Table 15.12: Impact assessment of direct habitat disturbance from construction on fish and shellfish populations in the offshore site
- Table 15.13: Impact assessment of increase in SSC from construction on fish and shellfish populations in the offshore site
- Table 15.14: Impact assessment of increased sediment settlement/smothering from construction on fish and shellfish populations in the offshore site
- Table 15.15 Impact assessment of piling installation of jacket foundations in the offshore site on fish and shellfish populations
- Table 15.16: Impact assessment of physical habitat disturbance during construction of the export cables route on fish and shellfish populations
- Table 15.17: Impact assessment of increased SSC, sediment settlement and smothering during construction of the export cables route on fish and shellfish populations





- Table 15.18: Impact assessment of permanent habitat loss in the offshore site during operation for fish and shellfish populations
- Table 15.19: Impact assessment of change in hydrodynamic regime in the offshore site during operation for fish and shellfish populations
- Table 15.20: Impact assessment of new substrates in the offshore site during operation for fish and shellfish populations
- Table 15.21: Impact assessment of operational noise in the offshore site during operation for fish and shellfish populations
- Table 15.22: Impact assessment of heating effects in the export cables route during operation for fish and shellfish populations
- Table 15.23: Impact assessment of EMF in the export cables route during operation for fish and shellfish populations
- Table 15.24: Summary of fish and shellfish impacts
- Table 16.1: Strategic and site level commitments and requirements commercial fisheries
- Table 16.2: Summary of worst (realistic) case parameters for commercial fisheries
- Table 16.3: Characteristic parameters for magnitude of effect relevant to commercial fisheries receptors
- Table 16.4: Characteristic parameters for vulnerability of receptor relevant to commercial fisheries receptors
- Table 16.5: Inch Cape offshore wind farm development parameters
- Table 16.6: Annual variation in net-and-coble and fixed engines catch (no. of individuals, all species combined) by districts (districts with no reported catches for the period 2000-2009 have been omitted in this table) (Source: Marine Scotland Science)
- Table 16.6: Firth of Forth Round 3 Zone 2 wind farm development parameters
- Table 16.8: Impact assessment conclusions for construction phase for fish and shellfish receptors
- Table 16.8: Impact assessment conclusions for construction phase for fish and shellfish receptors (continued).
- Table 16.8: Impact assessment of complete loss or restricted access to fishing grounds during construction
- Table 16.9: Impact assessment of displacement of fishing vessels into other areas during construction
- Table 16.9: Impact assessment of increased steaming times to fishing grounds during construction
- Table 16.9: Impact assessment of interference with fishing activities during construction
- Table 16.12: Impact assessment conclusions of operation and maintenance phase on fish and shellfish species
- Table 16.13: Impact assessment of complete loss or restricted access to fishing grounds during operation and maintenance
- Table 16.13: Impact assessment of interference with fishing activities during operation and maintenance
- Table 16.14: Impact assessment of increased steaming times to fishing grounds during operation and maintenance
- Table 16.15: Impact assessment of interference with fishing activities during operation and maintenance
- Table 16.19: Summary of impact assessment for commercial fisheries
- Table 17.1: Strategic and site level commitments and requirements
- Table 17.2: Definition of the impact on shipping and navigation
- Table 17.3: Definition of terms relating to the vulnerability of shipping and navigation
- Table 17.4: Risk matrix description
- Table 17.5: Mitigation measures
- Table 17.6: Summary of impacts, mitigation and residual impact on shipping and navigation (construction, operation and decommissioning phases)
- Table 17.7: Shipping and navigation summary significance table (receptor specific)
- Table 18.1: Rochdale Envelope worst (realistic) case parameters for military and aviation
- Table 18.1: Strategic and site level commitments and requirements military and aviation

