Argyll Array Offshore Wind Farm: Habitat Regulations Assessment – Screening for Likely Significant Effects

14 May 2014

Project Number: SGP6346

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Current Status:	**Draft for Comment**			
Issue Date:	**14 May 2014**	Revision Number:	**4**	
		Revision Notes:	**-**	
Project File Path:	**J:\SGP 6346 - Scottish Power Argyll Array Birds\Reports\Reports in Progress**			

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REPORT TEMPLATE	
TYPE:	Planning
ISSUE DATE:	18 May 2011
REVISION NUMBER:	-
REVISION DATE:	-

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1 INTRODUCTION

The Project

1.1 The proposed Argyll Array Offshore Wind Farm is being developed by ScottishPower Renewables (SPR). At its closest point, the application site is located approximately 5 km off the west coast of Tiree, Argyll. The wind farm lies entirely within Scottish Territorial Waters in water depths of 20 to 50 m. As the design layout has not been finalised to date, for the purposes of this assessment a realistic 'worst-case' set of turbine specifications, layouts and installation options (as provided by the developer) has been considered, in line with the concept of the 'Rochdale Envelope' approach.

The Habitat Regulations Requirements

1.2 A Habitat Regulations Assessment (HRA) is required under EC Directive 92/43/EEC on the Conservation of natural habitats and of wild flora and fauna (the 'Habitats Directive'[1]) Article 6(3)[2] wherever a plan or project that is not directly connected to, or necessary to the management of a Natura 2000 site[3] has the potential to have a significant effect on the qualifying species populations or habitats within the site.

1.3 From this the relevant plan-making body shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned, unless in exceptional circumstances, the provisions of Article 6(4) are met.

1.4 A HRA comprises a series of up to 13 sequential stages as identified by Scottish Natural Heritage (SNH) and outlined in Figure 1. The outcome from Stage 1 has already been determined – in part based on a recent Strategic Environmental Assessment by Marine Scotland (2010b) which identified the potential for a significant effect on sites designated for their nature conservation interest at a European Level, due to proposed offshore wind energy projects in Scottish Territorial Waters. As part of this process, the Argyll Array Offshore Wind Farm was identified as one of the short-term options for offshore wind energy where such effects may occur, thereby requiring further consideration in the HRA process.

[1] The Habitats Directive is implemented (with the EC Birds Directive (2009/147/EC)) in the UK as 'The Conservation (Natural Habitats, &c.) Regulations 1994'. This legislation provides the legal framework for the protection of habitats and species of European importance.

[2] Article 6(3) of the Habitats Directive sets out the decision-making tests for plans and projects likely to affect Special Areas of Conservation (SACs) and Special Protection Areas (SPAs); collectively these sites are referred to as Natura 2000 sites.

[3] This applies to all Natura 2000 sites, including candidate Special Areas of Conservation (cSACs) and potential Special Protection Areas (pSPAs), and designated Ramsar sites. Collectively these sites are referred to as 'European sites' for the purposes of this assessment. Paragraph 136 of the consolidated Scottish Planning Policy refers to the fact that that all Ramsar sites are also European sites. Where the interest features of Ramsar sites overlap with those of European sites it is Scottish Government policy to afford them the same protection. The Ramsar interests should be adequately protected by consideration of the effects of plans on the other European sites and do not need to be considered separately. The requirements of Article 6(3) do not apply as a matter of law or government policy to draft SACs or proposed Ramsar sites.

1.5 This report therefore considers Stages 2 to 7 which represent the 'screening' of identified European sites and features. The purpose of these stages is to:

- Identify all aspects of the plan or project which would not be likely to have a significant effect on a European site, either alone or in combination with other aspects of the same plan or other plans or projects, so that they can be eliminated from further consideration; and

- Identify those aspects of the plan or project where it is not possible to rule out the risk of likely significant effects on a European site, and thereby provide a clear scope for the parts of the plan that will require 'Appropriate Assessment'.

1.6 An Appropriate Assessment (AA) is required where, as a result of screening, it is concluded that a development proposal may have a significant effect on a European site. Its purpose is to consider the implications of the project on the Conservation Objectives of those qualifying interests for which a likely significant effect has been determined through this screening stage. The AA is conducted by the relevant Competent Authority, based on all information presented, and aims to ascertain whether the proposal will adversely affect the integrity of a Natura 2000 site rather than whether the proposal will cause an adverse effect. Thus there is the need to prove the negative in the Appropriate Assessment, reflecting the degree to which the precautionary principle is written into the Habitats Directive.

1.7 If the screening stage clearly identifies that there are not likely to be any significant impacts upon a European site, then an Appropriate Assessment will not be required.

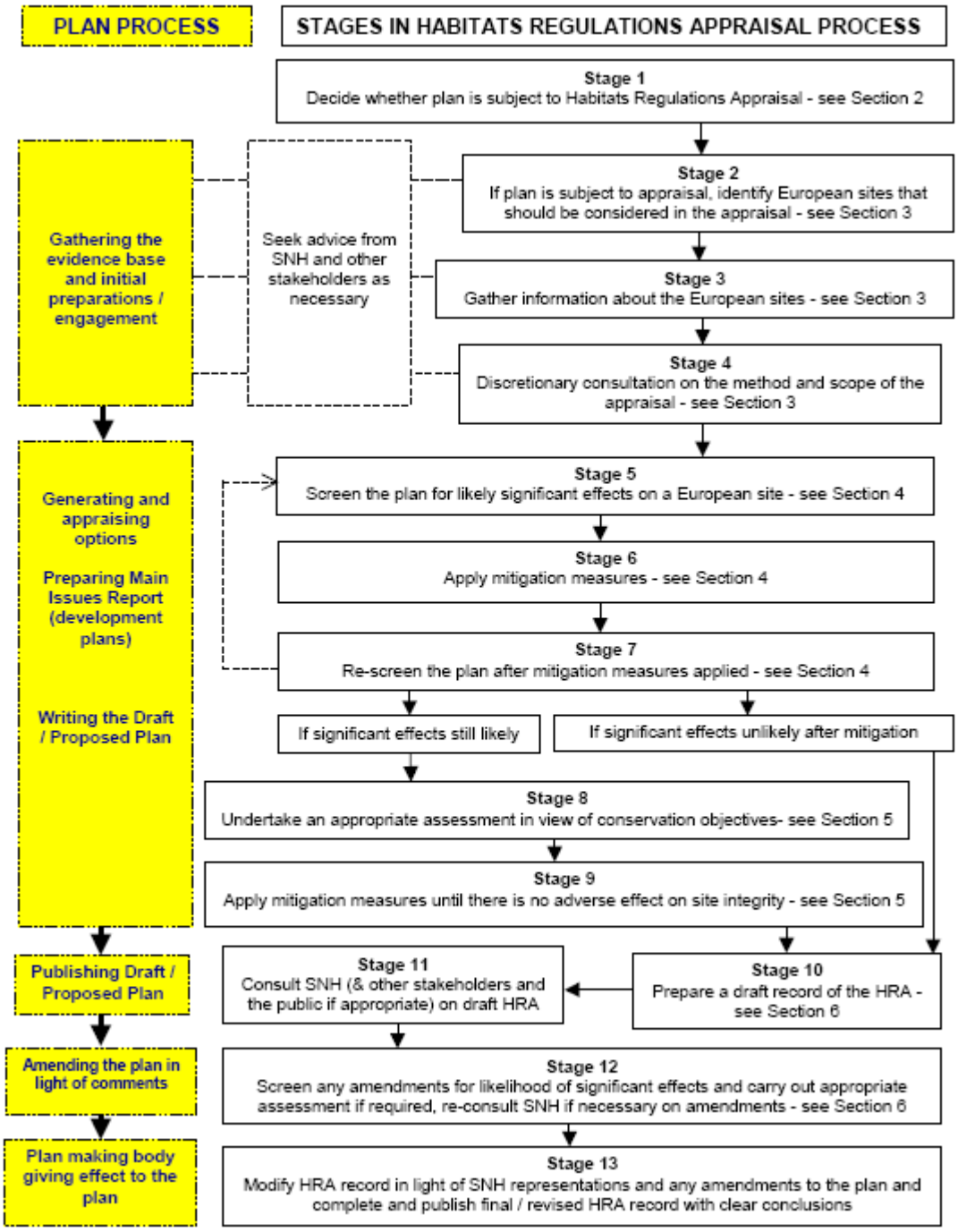

Figure 1: The 13 key stages of the Habitat Regulations Appraisal process for plans. From DTA, (2012).

1.8 The screening stage is focused on the 'likely significant effect' (LSE) test. A 'likely' effect is one that cannot be ruled out on the basis of objective information (DTA, 2012), and it should be noted that the test is a 'likelihood' of effects rather than a 'certainty' of effects[4]. In the SNH Scoping Advice letter (14 September 2010), it was recommended that the assessment is a broad approach so that potentially significant impacts are not missed out, or discounted too early in the HRA process.

[4] Managing Natura 2000 sites, EC, 2000. Section 4.4.2.

1.9 Determining whether there will be a LSE does not imply that there will be such an effect or even that an effect is more likely than not (Environment Agency, 2009). It would also not be correct to say that any effect is a likely significant effect, and the LSE test should be used to filter out effects that are clearly trivial or inconsequential, despite possible connectivity.

1.10 In the Waddenzee case[5] the European Court of Justice ruled that a project should be subject to Appropriate Assessment "*if it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site, either individually or in combination with other plans and projects*". 'Likely', in this context, should therefore be interpreted as whether a significant effect can objectively be ruled out.

1.11 Where a plan or project could undermine the site's Conservation Objectives, the effects on the site must be considered to be significant. It should be noted that a judgement of LSE in no way presupposes a judgement of adverse effect on site integrity as they are two quite separate tests and should not be confused

1.12 The aim of the LSE test is therefore to determine whether the plan either alone, or in-combination with other plans and projects and activities is likely to result in a significant effect on a European site. There is a presumption in favour of 'screening issues in' at this stage, following the precautionary approach (e.g. Marine Scotland, 2011). When considering the relevant screening methods to determine LSE, it is therefore understood that there needs to be a presumption in favour of including rather than excluding interest features and designated sites in the HRA process at this stage.

1.13 This Report therefore provides the necessary supporting information to enable the Competent Authority and its statutory nature conservancy bodies to undertake an HRA screening on the potential for significant effects of the Argyll Array Offshore Wind Farm on the qualifying species of European sites.

Report layout

1.14 The following text presents the iterative series of tasks as part of the HRA process that have been undertaken, based on guidelines by DTA (2012), as well as those in Marine Scotland (2011).

1.15 As recommended by SNH in their advice letter (dated 19 April 2012), LSE has been assessed by considering the three following aspects:

- Connectivity between the population at the project site and the SPA being appraised;
- The sources of impact to the population due to the project; and
- A population size attributable to the SPA being appraised.

1.16 A judgement is then made as to whether one or more of these aspects is non-trivial, which would then help determine whether a LSE can be ruled out or not.

[5] See paragraph 45 of European Court of Justice case C-127/02 dated 7th September 2004, 'the Waddenzee ruling'

Part 1: Identification of European Sites (Stages 2 and 3 of HRA process)

1.17 This part (Stage 5 of Figure 1) focuses on identifying European sites with potential connectivity to the Argyll Array Offshore Wind Farm site, based on recorded site utilisation by a European site's qualifying species during baseline surveys, and their ecology/behaviour recorded during baseline surveys, as well as from scientific studies.

1.18 For breeding seabirds that are qualifying interests of European sites, this screening stage is predominantly based on the likely foraging range for each species identified during Argyll Array baseline surveys (e.g. Thaxter *et al.* 2012). As our understanding of seabird foraging behaviour is incomplete and evolving, other site- and species-specific factors are also considered to provide an overall prediction of connectivity of seabirds found within the project site, and specific Special Protection Areas (SPAs).

Breeding populations of qualifying features at European sites are afforded protection throughout the year, and so 'off-site' impacts to those populations away from the European site, or during the non-breeding season must also be assessed. For migratory species, wintering seabirds, as well as non-seabird breeding species, foraging range is not an applicable indicator, and so screening is informed by baseline survey results, in combination with available knowledge of main passage movements in the wider area, biogeographical population (or biologically defined minimum population scale) and proximity to European sites (e.g. Wright *et al.* 2012). It should however be noted that a European site does not need to be in close proximity to the application site for some species' inclusion (e.g. migratory swans or geese), as noted by SNH in the Scoping Advice letter (14 September 2010).

1.19 A decision on whether a European site can be screened in or out on the basis of potential connectivity with the Argyll Array Offshore Wind Farm site is then made (i.e. because a LSE cannot be discounted at this point for one or more of their qualifying interest features).

1.20 As a result of this screening step, a list of European sites and their qualifying species which may demonstrate connectivity with the Argyll Array Offshore Wind Farm survey area is taken forward to Part 2.

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Part 2: Assessment of Likely Significant Effects (Stage 5 of HRA process)

1.21 Part 2 of the process continues Stage 5 in DTA (2012, Figure 1) and involves assessing the European sites and qualifying species screened in, in Part 1, and determining whether, as a result of identified connectivity, there will be LSE as a result of the effects of the construction, operation and decommissioning stages of the Argyll Array Offshore Wind Farm.

1.22 In order to conclude LSE or no LSE, it is therefore necessary to:

- Establish the range of impacts that the project could have on qualifying interest(s) of a European site (impact pathway);
- Determine whether qualifying feature(s) would, by virtue of its behavioural characteristics and ecology, be affected by a particular impact (species' sensitivity); and
- Where a qualifying feature is likely to be affected by an impact, appraise whether or not this is likely to undermine the conservation objectives for the European site (conclusion of LSE or no LSE), prior to mitigation.

1.23 Therefore, in addition to identifying the range of impacts that the project may have on certain qualifying interests for a LSE to be concluded, it is necessary to establish whether those

qualifying interests are sensitive to the impacts identified. Even if there is connectivity, and an impact pathway, if a particular qualifying interest is not sensitive to that impact then it is unlikely that there would be a significant effect on that species. Where this is the case the conclusion would be no LSE.

1.24 It should be noted that the test is on the whole European site and therefore if a LSE cannot be ruled out for only one species this has potential to affect the integrity of the site. The site is screened in or not depending on whether an LSE is identified for one or more of the qualifying interests. The LSE test is therefore not applied to the site, but to the individual qualifying interest.

Part 3: Re-screening (Stages 6 and 7 of the HRA process)

1.25 Part 3 involves re-screening for LSEs the revised list of European sites and qualifying features identified in Part 2 following the application of initial mitigation measures (Stage 6 of DTA, 2012, Figure 1) and then finalising the scope of an Appropriate Assessment (Stage 7 of DTA, 2012).

1.26 In general, specific impacts on species can be reduced through appropriate design (e.g. minimising footprint of the development to minimise loss or damage to seabed habitat), and selection and use of appropriate construction (e.g. environmental management plan; selection of low noise and minimal vibration installation technologies) and operation methods (e.g. use of noise attenuation technologies).

1.27 Using the results from Part 3, it is then determined whether it can be reasonably concluded that there may or may not be a LSE on any European site, based on the information available, and therefore whether an Appropriate Assessment is required (Stage 8).

Part 4: Appropriate Assessment

1.28 Where LSEs are identified during screening, more detailed assessment is required to assess the implications of the Project, either alone or in combination with other plans and projects, on the integrity of a European site in view of the sites' conservation objectives. The appropriate assessment (Stage 8, Figure 1) is undertaken by the relevant Competent Authority based on information from the detailed assessment which is provided in an HRA Report. The scope of any appropriate assessment is based on this screening report.

2 PART 1: IDENTIFICATION OF EUROPEAN SITES

Introduction

2.1 In this part of the HRA screening process, it is necessary to determine whether the individuals of species recorded within the Argyll Array Offshore Wind Farm ornithological survey area during baseline surveys may potentially form part of a qualifying interest of a European site with an ornithological interest: namely a SPA (including candidate and proposed sites) and/or a Ramsar site, by utilising both the designated site and the survey area at some point of their life cycle, i.e. there may be some degree of connectivity.

2.2 This includes a range of marine, coastal, terrestrial and freshwater sites which were identified during consultation as being capable of being affected by the Argyll Array Offshore Wind Farm on the basis of the qualifying interests for which the site is designated, the geographical position of the site in relation to the Argyll Array Offshore Wind Farm and the nature of the project.

European sites

Special Protection Areas

2.3 SPAs are classified under Article 4 of the Birds Directive. Article 4.1 requires the selection of the 'most suitable territories' as SPAs for sites supporting species which are rare or vulnerable in Europe, listed on Annex I of the Directive.

2.4 Article 4.2 requires the selection of SPAs for regularly occurring migratory species not listed on Annex I, with particular attention to be paid to the protection of wetlands of international importance. The UK criteria for SPA selection and the rationale for the UK SPA network are set out in Stroud *et al.* (2001). Thresholds for SPA selection for Annex I species are the presence of 1% or more of the British population of a given species, whereas for migratory species the threshold is 1% or more of the relevant international or bio-geographic population.

2.5 While SPAs are selected for particular species based on their occurrence during the breeding, winter or passage seasons, protection is also provided for these species throughout the year, and so 'off-site' impacts require consideration (JNCC and Natural England, 2013).

Ramsar sites

2.6 Ramsar sites are wetlands of international importance designated under the Ramsar Convention 1971, especially as habitats for waterfowl. The first Ramsar sites in the UK were designated in 1976, with an initial emphasis on selecting sites of importance to waterbirds. Consequently many Ramsar sites are also SPAs.