- Table 18.10: Summary significance table (receptor specific)
- Table 18.2: Identification of receptor
- Table 18.3: PEXA details
- Table 18.4: Summary of the military and civil passage systems being taken forward to assessment
- Table 18.5: Impact assessment conclusions of construction phase on military and civil radar
- Table 18.6: Impact assessment conclusions of construction phase on telecommunications
- Table 18.7: Impact assessment conclusions of construction phase for physical obstructions to aviation
- Table 18.8: Impact assessment conclusions of construction phase for military practice areas
- Table 18.9: Example mitigation and reassessment process
- Table 19.1: Definition of archaeological potential ratings
- Table 19.2: Strategic and site level commitments and requirements Maritime Archaeology and Cultural Heritage
- Table 19.3: Description of impacts considered to act upon cultural heritage assets
- Table 19.4: Cultural heritage 'worst (realistic) case' parameters for the offshore site and cable corridor
- Table 19.5: Magnitude of effect criteria for cultural heritage assets
- Table 19.6: Vulnerability of cultural heritage assets
- Table 19.7: Magnitude of an effect on the setting of a cultural heritage asset
- Table 19.8: Vulnerability of a cultural heritage asset to effects on setting
- Table 19.9: Matrix of overall significance
- Table 19.10: Cultural heritage receptors taken forward for assessment
- Table 19.11: Receptor specific assessment outputs
- Table 19.12: Impact assessment cable route construction phase
- Table 19.13: Impact assessment site known sites and geophysical anomalies operation and maintenance phase
- Table 19.14: Impact assessment cable route known sites and geophysical anomalies operation and maintenance
- Table 19.15: Impact assessment setting operation and maintenance phase
- Table 19.16: Impact assessment setting operation and maintenance phase
- Table 19.16: Receptor specific assessment output
- Table 19.17: Impact assessment setting operation and maintenance phase
- Table 19.18: Impact assessment setting operation and maintenance phase
- Table 19.19: Impact assessment setting operation and maintenance phase
- Table 19.20: Impact assessment setting operation and maintenance phase
- Table 19.21: Impact assessment setting operation and maintenance phase
- Table 19.22: Impact assessment setting operation and maintenance phase
- Table 19.23: Impact assessment setting operation and maintenance phase
- Table 19.24: Impact assessment setting operation and maintenance phase
- Table 19.25: Impact assessment setting operation and maintenance phase
- Table 19.26: Impact assessment setting operation and maintenance phase
- Table 19.27: Mitigation and reassessment process
- Table 21.1: Strategic and site level commitments and requirements seascape and visual impacts
- Table 21.2 Turbine options within the Rochdale Envelope
- Table 21.3: Assessment scenarios







Table 21.4: Magnitude of effect: seascape/landscape

Table 21.5: Magnitude of effect: visual resources

Table 21.6: Sensitivity of seascape/landscape resources

Table 21.7: Sensitivity of visual resources

Table 21.8: Magnitude of cumulative effect: seascape/landscape

Table 21.9: Magnitude of cumulative effect: visual resource

Table 21.10: Regional Seascape Units

Table 21.11: Landscape Character Types

Table 21.12: Landscape Designations

Table 21.13: Assessment viewpoints

Table 21.14: Impacts on seascape character

Table 21.15: Impacts on landscape character

Table 21.16: Impacts on landscape designations

Table 21.17: Viewpoint assessment summary

Table 21.18: Summary table of seascape and landscape impacts

Table 21.19: Summary table of visual impacts

Table 22.1: Strategic and site level commitments and requirements – other marine users

Table 22.2: Magnitude of effect category definitions for other users

Table 22.3: Vulnerability of receptor category definitions for other users

Table 22.4: Shellfish production areas and classifications in the study area

Table 22.6: Effects screened in for the impact assessment and related receptors

Table 22.7: Impact assessment conclusions for construction phase of offshore site for installation of offshore structures

Table 22.8: Impact assessment conclusions for construction phase of offshore site for installation of new structures

Table 22.9: Impact assessment conclusions for construction phase of offshore site for construction safety zones

Table 22.10: Impact assessment for construction phase for export cable route (offshore environment) for other users

Table 22.11: Impact assessment conclusions for construction phase of export cable route for cable installation

Table 22.12: Impact assessment conclusions for construction phase of export cables (coastal) for other users

Table 22.13: Impact assessment conclusions for other impacts associated with export cable installation (coastal)

Table 22.14: Impact assessment conclusions for operation and maintenance phase for offshore site