2.7 Natural England advises the UK government on sites that qualify as Ramsar sites, and when doing so is guided by criteria set out in the Ramsar Convention. The main criteria for ornithological interest are: (i) if a site regularly supports 20,000 or more water birds; and/or (ii) if it regularly supports at least 1% of the individuals in a population of one species or subspecies of water bird.

2.8 In Scotland, the February 2010 Scottish Planning Policy (SPP) document (SG, 2010) qualifies that Ramsar sites are "*also Natura sites and/or Sites of Special Scientific Interest and are protected under the relevant statutory regimes*". Therefore, in Scotland, where the interests of Ramsar sites correspond with those of overlapping European sites, there is no need to consider them separately (DTA, 2012).

2.9 A desk study revealed that all Ramsar sites within foraging range of species recorded within the Argyll Array Offshore Wind Farm are coincidental in extent with SPAs. Therefore these sites do not need to be considered separately, and so each relevant SPA's Conservation Objectives and qualifying species will be the focus of the HRA screening process.

Initial screening

2.10 In May 2010, a Draft Plan for Offshore Wind Energy in Scottish Territorial Waters was published by Marine Scotland (2010a). The purpose of this Draft Plan was to consider the potential of Scottish Territorial Waters to accommodate developments from a national perspective. It makes proposals and defines potential areas as short-, medium- and long-term options for offshore wind energy generation (Marine Scotland, 2011). Argyll Array Offshore Wind Farm was included as a short-term option.

2.11 A Strategic Environmental Assessment (SEA) of the Draft Plan (Marine Scotland, 2010b) identified the potential for a LSE on European sites. Accordingly, a HRA of the Draft Plan was required, and as Competent Authority, Marine Scotland carried out this HRA and Appropriate Assessment in fulfilment of obligations under these Regulations.

As a first stage for this HRA work, a pre-screening study was undertaken to identify the possible impacts of offshore wind energy projects (including Argyll Array) on bird interests (Halcrow, 2010). In light of the findings from the pre-screening studies and a subsequent working paper (ABPmer, 2010), an Appropriate Information Assessment Review by Marine Scotland (2011) set out the findings of the screening and assessment work (for both the short and medium term options). This assessment work constituted Stages 4 to 10 of the Plan-level HRA process (Figure 1).

2.12 When determining the European/Ramsar sites to be screened in or out, advice was provided by SNH and JNCC during the HRA consultation process. A large number of European/Ramsar sites were identified at which it was not possible to conclude that there would be no LSE from the Draft Offshore Wind Energy Plan for some, or all, of the qualifying bird interest features specifically. In total there were 149 SPAs and a further 60 Ramsar Sites with qualifying bird interest features that were screened in at a plan-wide level.

2.13 For Argyll Array Offshore Wind Farm, a total of 31 species (including those listed as being a regularly occurring part of a breeding seabird assemblage) from 26 SPAs and 7 Ramsar sites within 100 km were screened in as having a potential LSE, based on an assessment of maximum foraging ranges. In addition, further SPAs were identified for some species (fulmar, gannet, kittiwake, guillemot and puffin) where maximum foraging ranges may be beyond this 100 km scoping area. This includes SPAs from the Republic of Ireland.

2.14 Table 1 shows a list of SPAs scoped in to the HRA in the Marine Scotland (2011) review, as well as additional SPAs which were considered to have potential connectivity with the project, for example being a potential destination for migratory non-seabird species that were recorded

within the Argyll Array Offshore Wind Farm site during baseline surveys, or where foraging ranges may be greater than 100km, based on more recent available information (e.g. Thaxter *et al.* 2012). The list of SPAs includes those recommended by SNH in their HRA Scoping Advice letter (14 September 2010), which were previously not considered in a draft of this report. Migratory corridors used to determine potential connectivity for non-seabirds are based on information given in a review by Wright *et al.* (2012) and other sources such as Wernham *et al.* (2002).

2.15 Table 1 includes all qualifying interests of each SPA, even those which were not highlighted as having potential connectivity by Marine Scotland or SNH (e.g. non-migratory terrestrial species such as chough). These species are included in brackets [ ].

TABLE 1: SPAS SCREENED IN AS HAVING A POTENTIAL LSE DUE TO ARGYLL ARRAY OFFSHORE WIND FARM

SPAs	Country/ State	Distance from Argyll Array	Qualifying interests
Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast)	Scotland	3.5 km E	Dunlin, redshank, ringed plover, oystercatcher, barnacle goose, Greenland white-fronted goose, turnstone
Tiree (Corncrake)	Scotland	5.5 km E	Corncrake
Coll	Scotland	20 km E	Barnacle goose, Greenland white-fronted goose
Coll (Corncrake)	Scotland	26 km E	Corncrake
Treshnish Isles	Scotland	27 km E	Storm petrel, barnacle goose
Mingulay and Berneray	Scotland	34 km NW	Kittiwake, guillemot, fulmar, shag, puffin, razorbill, northern fulmar
Cnuic agus Cladach Mhulie	Scotland	41.5 km SE	Golden eagle
Rum	Scotland	51 km NE	Kittiwake, guillemot, red-throated diver, Manx shearwater
North Colonsay and Western Cliffs	Scotland	51.5 km SE	Kittiwake, guillemot, [chough]
Oronsay and South Colonsay	Scotland	55 km SE	Corncrake, [chough]
Eoligarry, Barra	Scotland	56.5 km NW	Corncrake, [chough]
Canna and Sanday	Scotland	60 km NE	Kittiwake, herring gull, guillemot, shag, puffin
Kilpheder and Smerclate, South Uist	Scotland	62.5 km N	Corncrake
Rinns of Islay	Scotland	64 km SE	Corncrake, common scoter, Greenland white-fronted goose, [whooper swan, hen harrier, chough]
Gruinart Flats	Scotland	64 km SE	Barnacle goose, Greenland white-fronted goose, Light-bellied brent goose, [chough]
South Uist Machair	Scotland	69 km N	Corncrake, dunlin, little tern, redshank, ringed plover, lapwing, oystercatcher, greylag goose, sanderling
Bridgend Flats, Islay	Scotland	75.5 km SE	Barnacle goose
Loch Shiel	Scotland	76.5 km NE	Black-throated diver
Jura, Scarba and the Garvellachs	Scotland	78 km E	Golden eagle
Laggan, Islay	Scotland	78 km SE	Barnacle goose, Greenland white-fronted goose
Eilean na Muice Duibhe (Duich Moss), Islay	Scotland	81 km SE	Greenland white-fronted goose
Cuillins	Scotland	83.5 km NE	Golden eagle
Knapdale Lochs	Scotland	95 km SE	Black-throated diver
Aird and Borve, Benbecula	Scotland	97.5 km N	Corncrake
North Uist Machair and Islands	Scotland	105 km N	Barnacle goose, corncrake, dunlin, oystercatcher, redshank, ringed plover , purple sandpiper, turnstone
Glas Eileanan	Scotland	108.5 km NE	Common tern
Kintyre Goose Roosts	Scotland	111 km SE	Greenland white-fronted goose
Horn Head to Fanad Head	Republic of Ireland	113 km SE	Puffin, kittiwake, guillemot, northern fulmar, [peregrine, chough, cormorant, shag,