Table 22.15: Impact assessment summary for other marine and coastal users

Table 23.1: Strategic and site level commitments and requirements – socioeconomics

Table 23.2: Phase and sub-phase of development

Table 23.3: Definitions of impact

Table 23.4: Population estimates for the Study Area and Scotland, 2009. Source: Mid-year population estimates (ONS, 2011b)

Table 23.5: Consultation findings. Source: Consultation exercise stakeholders

Table 23.6: Proportion of spend by geography for low case – Mainstream Renewable Power

Table 23.7: Proportion of spend by geography for high case - Mainstream Renewable Power

Table 23.8: Present Value of Gross GVA impacts over project lifetime (£ millions, 2011 prices) – low and high case scenarios

Table 23.9: Receptor specific assessment outputs - GVA

Table 23.10: Predicted employment impacts over project lifetime (job years) – low and high case scenarios

Table 23.11: Receptor specific assessment outputs - Employment

Table 23.12: Summary of findings from consultation exercise on tourism carried out in 2012

Table 23.13: Summary of findings from desk review

Table 23.14: Summary significance table (receptor specific)

Table 23.15: Summary assessment table (receptor specific)

Chapter 24: Summary of Environmental Impact Assessment

Table 25.1: Management plans anticipated for Neart na Gaoithe

Table 25.2: Anticipated consent conditions

Table 25.3: Commercial fishing mitigation

Table 25.4: Shipping and navigation mitigation

Table 25.5: Radar and military mitigation

Table 25.6: Summary of mitigation and monitoring





## **Appendices**

Appendix 6.1: Scoping Opinion

Appendix 6.2: Scottish Territorial Waters Offshore Wind Farms – East Coast –Discussion Document – Cumulative Effects

Appendix 6.3: Scottish Offshore Wind Farms - East Coast - Discussion Document - Approach to Cumulative Effects

Assessment

Appendix 7.1: Consultation and Meeting Log

Appendix 7.2: PACC report

Appendix 8.1: Shellfish and Bathing Water Quality Information

Appendix 9.1 - Data Gap Analysis and Data Review

Appendix 9.2 – Hydrodynamic and Spectral Wave Model Calibration and Validation

Appendix 9.3 – Physical Processes Technical Report

Appendix 9.4 - Proposed Methodology for Metocean and Coastal Processes Assessments

Appendix 9.5 – Stakeholder Consultation

Appendix 9.6 – Regional Baseline Description

Appendix 11.1: Nature Conservation Agreements and Conventions

Appendix 11.2: Special Protection Areas with connectivity to Neart na Gaoithe

Appendix 11.3: Overview of Potential Impacts on Bats

Appendix 12.1: Ornithology Technical Report

Appendix 12.2: Statistical Report

Appendix 13.1: Noise Model Technical Report

Appendix 13.2: SMRU Ltd Report - SAFESIMM Report

Appendix 13.3: SMRU Ltd Report – Bottlenose dolphins baseline

Appendix 13.4: SMRU Ltd Report – Seal Characterisation

Appendix 13.5: Acoustic and visual surveys

Appendix 13.6: SMRU Aerial Survey

Appendix 14.1: Benthic Ecology Characterisation Survey

Appendix 14.2: Preliminary Assessment of Coarse Sediment Habitats

Appendix 16.1: Commercial Fisheries Baseline Technical Report

Appendix 16.2: Salmon and Sea Trout Fisheries Baseline Technical Report

Appendix 17.1: Neart na Gaoithe Offshore Wind Farm – Navigation Risk Assessment

Appendix 17.2: Hazard Log Review Report

Appendix 17.3: Consequences Assessment Report

Appendix 17.4: Neart na Gaoithe Offshore Wind Farm MGN 371 Checklist

Appendix 17.5: Hazard Log Review Minutes

Appendix 17.6: FTOWDG Regional Shipping Review

Appendix 18.1: Military and Aviation Technical report

Appendix 18.2: Aviation Lighting and Marking Requirements

Appendix 19.1: Maritime Archaeology and Cultural Heritage Technical Report

Appendix 19.2: Gazetteer and Concordance

Appendix 20.1: Unexploded Ordnance Report

Appendix 21.1: Seascape, Landscape and Visual Impacts Technical Report

Appendix 21.2: Seascape, Landscape and Visual Impacts Assessment Figures

Appendix 21.3: Regional Seascape Character Assessment

Appendix 21.4: Regional Seascape Character Areas

Appendix 22.1: Other Users Consultation Log.

Appendix 23.1: Socioeconomic Technical Report





## Glossary

BIS UK Department for Business, Innovation and Skills Appropriate Assessment AA **BMAPA** British Marine Aggregate Producers Association Anti-Aircraft Artillery AAA **BMEWS** Ballistic Missile Early Warning System ACP Airspace change process BoC Base of Cover ΑD Air Defence BODC British Oceanographic Data Centre ADS Archaeology Data Service BOP Balance of plant AIS **Automatic Identification System** BP Before present **AGDS Acoustic Ground Discrimination System** BRE **Buildings Research Establishment** AHD **Acoustic Harassment Device** BSF Below sea floor Abnormal Indivisible Loads AILBTO **British Trust for Ornithology** AIS **Automatic Identification System** BTU **British Thermal Units** ALARP As low as reasonably practical **BWEA** British Wind Energy Association (now RenewableUK) ALB All Weather Lifeboat CA **Cruising Association AMSL** Above Mean Sea Level Civil Aviation Authority CAA ANSP Air Navigation Service Providers CAPEX Capital Expenditure AON **Apparently Occupied Nests** CBD Convention on Biodiversity **AONB** Area of Outstanding Natural Beauty  $CCI_4$ Chemical symbol for carbon tetrachloride AoS Area of Search CCS Carbon Capture and Storage AOS **Apparently Occupied Sites** CCTV **Closed Circuit Television AQMA** Air Quality Management Area CD **Chart Datum** ARPA **Automatic Radar Plotting Aid** CDM Construction, Design and Management Regulations AST **Atlantic Salmon Trust** CEC **Crown Estate Commission ASFB** Association of Salmon Fisheries Board Cefas Centre for Environment, Fisheries and Aquaculture Science ATBA Area to be avoided CEMP Construction and Environmental Management Plan ATC Air Traffic Control CEO **Chief Executive Officer ATCO** Air Traffic Control Officer CERT **Carbon Emissions Reduction Target**  $\mathsf{AWACs}$ **Acoustic Doppler Wave and Current Profilers**  $CH_4$ Chemical symbol for methane **AWACS** Airborne Warning and Control System **CMACS** Centre for Marine and Coastal Studies BAA **British Airports Authority**  $CO_2$ Carbon dioxide Before-After-Gradient BAG Carbon dioxide emissions CO₂e BAP **Biodiversity Action Plan** COLREGS Collision Regulations 1972 **British Broadcasting Corporation** BBC **COWRIE** Collaborative Offshore Wind Research into the Environment Bc/s Blow count per second CPA Coastal Protection Act BCT **Botney Cut Formation** CPT **Cone Penetration Test** BDK **Bolders Bank Formation CREEM** Centre for Research into Ecological and Environmental Modelling BERR Department for Business Enterprise and Regulatory Reform (now BIS) DAB **Digital Audio Broadcasting** 