TABLE 1: SPAS SCREENED IN AS HAVING A POTENTIAL LSE DUE TO ARGYLL ARRAY OFFSHORE WIND FARM

SPAs	Country/ State	Distance from Argyll Array	Qualifying interests
			razorbill, Greenland white-fronted goose, barnacle goose]
Rathlin Island	Northern Ireland	121 km S	Kittiwake, guillemot, lesser black-backed gull, [razorbill, peregrine]
Lough Foyle	Northern Ireland	124 km S	Whooper swan, Canadian pale-bellied brent goose, [bar-tailed godwit]
Tory Island	Republic of Ireland	127.5 km SW	Puffin, kittiwake, guillemot, northern fulmar, [razorbill, common gull, corncrake]
Inishtrahull	Republic of Ireland	150.5 km SW	Shag, great black-backed gull, common gull, kittiwake, guillemot, northern fulmar, [barnacle goose]
Shiant Isles	Scotland	150.5 km NE	Puffin, kittiwake, guillemot, northern fulmar, [shag, barnacle goose, razorbill]
St Kilda	Scotland	156km NW	Puffin, kittiwake, guillemot, Manx shearwater, northern fulmar, northern gannet, [European storm petrel, Leach's storm petrel, great skua, razorbill]
Ailsa Craig	Scotland	165.5 km SE	Kittiwake, guillemot, northern gannet, lesser black-backed gull, [herring gull]
Lough Neagh and Lough Beg	Northern Ireland	172 km S	Whooper swan, [tundra swan, pochard, tufted duck, goldeneye, common tern]
Larne Lough	Northern Ireland	184 km SE	Canadian pale-bellied brent goose, [Sandwich tern, roseate tern, common tern]
Flannan Isles	Scotland	190.5 km N	Puffin, kittiwake, guillemot, northern fulmar [Leach's storm petrel, razorbill]
Ness and Barvas, Lewis	Scotland	203 km N	Corncrake
Loch of Inch and Torrs Warren	Scotland	204 km SE	Greenland white-fronted goose, [hen harrier]
Copeland Islands	Northern Ireland	207 km SE	Manx shearwater, [Arctic tern]
Strangford Lough	Northern Ireland	213 km SE	Canadian pale-bellied brent goose, [knot, redshank, Sandwich tern, common tern, Arctic tern]
Upper Lough Erne	Northern Ireland	222 km SW	Whooper swan
Loch Ken and River Dee Marshes	Scotland	229 km SE	Greenland white-fronted goose, [greylag goose]
Handa	Scotland	229 km NE	Northern fulmar, [great skua, kittiwake, guillemot, razorbill]
Outer Ards	Northern Ireland	235.5 km SE	Manx shearwater, [light-bellied brent goose, ringed plover, golden plover, turnstone, Arctic tern]
Aughris Head	Republic of Ireland	242 km SW	Northern fulmar, [kittiwake, guillemot, razorbill]
Killough Harbour	Northern Ireland	246 km S	Canadian pale-bellied brent goose
Carlingford Lough	Northern Ireland	254 km S	Canadian pale-bellied brent goose, [Sandwich tern, common tern]
Cape Wrath	Scotland	256 km NE	Northern fulmar, [kittiwake, guillemot, razorbill, puffin]
Castle Loch, Lochmaben	Scotland	260 km SE	Pink-footed goose
Upper Solway Flats and Marshes	Scotland	260 km SE	Pink-footed goose, whooper swan, Svalbard barnacle goose, [shelduck, teal, pintail, shoveler, scaup, goldeneye, oystercatcher, golden plover, grey plover, knot, sanderling, dunlin, bar-tailed godwit, curlew, redshank, turnstone]
Illanmaster	Republic of Ireland	265 km SW	Northern fulmar, [European storm petrel, barnacle goose]
Stags of Broadhaven	Republic of Ireland	275 km SW	Northern fulmar, [European storm petrel, Leach's storm petrel, puffin]
North Rona and Sula Sgeir	Scotland	286 km NE	Northern fulmar, northern gannet, {European storm petrel, Leach's storm petrel, great black-backed gull, kittiwake, razorbill, guillemot, puffin]
Duvillaun Islands	Republic of Ireland	307 km SW	Northern fulmar, [European storm petrel, barnacle goose, peregrine, chough]
Skerries Islands	Republic of Ireland	309 km S	Northern fulmar, [cormorant, shag, light-bellied brent goose, purple sandpiper,

TABLE 1: SPAS SCREENED IN AS HAVING A POTENTIAL LSE DUE TO ARGYLL ARRAY OFFSHORE WIND FARM			
SPAs	**Country/ State**	**Distance from Argyll Array**	**Qualifying interests**
			turnstone, herring gull]
Sule Skerry and Sule Stack	Scotland	312.5 km NE	Northern gannet, [European storm petrel, Leach's storm petrel, shag, guillemot, puffin]
Lambay Island	Republic of Ireland	319.5 km S	Manx shearwater, northern fulmar, [cormorant, shag, greylag goose, lesser black-backed gull, herring gull, kittiwake, guillemot, razorbill, puffin]
Howth Head Coast	Republic of Ireland	320 km S	Northern fulmar, [peregrine, kittiwake, guillemot, razorbill]
Ireland's Eye	Republic of Ireland	328.5 km S	Manx shearwater, northern fulmar, northern gannet, [peregrine, kittiwake, guillemot, razorbill, puffin]
Hoy	Scotland	333 km NE	Northern fulmar, [red-throated diver, peregrine, Arctic skua, great skua, great black-backed gull, kittiwake, guillemot, puffin]
Morecambe Bay	England	334 km SE	Pink-footed goose, [shelduck, pintail, oystercatcher, golden plover, grey plover, knot, dunlin, bar-tailed godwit, curlew, redshank, turnstone, Sandwich tern]
High Island, Inishshark and Davillaun	Republic of Ireland	354 km SW	Manx shearwater, northern fulmar, [barnacle goose, herring gull, common gull, shag, kittiwake, Arctic tern]
Copinsay	Scotland	365.5 km NE	Northern fulmar, [great black-backed gull, kittiwake, guillemot]
Rousay	Scotland	372 km NE	Northern fulmar, [Arctic skua, kittiwake, Arctic tern, guillemot]
Slyne Head Islands	Republic of Ireland	372.5 km SW	Manx shearwater, [barnacle goose, Sandwich tern, Arctic tern, little tern]
Wicklow Head	Republic of Ireland	378 km S	Northern fulmar, [peregrine, kittiwake, guillemot, razorbill, whitethroat]
Ribble and Alt Estuaries	England	382 km SE	Pink-footed goose, whooper swan, tundra swan, [cormorant, shelduck, wigeon, teal, pintail, scaup, common scoter, oystercatcher, ringed plover, golden plover, grey plover, lapwing, knot, sanderling, dunlin, ruff , black-tailed godwit, bar-tailed godwit, whimbrel, curlew, redshank , redshank, black-headed gull, lesser black-backed gull, common tern]
West Westray	Scotland	385 km NE	Northern fulmar, [Arctic skua, kittiwake, Arctic tern, guillemot, razorbill]
Calf of Eday	Scotland	394 km NE	Northern fulmar, [cormorant, great black-backed gull, kittiwake, guillemot]
Martin Mere	England	400 km SE	Pink-footed goose, whooper swan, tundra swan, [wigeon, pintail]
Aberdaron Coast and Bardsey Island	Wales	425 km SE	Manx shearwater, [chough]
Fair Isle	Scotland	456 km NE	Northern fulmar, northern gannet, [shag, Arctic skua, great skua, kittiwake, Arctic tern, guillemot, razorbill, puffin, Fair Isle wren]
Saltee Islands	Republic of Ireland	463 km S	Northern fulmar, northern gannet, [peregrine, chough, Manx shearwater, gannet, shag, lesser black-backed gull, kittiwake, guillemot, razorbill, puffin]
Helvick Head to Ballyquin	Republic of Ireland	467 km S	Northern fulmar, [cormorant, peregrine, chough, shag, herring gull, great black-backed gull, kittiwake, guillemot, razorbill]
Foula	Scotland	488.5 km NE	Northern fulmar, [red-throated diver, Leach's storm petrel, shag, Arctic skua, great skua, kittiwake, Arctic tern, common guillemot, razorbill, puffin]
Sumburgh Head	Scotland	498 km NE	Northern fulmar, [kittiwake, Arctic tern, guillemot]
Grassholm	Wales	519.5 km SE	Northern gannet
Noss	Scotland	532 km NE	Northern fulmar, northern gannet, [great skua, kittiwake, guillemot, puffin]

TABLE 1: SPAS SCREENED IN AS HAVING A POTENTIAL LSE DUE TO ARGYLL ARRAY OFFSHORE WIND FARM			
SPAs	**Country/ State**	**Distance from Argyll Array**	**Qualifying interests**
Skelligs	Republic of Ireland	544.5 km SW	Northern fulmar, northern gannet, [European storm petrel, chough, Manx shearwater, kittiwake, guillemot, razorbill, puffin]
Fetlar	Scotland	568.5 km NE	Northern fulmar, [whimbrel, red-necked phalarope, Arctic skua, great skua, Arctic tern, dunlin]
Hermaness, Saxa Vord and Valla Field	Scotland	588.5 km NE	Northern fulmar, northern gannet, [red-throated diver, shag, great skua, kittiwake, guillemot, puffin]
Notes:			

Note: All SPA qualifying interests shown. Those interests in brackets [ ] represent those scoped out of the Marine Scotland test for LSE and/or the list of SPAs recommended for inclusion in the HRA .

Determining connectivity of European sites with the Argyll Array Offshore Wind Farm

2.16 Connectivity may exist because individuals from a population may visit both an SPA (for breeding and roosting for example) and the Argyll Array Offshore Wind Farm site (for foraging or loafing, or on transit elsewhere) for at least part of the year. In an offshore environment, it is generally very difficult to know from which population a bird at sea originates, unless for example, particular individuals are radio-tagged. Consequently, drawing conclusions about impacts of offshore wind farms on populations from individual European sites can often be complicated.

2.17 The following points (based on Marine Scotland, 2011 guidelines) help identify the European sites potentially affected by the Argyll Array Offshore Wind Farm, to be included further in the HRA process:

- screen out bird qualifying interest features where they are confined to inland terrestrial habitats and do not migrate;
- screen out qualifying interest features (and where possible the relevant European sites) that forage on the coastal zone but at distances of greater than one tidal excursion from the offshore energy project (but recognising that these species may still be affected during migratory movements); and
- review flyway data to identify any overlap of migratory routes with the offshore energy project to identify sites (both in UK and rest of Europe) for which LSE on features are possible.

2.18 Seabird foraging ranges in the breeding season are strongly linked to food availability. In the marine environment such resources tend to be patchily distributed, with often marked inter-annual variation in distribution. Accordingly, seabirds must respond to such variation in order to forage optimally, both to maintain their physical condition and maximise their breeding success. A second consideration is the effect of colony size on foraging range leading to intra-specific competition - larger colonies are more at risk of having a depleting effect on prey densities (at least locally) in turn leading to birds having to travel further to forage (e.g. Lewis et al. 2001). Thus foraging ranges during the breeding season can differ substantially from year to year as well as between colonies. Simply put, birds might have to forage further from their colonies if a key prey species is scarce in a given season (and possibly further still if colony size is large) or, conversely, birds might be able to stay close to their colonies when abundant resources occur in

close proximity (see e.g. Hamer et al. 2007 for an example of annual variation in gannet foraging range).

2.19 It is considered that if connectivity were to be solely defined using either mean or maximum foraging ranges this could substantially under- or over-estimate the average 'site to colony' connectivity. Instead, spatial connectivity between the proposed project site and seabird colonies was approximated – where appropriate - by using the mean maximum foraging range plus one standard deviation (+ 1 SD) given in Thaxter et al. (2012). This is considered to be a reasonably robust indicator of connectivity for the key breeding seabird species involved as it provides an intermediate scenario (between mean and maximum ranges). According to recent Natural England and JNCC guidance NE/JNCC (February, 2013), mean maximum is a suitable metric for HRA because "*it recognises that different maxima have been estimated or measured for the same species, and the mean maximum range incorporates this variability without relying on single values that might be unrepresentative of all colonies*". Colony size was not considered always to be a reliable indicator of likely connectivity because for most species no, or insufficient, data are available for this. Instead, qualitative considerations about likely foraging ranges helped inform connectivity.

2.20 To avoid too rigid an application of the connectivity definition, colonies which fell just outside a foraging range were considered for inclusion on a case by case basis. For example, for kittiwake the colonies on the west and south west coast of Skye fall outside the foraging range by a few kilometres. However, given their location relative to the proposed project site, with the potential of a direct line of flight and the species' capacity to forage over moderately long distances, connectivity with the study area was assumed (in this case during the breeding season – different criteria have been considered for connectivity during the passage and wintering periods – see below).

2.21 Where the mean maximum range + 1 SD exceeded a species' maximum foraging range, the mean maximum alone was used instead (fulmar, Arctic skua, herring gull, lesser black-backed gull, Arctic tern). This approach is considered suitably precautionary while it avoids basing the impact assessment on improbably large receptor populations.

2.22 Due to a lack of available foraging range information for great black-backed gull (not included in Thaxter *et al.* 2012) maximum range of 40 km was assumed (Ratcliffe et al. 2000). Standard deviations were not available for Manx shearwater, storm petrel, great skua, common gull, and great black-backed gull.

2.23 It was agreed during a meeting with SNH on 10 April 2012 that all east coast European sites can reasonably be excluded from the assessment because of the low likelihood that connectivity would exist by birds crossing the terrestrial environment to reach the west coast. It was also concluded here that no connectivity would exist, even during the non-breeding season, with qualifying interests from SPAs within the Orkney and Shetland Isles, or west coast of Ireland due to the large distances from the project site, and the likely biogeographical separation of these populations from the area around the Minches and Western Isles in both the breeding and non-breeding seasons.

2.24 Those species that do form part of a UK SPA interest, but where the wind farm is beyond predicted foraging range from any European site may also be excluded, **unless** the site appears to be important for a qualifying interest during the migratory or general non-breeding season (i.e. peak population estimates outside of the breeding season), when foraging range is not

applicable. Where the individuals recorded during baseline surveys are unlikely to form part of a SPA population, or if they do, will only utilise the site very occasionally and/or in very small numbers, no LSEs are predicted.

2.25 Different criteria for inclusion have been considered for migratory wildfowl species, which are likely to form part of a SPA population at some stage during the winter, although will only utilise the wind farm area briefly on passage. In these circumstances, the relatively small sample time of boat-based surveys may miss large peak passage movements, and so these species have been considered as a precaution (Table 2).

2.26 An assessment using mean maximum foraging ranges is generally not applicable in this case. Although it is acknowledged that some species may forage at a distance from breeding/roost sites, and so may cross over open areas of water, the Argyll Array Offshore Wind Farm site was considered to be outside of likely daily foraging ranges for any of the species in Table 2.

2.27 In some SPAs, wader species are qualifying interests during the breeding season, and although birds will not utilise the project site during this period, they may transit through on migration to and from wintering grounds.

2.28 Any connectivity between SPAs with non-seabird species and the project site is therefore likely to be due to birds passing briefly on migration. By collating species-specific information on migratory behaviour (e.g. in Wernham *et al.,* 2002; Marine Scotland, 2011; Wright *et al.* 2012) it was determined for qualifying species recorded during baseline surveys, whether the development site was potentially within the migratory pathway for each species, between a European site and breeding or wintering grounds elsewhere.

TABLE 2: LIST OF SEABIRD SPA INTERESTS AND INITIAL TEST FOR CONNECTIVITY									
Qualifying interests of SPAs screened into HRA	**Peak population estimate in whole study area (in breeding season)**	**Month of peak estimate (in breeding season)**	**Survey Type when peak recorded**	**Mean max. foraging range (+1 SD)**	**Maximum foraging range**	**Range used**	**SPA(s) within. foraging range**	**Migratory or wintering connectivity?**	**Potential for LSE?**
SEABIRDS									
Red-throated diver	3 * (boat) 5 (VP)	Jun 11 Nov/ Dec 09	VP	9 km	9 km	MM	NO	There is a general southerly movement away from breeding grounds in the autumn but wintering birds have a wide distribution all around British and Irish coasts (Wright *et al.* 2012). The closest SPA is on Rum, some 51 km northeast, and so although SPA birds from here may pass through, connectivity will likely be trivial.	NO
Black-throated diver	0	-	-	-	-	-	NO	There is almost no information on the migration routes of black-throated divers from UK SPA breeding populations (Wright *et al.* 2012), but with the closest SPA over 76km away, connectivity will be trivial at best.	NO
Common scoter	13 (4)	Oct 10 (Jun 11)	Boat	-	8.2 km	MM	NO	The closest SPA for breeding birds is 64 km south, and although individuals may winter all around UK shores, connectivity is likely to be trivial at best, with birds present potentially part of the Icelandic population (Wright *et al.* 2012).	NO
Manx Shearwater	698 (682)	Apr 10 (May 11)	Boat	330 km	-	MM	YES	With large breeding colonies of c.125,000 pairs on St Kilda and Rum, large numbers are likely to move through the site on passage. The vast majority of Manx shearwater migration occurs along the west of Britain (Wright et al. 2012), and so birds are likely to come from a range of SPA colonies, albeit use the project site only briefly.	YES
Gannet	1,735	Jul 11	Boat	229.4 ± 124.3 km	590 km	MM	YES	There is a protracted migration southwards of gannets after breeding ends (Wright *et al.* 2012). Peak estimates recorded within the study area occurred in March and October, suggesting passage movements of SPA birds.	YES
Fulmar	1,442	Jul 11	Boat	400 ± 245.8 km	580 km	MM	YES	Fulmars disperse widely across offshore areas during winter periods, though many continue to attend colonies throughout the year (Wright *et al.* 2012). Although numbers were relatively low in the non-breeding season, connectivity with SPA breeding populations is possible.	YES
European Storm Petrel	317	Aug 11	Boat	-	>65 km	Max	YES	It is thought that storm petrels move south to wintering grounds over a long period in late summer and early autumn (Wright *et al.* 2012), and so brief and likely trivial connectivity with SPA birds may exist at this time.	YES
Leach's storm petrel	8 * (0)	Sep 09 (-)	Boat	91.7 ± 27.5 km	<120 km	MM	NO	The closest SPA is at St. Kilda, some 156km north, and although birds may cross the project site on migration, any connectivity during the non-breeding season is likely to be trivial at best, with birds generally passing through more open ocean (Forrester *et al.* 2007).	NO