BGS

**British Geological Survey** 





DAP	Directorate of Airspace Policy	ERCoP	Emergency Response Co-operation Plan
DASSH	Data Archive for Seabed Species and Habitats	ERMC	Environmental Risk Management Capability
DBA	Desk Based Assessment	ERP	Emergency Response Procedures
dB	Decibel	ES	Environmental Statement
$dB_{ht} \\$	Decibel hearing threshold (a unit for measuring noise responses by marine species)	ESAS	European Seabirds at Sea
DCLG	Department for Communities and Local Government	ESRC	Economic and Social Research Centre
DCO	Development Consent Order	EST	Energy Savings Trust
DECC	Department of Energy and Climate Change	EU	European Union
Defra	Department for Environment, Food and Rural Affairs	EUNIS	European Union Nature Information System
DF	Direction Finding	FCS	Favourable Conservation Status
DFT	Department for Transport	FEPA	Food and Environmental Protection Act
DGPS	Differential GPS	FIR	Fishing Industry Representatives
DME	Distance Measuring Equipment	FLOWW	Fishing Liaison with Offshore Wind and Wet renewables group
DMRB	Design Manual for Roads and Bridges	FM	Frequency Modulation
DP	Dynamic positioning	FMA	Fishermen's Mutual Association
dSAC	Draft Special Area of Conservation	FPSO	Floating Production, Storage and Offloading vessel
DSC	Digital Selective Calling	FRA	Flood Risk Assessment
DTI	Department of Trade and Industry (now Department for Business Innovation and Skills)	FREDS	Forum for Renewable Energy Development in Scotland
DTLR	Department for Transport, Local Government and the Regions (now called Communities and Local	FRPB	Forth River Purification Board
	Government)	FRS	Fisheries Research Service (now Marine Scotland Science)
DWR	Deep Water Routes	FSA	Formal Safety Assessment
DWT	Dead Weight Tonnage	FT	Full time
EA	Environment Agency	FTOWDG	Forth and Tay Offshore Wind Developers Group
EA 1989	Electricity Act 1989	G8	Assembly of world leaders who meeat annually to discuss global issues. Also known as the Group of 8
EC	European Commission	GCR	Geological Conservation Review
EcIA	Ecological Impact Assessment	GDP	Gross Domestic Product
ECS	European Cetacean Society	GH	General handling
ECU	Energy Consents Unit	GHG	Greenhouse gas
EEA	European Environment Agency	GIS	Geographical Information Systems
EEZ	Economic Exclusion Zone	GLOSS	Global Sea Level Observing System
EIA	Environmental Impact Assessment	GMDSS	Global Maritimee Distress Safety System
ELT	Emergency locator tramitters	GOOSAG	Global Ocean Observing System Action Group
EMF	Electromagnetic Fields	grt	Gross registered tonnage
EO	Earth Observation	GPS	Global Positioning System
EPIRB	Emergency Position-Indicating Radio Beacon	GVA	Gross Value Added
EPS	European Protected Species	GW	Gigawatt
EQRs	Ecological quality ratios	GWRS	Greater Wash Regional Scheme





НАР	Habitat Action Plans	IWEA	Irish Wind Energy Industry	
HAT	Highest astronomical tide	JNAPC	Joint Nautical Archaeology Policy Committee	
HDD	Horizontal directional drilling	JNCC	Joint Nature Conservation Committee	
HER	Historic Environment Records	JRC	Joint Radio Company	
HS	Historic Scotland	kHz	Kilohertz	
HGDL	Historic Garden and Designed Landscape	kJ	Kilo joule	
HGV	Heavy Good Vehicle	km	Kilometre	
HMR	Helicopter Main Routes	kV	Kilo volt	
HRA	Habitat Regulations Assessment	LA	Local Authority	
HVAC	High Voltage Alternating Current	LBAP	Local Biodiversity Action Plan	
HVDC	High Voltage Direct Current	LCA	Lifecycle Carbon Analysis	
Hz	Hertz	LCES	Low Carbon Economic Strategy	
IALA	International Association of Lighthouse Authorities	LFA	Low Flying Area	
IAPP	International Air Pollution Prevention Certificate	LHA	Local Highways Authority	
IBA	Important Bird Area	LI	Landscape Institute	
ICAO	International Civil Aviation Organization	LiDAR	Light Detection and Ranging	
ICES	International Council for the Exploration of the Sea	LLP	Limited Liability Partnership	
ICOMAS	International Council on Monuments and Sites	LNR	Local Nature Reserve	
ICPC	International Cable Protection Committee	LOIS	Land-Ocean Interaction Study	
IEEM	Institute of Ecology and Environmental Management	LORAN	Long Range Navigation	
IEMA	Institute of Environmental Management and Assessment	LoS	Line of Sight	
IFA	Institute for Archaeologists	LSE	Likely Significant Effect	
IFR	Instrument flight rules	LVIA	Landscape and Visual Impact Assessment	
IFREMER	French institute for exploitation of the sea	MAIB	Marine Accident Investigation Branch	
IFG	Inshore Fisheries Group	MAGIC	Multi-Agency Geographic Information for the Countryside	
IHO	International Hydrographic Organisation	MAIB	Marine Accident Investigation Branch	
ILS	Instrument Landing Systems	MarLIN	United Kingdom Marine Life Information Network	
IMC	Instrument Meterological Conditions	MARPOL	The International Convention for the Prevention of Pollution from Ships	
IMO	International Maritime Organisation	MaRS	Marine Resource System	
INCA	Industry Nature Conservation Association	MCA	Maritime and Coastguard Agency	
IODE	International Oceanographic Data and Information Exchange	MCEU	Marine Consents and Environment Unit	
IP	Institute of Petroleum	MCZ	Marine Conservation Zone	
IPCC	Intergovernmental Panel on Climate Change	MDA	Managed Danger Area	
IRPCS	International Regulations for Preventing Collisions at Sea	MEDIN	Marine Environment Data information Network	
ISQG	Interim Sediment Quality Guidelines	MEHRA	Marine Environmental High Risk Areas	
IUCN	International Union for the Conservation of Nature	MESH	Mapping European Seabed Habitats	
IWC	Integrated Water Column	MHWS	Mean High Water Springs	