TABLE 2: LIST OF SEABIRD SPA INTERESTS AND INITIAL TEST FOR CONNECTIVITY									
Qualifying interests of SPAs screened into HRA	**Peak population estimate in whole study area (in breeding season)**	**Month of peak estimate (in breeding season)**	**Survey Type when peak recorded**	**Mean max. foraging range (+1 SD)**	**Maximum foraging range**	**Range used**	**SPA(s) within. foraging range**	**Migratory or wintering connectivity?**	**Potential for LSE?**
Cormorant	8 * 17 (VP)	May 10 Oct 09	VP	25 ± 10 km	35 km	MM	NO	Many of the cormorants that breed in the UK remain close to their breeding colonies throughout the year, although some migrate southwards along the west coast (Wright *et al.* 2012). With the closest SPA over 100km south of the project site, any connectivity is expected to be trivial at best.	NO
Shag	853 (364)	Oct 10 (Mar 11)	Boat	14.5 ± 3.5 km	17 km	Max	NO	Some shags disperse widely outside the breeding season but many remain within 50-100 km of breeding colonies throughout the year (Wright *et al.* 2012). Although two SPAs are within 100km, it was reported by Wernham *et al.* (2002) that birds from northwest Scotland tend to stay close to colonies, and so no connectivity is predicted.	NO
Great Skua	13	Aug 11	Boat	10.9 / 86.4 ± 3.0 km	13 / 219 km	MM (86.4 km)	NO	Migratory after breeding ends. Birds from west coast colonies probably migrate down the west coast of Britain and Ireland (Wright *et al.* 2012). Spring migration of UK birds takes place predominantly along the west coast of Scotland (Forrester *et al.* 2007). With the closest SPA 156km north, connectivity is expected to be trivial.	NO
Arctic skua	1	Various	Boat / VP	62.5 ± 17.7 km	75 km	MM	NO	Migratory after breeding ends. Most birds probably follow a migration route through the North Sea (Wernham et al. 2002). Birds that migrate along the coasts of Britain and Ireland comprise both UK-breeding birds and those that breed in the north of Europe (Wernham et al. 2002). Closest SPA is at Hoy over 300km distant, and so no connectivity is likely.	NO
Herring Gull	239 (18)	Oct10 (Jun 11)	Boat	61.1 ± 44.2 km	92 km	MM+SD	YES	Herring gulls that breed in Britain and Ireland are largely sedentary or only make small within-country movements between breeding and wintering sites (Wright *et al.* 2012). Some connectivity may therefore occur with Canna SPA, which is just within mean maximum foraging range.	YES
Black-headed gull	2 *	Oct 10	Boat	25.5 ± 20.5 km	40 km	MM+SD	NO	Most black-headed gulls that breed in the UK remain in Britain or Ireland during the winter, and although some migration through the project site is possible, no Scottish SPAs were screened into the HRA, and so no connectivity is predicted.	NO
Lesser Black-Backed Gull	73	May 10	Boat	141± 50.8 km	181 km	MM	YES	The species is at least partially migratory in the non-breeding season, wintering in Iberia and north Africa. The species forages widely and with an SPA within potential foraging range, connectivity may therefore occur.	YES
Great Black-backed	105 (93)	Oct 10	Boat	-	40 km	Max	NO	Great black-backed gulls that breed in Britain and	NO

TABLE 2: LIST OF SEABIRD SPA INTERESTS AND INITIAL TEST FOR CONNECTIVITY									
Qualifying interests of SPAs screened into HRA	**Peak population estimate in whole study area (in breeding season)**	**Month of peak estimate (in breeding season)**	**Survey Type when peak recorded**	**Mean max. foraging range (+1 SD)**	**Maximum foraging range**	**Range used**	**SPA(s) within. foraging range**	**Migratory or wintering connectivity?**	**Potential for LSE?**
Gull		(Apr 10)						Ireland are largely sedentary or only make small within-country movements between breeding and wintering sites. Wright *et al.* (2012) suggested that 10-25% of birds may undertake longer migrations, but with the closest SPA 150km south, connectivity is predicted to be trivial at best.	
Kittiwake	946 (181)	Oct 10 (May 10)	Boat	60 ± 23.3 km	120 km	MM+SD	YES	Kittiwakes disperse widely into pelagic feeding grounds during the non-breeding season, with the majority of UK breeding birds remaining in British waters (Fredericksen *et al.* 2012). As the species is present within the study area throughout the year, connectivity with SPA breeding populations (four within mean maximum foraging range) is possible.	YES
Common Gull	72 (boat) 102 (VP)	Dec 10 Dec 09	VP	50 km	50 km	MM	NO	Common gulls breeding in Britain and Ireland are partial migrants, with some being relatively sedentary while others move in a south or south-westerly direction from breeding sites (Wernham *et al.* 2002), Birds were recorded within the passage and early winter periods, but since the SPAs screened in are all well south of the project site, no connectivity is predicted.	NO
Common tern	2	May 10	Boat	15.2 ± 11.2 km	30 km	MM+SD	NO	Common terns migrate southwards to winter off west African coasts. Only one SPA screened into the HRA is to the north of the project site (Glas Eileanan. 108km away) and so any connectivity is expected to be trivial at best during brief migratory passage.	NO
Arctic Tern	26	May 11	Boat	24.2 ± 6.3 km	30 km	MM	NO	Following breeding, birds migrate southwards, probably mainly offshore, via the coast of western and southern Africa to wintering sites around the Antarctic (Wright *et al.* 2012). Of the SPAs screened in for this species, the nearest is 200km southeast, and the closest to the north is Rousay, at 372km distant. Any connectivity is likely to be trivial at best.	NO
Sandwich tern	4 *	Jun 11	Boat	49.0 ± 7.1 km	-	MM	NO	After the breeding season, birds disperse around the coasts of Britain and Ireland and across the North Sea to the Netherlands and Denmark (Wernham *et al.* 2002). The species is a scare migrant to the northwest of Scotland and no SPAs are designated in this area. No connectivity is therefore predicted.	NO
Roseate tern	2		VP	16.6 ±11.6 km	-	MM+SD	NO	Only a small number of Roseate Terns breed in the UK with the majority breeding in the 7 SPAs for which this species is designated. None of these are in northwest Scotland and so no connectivity is predicted.	NO
Little tern	0	-	-	6.3 ± 2.4 km	11 km	Max	NO	All little terns that breed in the UK migrate to and from	NO

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Qualifying interests of SPAs screened into HRA	**Peak population estimate in whole study area (in breeding season)**	**Month of peak estimate (in breeding season)**	**Survey Type when peak recorded**	**Mean max. foraging range (+1 SD)**	**Maximum foraging range**	**Range used**	**SPA(s) within. foraging range**	**Migratory or wintering connectivity?**	**Potential for LSE?**
								wintering sites off western Africa, probably via the western coasts of Europe. The closest SPA is South Uist Machair, around 70km to the north, and although some birds may migrate through the project site, baseline survey results suggest that the connectivity would be trivial.	
Guillemot	2,963	May 10	Boat	84.2 ± 50.1 km	135 km	MM+SD	YES	Guillemots are dispersive rather than migratory, with breeding birds found in surrounding seas throughout the winter. With four SPAs within mean maximum foraging range during the breeding season, connectivity in post-breeding and winter months is possible.	YES
Razorbill	1,611	Apr 10	Boat	48.5 ± 35.0 km	95 km	MM+SD	YES	Razorbills generally migrate in a southerly direction following the breeding season, to wintering sites along the Atlantic coast. They are thought to remain relatively close to breeding sites until October. With the closest SPA (Mingulay and Berneray) around 35km away, some connectivity is possible in the post-breeding or non-breeding periods.	YES
Puffin	1,863	Apr 10	Boat	105.4 ± 46.0 km	200 km	MM+SD	YES	Puffins are likely to be dispersive rather than follow particular migratory routes (Wernham et al. 2002). With a number of SPAs within mean maximum foraging range, connectivity in the non-breeding season is possible.	YES

* = raw count; MM = mean maximum foraging range as per Thaxter *et al.* (2012); MM +SD = mean maximum foraging range plus one standard deviation