MFOWDG	Moray Firth Offshore Wind Farm Developers	NPF2	National Planning Framework 2
MGN	Marine Guidance Note	NPS	National Policy Statement
MIPU	Major Infrastructure Planning Unit	NRA	Navigation Risk Assessment
MLS	Microwave Landing System	NRMM	Non Road Mobile Machinery
MLWS	Mean Low Water Springs	NSRAC	North Sea Regional Advisory Council
MMO	Marine Mammal Observer	NtM	Notice to Mariners
(MMO	Marine Management Organisation)	NTS	Non Technical Summary
MOD	Ministry of Defence	NVC	National Vegetation Classification
MPA	Marine Protected Area	0&M	Operation and Maintenance
MPS	Marine Policy Statement	OBS	Optical Backscatter Sensor
MRCC	Marine Rescue Co-ordination Centre	ODPM	Office of the Deputy Prime Minister
MRSC	Marine Rescue Sub Centre	OFGEM	Office of Gas and Electricity Markets
MSD	Minimum Separation Distance	OFLR	Onshore Fisheries Liaison Representative
MSFD	Marine Strategy Framework Directive	OFTO	Offshore Transmission Owner
MS-LOT	Marine Scotland Licensing Operations Team	OLS	Obstacle Limitation Surfaces
MTZ	Mandatory Transponder Zones	ONS	Office of National Statistics
MVAC	Median Voltage Alternating Current	OPEC	Organisation of Petroleum Exporting Countries
MW	Mega Watt	OREI	Offshore Renewable Energy Installation
NAEI	National Atmospheric Emissions Inventory	OS	Ordnance Survey
NATO	North Atlantic Treaty Organization	OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
NATS	National Air Traffic Service	OWE	Offshore Wind Energy Europe
Navaids	Aeronautical Navigation Aids	PACC	Pre-application Consultation with Communities Report
NBN	National Biodiversity Network	PAD	Protocol for Archaeological Discoveries
NDB	Non-Directional Beacons	PAM	Passive Acoustic Monitoring
NERL	NATS En Route Plc.	PAR	Precision Approach Radar
NFFO	National Federation Fishermen's Organisation	PBT	Persistent, bioaccumulative, toxic
NG	National Grid	PEL	Probable effects levels
NGDC	National Geosciences Data Collections	PEXA	Practice and Exercise Area
NGET	National Grid Electricity Transmission	PLB	Personal Locator Beacon
NLB	Northern Lighthouse Board	PPS	Planning Policy Statement
NLH	National Lobster Hatchery	PROW	Public Rights of Way
NM	Nautical Mile	PMF	Priority Marine Feature
NMBAQC	National Marine Biological Analytical Quality Control Scheme	PSA	Particle size analysis
NMRS	National Monuments Record of Scotland	pSAC	Possible Special Area of Conservation
NNR	National Nature Reserve	pSPA	Possible Special Protection Area
$NO_2$	Chemical symbol for nitrogen dioxide	PSD	Particle size distribution
NOx	Chemical symbol for nitrogen oxides	PSR	Primary Surveillance Radar





PT	Part time	SMP	Shoreline Management Plan
PTS	Permanent Threshold Shift	SNFAS	Salmon Net Fishing Association of Scotland
PVA	Population Viability Analysis	SNH	Scottish Natural Heritage
RAF	Royal Air Force	SNS	Southern North Sea Sediment Transport Study
Ramsar	The Ramsar Convention on Wetlands	SoCC	Species of Conservation Concern
RAP	Renewables Action Plan	SOCC	Statement of Community Consultation
RAP	Recognised Air Picture	SOLAS	Safety of Life at Sea
RBMP	River Basin Management Plan	SOV	Service Operations Vessel
RCAHMS	Royal Commission on the Ancient and Historical Monuments of Scotland	$SO_x$	Sulphur Oxides
RCS	Radar Cross Section	SPA	Special Protection Area
RDA	Regional Development Agency	SP=EED	Scottish Planning = Effective Engagement and Delivery
RNLI	Royal National Lifeboat Institution	SPM	Suspended Particulate Matter
RO	Renewables Obligation	SPP	Scottish Planning Policy
ROV	Remotely Operated Vehicle	SQW	SQW (Socio-economic consultants)
ROW	Receiver of Wreck	SRA	Synthetic Radar Aperture
Rpm	Revolutions per minute	SSC	Suspended sediment concentration
RSL	Relative Sea Level	SSR	Secondary Surveillance Radar
RSPB	Royal Society for the Protection of Birds	SSSI	Site of Special Scientific Interest
RUK	RenewableUK	STW	Scottish Territorial Waters
RYA	Royal Yachting Association	TACAN	Tactical Air Navigation
SAC	Special Area of Conservation	TCE	The Crown Estate
SAM	Scheduled Ancient Monument	TCP	Town and Country Planning Act
SAP	Species Action Plans	TEZ	Temporary Exclusion Zone
SAR	Search and Rescue	TMP	Traffic Management Plan
SART	Search and Rescue Transponders	TMZ	Transponder Mandatory Zone
SCADA	Supervisory Control and Data Acquisition	TSS	Traffic Separation Scheme
SDME	Spatial Data Management Environment	TTS	Temporary Threshold Shift
SDP	Strategic Develoment Plan	UK	United Kingdom
SEA	Strategic Environmental Assessment	UKAPP	United Kingdom Air Pollution Prevention Certificate
SEL	Sound Exposure Level	UKAS	United Kingdom Accreditation Service
SEMP	Site environmental management plan	UKBAP	United Kingdom Biodiversity Action Plan
SEPA	Scottish Environmental Protection Agency	UKCS	United Kingdom Continental Shelf
SESplan	South East Scotland Strategic Development Plan Authority	UKHO	United Kingdom Hydrographic Office
SF	Chemical symbol for sulphur hexaflouride	ULSD	Ultra low sulphur diesel
SFF	Scottish Fishermen's Federation	UN	United Nations
SFPA	Scottish Fisheries Protection Agency (now Marine Scotland Compliance)	UNECE	United Nations Economic Commission for Europe
SMRU	Sea Mammale Research Unit (Ltd)	UNEP	United Nations Environment Programme





UNESCO United Nations Educational, Scientific and Cultural Organization

UPS Uninterruptable Power System

US United States

USA United States of America

USAF United States Air Force

UXO Unexploded Ordnance

VFR Visual Flight Rules

VHF Very High Frequency

VMC Visual Mteorological Conditions

VMS Vessel Monitoring System

VOR VHF Omni-directional Radio Range

VRLA Valve regulated lead acid battery

VTS Vessel Traffic Services

WEDCA Wind Energy, Defence & Civil Aviation

WFD Water Framework Directive

WQTAG Water Quality Technical Advisory Group

WSI Written Scheme of Investigations

WWI First World War

WWII Second World War

XLPE Cross linked polyethylene

ZTV Zone of Theoretical Visibility