TABLE 3: LIST OF NON-SEABIRD SPA INTERESTS AND INITIAL TEST FOR CONNECTIVITY				
Qualifying interests of SPAs screened into HRA	**Total raw count 2009-11**	**Survey**	**Migratory or wintering connectivity?**	**Potential for LSE?**
Greenland white-fronted goose	11 (autumn radar) 26 (VP) 16 (boat)	VP	The Inner Hebrides are an important stopover and wintering site for the species, with internationally important numbers present on Tiree and Coll between 2006/7 and 2010/11 (Holt et al. 2012). Individuals from UK SPAs may pass through development site as they move southeast from Greenland. Extreme site-fidelity displayed between and within winters.	YES
Greenland barnacle goose	2,347 (autumn radar) 38 (VP) 123 (boat)	Radar	The Inner Hebrides are an important stop-over and wintering site for the species, with internationally important numbers present on Tiree and Coll between 2006/7 and 2010/11 (Holt et al. 2012).Individuals from UK SPAs likely to pass through development site. Birds arrive at staging and wintering areas in Sep and Oct, often via Iceland. Majority of birds recorded on Islay are relatively stable after migratory period. High site-fidelity displayed between and within winters.	YES
Canadian light-bellied brent goose	775 (autumn radar) 7 (VP)	Radar	Movements by satellite tagged birds showed that the Inner Hebrides are within the species' flyway corridor, particularly in relation to populations wintering in Northern Ireland and north-east Ireland, with geese wintering in west Ireland apparently taking a more direct route across open sea (Griffin et al. 2011). There are small numbers present in the Hebrides over winter, but the Scottish sites generally serve as temporary staging sites, probably when unfavourable weather conditions develop during migration, or when some geese find themselves under stress (Robinson *et al.*, 2004).	YES
Whooper swan	32 (autumn radar) 4 (VP)	Radar	Movements by satellite tagged birds showed that the Inner Hebrides (and by extension the Study Area) lies within the species' flyway corridor, with a number of birds moving through the proposed Argyll Array development area (Griffin et al. 2011). May stage briefly on Islay before heading towards Ireland or vice versa.	YES
Tundra swan	0	-	Birds migrate to Britain across the North Sea from staging sites in the Netherlands, and with the closest SPA (Wright *et al.* 2012), and so the project site is outside of any migration route.	NO
Greylag goose	124 (boat) 17 (autumn radar)	Boat	Greylag goose movements on Coll and Tiree are thought to almost exclusively involve birds from the native population breeding in NW Scotland (not an SPA qualifier). The native populations in Scotland are largely sedentary with short-range movements between breeding, moulting and wintering areas (Forrester et al. 2007).	NO
Pink-footed goose	313 (autumn radar)	Radar	Individuals from UK SPAs likely to pass through development site. Birds arrive in Britain from breeding grounds in Greenland and Iceland in mid-September. Populations are concentrated in north-east Scotland, eastern Scotland and Lothian and Borders (Fox *et al.*, 1994; Douse, 1998). In early winter, birds redistribute south to Lancashire and Norfolk in particular. Birds move north again from February, when numbers peak in the Solway Estuary.	YES
Shelduck	0	-	The main movements of British and Irish breeding shelduck involve a moult migration across the North Sea to moulting sites in the Helgoland Bight in the Wadden Sea. A smaller number remain in Britain, moulting on a few large estuaries, but no connectivity of SPA birds with the project site is likely, particularly with the large distance to the closest SPA.	NO
Pintail	0	-	Birds travel over UK waters on passage migration in spring and autumn from breeding grounds in Iceland, Scandinavia, the Baltic States and Russia. The closest SPAs are in England and Wales, and so connectivity is likely to be trivial at best.	NO
Shoveler	0	-	An influx of birds comes across the North Sea from continental Europe in winter, although	NO

TABLE 3: LIST OF NON-SEABIRD SPA INTERESTS AND INITIAL TEST FOR CONNECTIVITY				
Qualifying interests of SPAs screened into HRA	**Total raw count 2009-11**	**Survey**	**Migratory or wintering connectivity?**	**Potential for LSE?**
			some also arrive from across the Irish Sea. The closest SPA is 260km south, and so no connectivity is predicted.	
Scaup	0	-	The majority of wintering birds in the UK originate in Iceland, and although it is possible that birds from SPAs further south may pass through the project site en route, connectivity is likely to be trivial, with no birds recorded during baseline surveys.	NO
Red-necked phalarope	0	-	A small number of red-necked phalaropes breed in Britain and Ireland and will pass across UK waters on migration to or from pelagic wintering areas (Wright *et al.* 2012). With the closest SPA in Fetlar, over 500km from the project site, no connectivity is predicted.	NO
Knot	0	-	Knot breeds in the high Arctic and migrates via staging sites in Iceland or Norway in autumn to wintering sites on large estuaries in western Europe. Although an SPA species for some sites in Northern Ireland and England, baseline results suggests that no, or trivial connectivity with the project site is likely.	NO
Corncrake	0	-	Corncrakes are migratory and depart from breeding areas from late Jul-Sep towards south and east Africa. Return in Apr-early May. Individuals from Coll and Tiree SPAs within may pass through development site on nocturnal migration. Occasional between-island movements also possible in breeding season.	YES
Whimbrel	11	Boat	Breeding birds from Iceland cross to estuaries within the UK on passage. They are known to use a small number of major staging sites where large concentrations of birds occur, thus it seems likely that migration routes could be concentrated in certain areas (Wright *et al.* 2012). With the Ribble and Alt Estuaries SPA (380km away) the only site screened in for the HRA, no, or trivial connectivity is predicted.	NO
Curlew	14 (boat) 39 (VP)	VP	Migration may occur on a broad front across the North and Irish Seas, or may be concentrated in particular areas (Wright *et al.* 2012). With breeding occurring across Scotland, and the closest SPA being 260km south of the project site, connectivity is likely to be trivial at best.	NO
Ringed plover	5	Boat	Birds that breed in the UK often make relatively small movements between breeding and wintering sites, with many remaining in the UK, and some crossing either the Irish Sea or English Channel to wintering sites in Ireland or France (Wright *et al.* 2012). The Tiree Wetlands and Coast SPA is 3.5km away and although connectivity during the breeding season is unlikely, migratory movements across the project site cannot be ruled out.	YES
Golden plover	21	Boat	Influxes of birds from Iceland and the Faeroes occur during autumn migration, and with a variety of source populations, birds may be found throughout British waters. The species is a feature of a number of SPAs in the UK, and so connectivity is difficult to determine. However, with the closest SPA over 200km away, connectivity is likely to be trivial at best.	NO
Turnstone	3	Boat	Migration occurs between Northern Europe, Greenland and Canada to Britain and Ireland. With the closest SPA (Tiree Wetlands and Coast) only 3.5km away, the project site may be within a migratory pathway of the SPA and so connectivity cannot be ruled out.	YES
Lapwing	21	Boat	British breeding lapwings migrate mainly to the west, across the Irish Sea, and southwest across the English Channel to western France and Iberia, though the British breeding population is only partially migratory with many birds remaining close to breeding sites during the winter (Wright *et al.* 2012). With the closest SPA (South Uist Machair) some 70km north, connectivity is likely to be trivial.	NO

TABLE 3: LIST OF NON-SEABIRD SPA INTERESTS AND INITIAL TEST FOR CONNECTIVITY				
Qualifying interests of SPAs screened into HRA	**Total raw count 2009-11**	**Survey**	**Migratory or wintering connectivity?**	**Potential for LSE?**
Purple sandpiper	6 11	Boat VP	UK wintering populations of purple sandpiper includes breeding birds from Greenland and arctic Canada. The species probably regularly migrates across waters off the north and west coasts in order to reach the UK SPA sites where it is a designated feature (Wright *et al.* 2012). The closest SPA is North Uist Machair and Islands some 100km north, and although connectivity cannot be ruled out, it is likely to be trivial at best.	NO
Bar-tailed godwit	1	Boat	The migration route is predominantly across the North Sea, with some birds continuing across the Irish Sea or English Channel, while others remain in Britain throughout the winter (Wright *et al.* 2012). The project site appears to be outside of the migration range of the species, and so no connectivity is predicted.	NO
Goldeneye	2	Boat	The main migration route for birds wintering in Britain and Ireland is across the North Sea, and with the closest SPA over 170km south, no connectivity is predicted.	NO
Dunlin	10	Boat	Breeding dunlin occur at upland sites in Scotland and on Scottish islands, including Tiree Wetlands and Coast SPA, which is 3.5km away. Although during the breeding season birds are not likely to pass through the project site, connectivity cannot be ruled out during the migration period as birds move southwards.	YES
Oystercatcher	1 6	Boat VP	The British breeding oystercatcher population tends to move south in the non-breeding season, although many will remain as residents in the UK throughout the winter (Wright *et al.* 2012). The closest SPA to the project site (Tiree Wetlands and Coast, 3.5km away) is designated for its breeding population, although it is possible that birds may migrate through the project site. Connectivity cannot be ruled out.	YES
Teal	3	VP	Teals migrate to Britain and Ireland from Iceland and from northern Europe and Russia (Wright *et al.* 2012). Although it is possible that some birds that winter in the Upper Solway Flats and Marshes SPA (260km south) pass through the project site, connectivity is likely to be trivial at best.	NO
Redshank	7 1	Boat VP	The closest SPA to the project site is Tiree Wetlands and Coast (3.5km) where the species is a breeding season interest. No connectivity is likely during this period but as birds move to coastal areas in winter, with most in the north heading south, connectivity may be possible during the passage periods.	YES
Wigeon	5	VP	Although a small number of wigeon breed in the UK, a far greater number visit the country during the winter, migrating from breeding areas in Scandinavia and northern Russia, with some also coming from Iceland (Wright *et al.* 2012). With the closest SPA in England, no connectivity to the project site is predicted.	NO
Black-tailed godwit	28	Boat	The vast majority of the Icelandic population of black-tailed godwits either winters in or migrates across the British Isles (Wright *et al.* 2012). With the closest SPA being the Ribble and Alt Estuaries, no connectivity during migration is predicted.	NO
Ruff	4	Boat	Ruffs occur in Britain primarily on passage migration although a small number also breed or winter here (Wright *et al.* 2012). Passage routes are mainly across the North Sea and southern Irish Sea and so the project site is outside of the main migratory corridor. With the closest SPA being the Ribble and Alt Estuaries, no connectivity during migration is predicted.	NO
Sanderling	1	Boat	Large numbers of Sanderling pass through staging and moulting sites on UK estuaries in spring and autumn, on passage migration from high-arctic breeding grounds to wintering sites further south in Europe or in West Africa (Wright *et al.* 2012). South Uist Machair SPA (70km north) is the closest site for the species, and although some connectivity is possible on passage, this is likely to be trivial at best.	NO

TABLE 3: LIST OF NON-SEABIRD SPA INTERESTS AND INITIAL TEST FOR CONNECTIVITY				
Qualifying interests of SPAs screened into HRA	**Total raw count 2009-11**	**Survey**	**Migratory or wintering connectivity?**	**Potential for LSE?**
Golden eagle	0	-	No records during surveys and no migratory pathway of this terrestrial species	NO
Peregrine	0	-	No records during surveys and no migratory pathway of this terrestrial species	NO
Chough	0	-	No records during surveys and no migratory pathway of this terrestrial species	NO
Hen harrier	0	-	No records during surveys and no migratory pathway of this terrestrial species	NO
Whitethroat	0	-	No records during surveys and no migratory pathway of this terrestrial species	NO
Fair Isle wren	0	-	No records during surveys and no migratory pathway of this terrestrial species	NO

2.29 For all seabird species presented above in Table 2, the following SPA qualifying interests will be considered further in this HRA:

- Manx shearwater,
- Fulmar;
- Gannet;
- Storm petrel;
- Kittiwake;
- Lesser black-backed gull;
- Herring gull;
- Guillemot;
- Razorbill; and
- Puffin.

2.30 From Table 3 the following non-seabird SPA qualifying interests will also be included in further analysis, as counts recorded may form an important part of a total SPA population that potentially crosses the Argyll Array site:

- Greenland white-fronted goose;
- Greenland barnacle goose;
- Canadian light-bellied brent goose;
- Pink-footed goose;
- Whooper swan;
- Ringed plover;
- Turnstone;
- Dunlin;
- Oystercatcher;
- Redshank; and
- Corncrake.

2.31 Although no corncrakes were recorded during baseline surveys, from consultation with SNH it was raised that nocturnal migratory movements of breeding birds from nearby islands may be missed due to the temporal limitations of surveys. As a precaution therefore, the species will be included further in this assessment.

3 PART 2: ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

3.1 This part of Stage 5 of the HRA screening process (DTA, 2012) involves selecting a final list of the SPAs and associated interest features which may be 'screened into' an Appropriate Assessment, because a LSE on an interest of an SPA cannot be excluded via the identified impact pathways.

3.2 In DTA (2012), the determination of LSE involves a judgement as to whether a project could undermine the conversation objectives of a Natura site. Although this need not involve a detailed assessment, a judgment of LSE should take into account characteristics of the qualifying interests of the site involved e.g. behavioural / foraging ecology and should be informed by an understanding of the characteristics of the project and context of the development site.

3.3 Therefore in order to conclude LSE for the SPAs with a connection to the Project (as listed in the section above) the following section sets out:

- The range of impacts that the Project could have on qualifying interest(s) of a site (impact pathway);
- Whether a qualifying feature(s) would, by virtue of its behavioural and ecological characteristics, be affected by a particular impact (species sensitivity); and
- Where a qualifying feature is likely to be affected by an impact, an appraisal of whether or not there is potential for any of the conservation objectives relating to these qualifying interests to be undermined on the basis of the potential effects. Where there is potential for the conservation objective(s) to be undermined LSE should be concluded.

Identified impacts

3.4 Based on reviews and evidence in the scientific literature (e.g. Drewitt and Langston, 2006; Dierschke *et al*., 2006; Langston 2010), an offshore wind farm such as Argyll Array may affect birds through the following:

- Direct **habitat loss/gain**: long-term or temporary physical loss of habitat due to construction of infrastructure may result in a direct impact to a species, or an indirect one due to effects on its prey, as a result of construction of wind farm infrastructure. These structures may conversely result in increased prey or the provision of roost structures due to habitat changes.
- **Disturbance**: displacement of birds (direct effect) or their prey (indirect effect) from a particular area around a source of disturbance (noise, vibration or visual), equating to indirect habitat loss for the duration of the disturbance. This may occur during the construction, operation or decommissioning phases, and will take the form of an increase in boat traffic, and associated construction or maintenance activities;
- Long-term indirect habitat loss due to **displacement** of birds or their prey around operational turbines and other infrastructure;
- **Risk of collisions** with turbine rotors or other structures resulting in death; and

- **Formation of barriers** on daily or seasonal migration routes due to the presence of turbines, resulting in greater energy expenditure for individuals, or disconnection of ecological units, such as breeding, roosting and feeding sites.
- **Indirect effects** due to disturbance or displacement of prey species, or changes in habitat supporting such species, which may impact on the ability for birds to obtain sufficient food. These effects may occur during construction or operation.

3.5 Any impact on qualifying species' populations would occur as a result of the wind farm's effect on individual birds and on their fitness or productivity levels. The significance of the impact depends on a number of interacting factors which include the sensitivity of a particular species, the duration/extent of impact and the proportion of the population that is affected. The impacts on a SPA is related to survival and productivity rates, which may be reduced if birds are killed, or have to move to less profitable areas during longer periods of time. Impacts on a population are measured in terms of the number of birds from the population affected or the increases to the baseline mortality rate of the population.

Species' sensitivity to impacts

3.6 For a LSE to be concluded it is necessary to establish whether those identified qualifying interests are sensitive to the potential impacts of the Argyll Array Offshore Wind Farm. Even if there is connectivity, and an impact pathway, if a particular qualifying interest is not sensitive to that impact/activity then it is unlikely that there will be a significant effect on the species. Therefore the conclusion should be no LSE.

3.7 Sensitivity to an impact or activity is influenced by behavioural characteristics of certain species including for example foraging strategy, flight behaviour, diet (prey), moulting behaviour, and migration patterns. The information on sensitivity in Table 4 is based on information in Furness and Wade (2012) and Langston (2010) for seabirds. Sensitivity ratings for non-seabird species are based on the fact that the site is only likely to be utilised briefly during migration periods, and so it is likely that impact pathways may potentially exist only via collision risk and barrier effects. Information on flight behaviour and therefore propensity for a LSE for a number of non-seabird species, is presented in Wright *et al.* (2012).

TABLE 4: SPA SPECIES CHARACTERISTICS AND SENSITIVITY									
Species	Peak abundance estimate (breeding season)	Population Trends	Sensitivity to potential impacts						Site usage
			Habitat loss	Disturbance	Displacement	Collision risk	Barrier Effect	Indirect Effects	
Seabirds									
Manx shearwater	698 (682)	n/a	Very low	Very low	Very low	Very low	Very low	Very low	Distribution patterns based on boat-based survey data indicate an apparent preference for the shallower waters in the Study Area. With large breeding colonies of c.125,000 pairs on St Kilda and Rum the large numbers moving through the site are not unexpected.
Gannet	1,735	n/a	Very low	Low	Low	High	Low	Very low	Boat-based survey data indicate the species is widely distributed across the Study Area, with somewhat higher numbers occurring over shallower waters. Flight direction data show a south versus north and west directional pattern during the breeding season, and a similar, though less pronounced pattern during the non-breeding season. Both are likely due to movements to and from the large colonies on St Kilda and Ailsa Craig in particular, as Tiree lies approximately equidistant on a northwest-southeast axis between both colonies.
Fulmar	1,442	-13% (-7%)	Very low	Very low	Very low	Low	Low	Very low	Observed throughout the survey area. Flight direction data show a largely east-west pattern, regardless of season and it seems reasonable to assume that this directional pattern is linked to the large fulmar colonies on Tiree.
Kittiwake	946 (181)	-47% (-66%)	Low	Low	Low	High	Low	Low	Boat-based survey data indicate the species' distribution is scattered across the Study Area, with no apparent preference in terms of water depth. Larger (foraging) flocks appear to occur predominantly in the northeast and south of the Study Area. Flight direction data show a pronounced bias in western direction during the breeding season, presumably reflecting foraging movements from the non-designated Ceann a' Mhara colony. During the non-breeding season the pattern likely reflects passage movements to the south and west.
Herring gull	239 (18)	-36% (-58%)	Very low	Low	Low	High	Low	Very low	Boat-based survey data indicate the species' distribution is scattered across the Study Area, with no apparent preference.
European storm petrel	317	n/a	Very low	Very low	Very low	Very low	Very low	Very low	Distribution patterns based on boat-based survey data indicate an apparent preference for the deeper waters in the Study Area. The nearest European storm-petrel breeding colonies are on Lunga in the Treshnish Isles, some 27 km to the east.
Razorbill	1,611	+3%	Medium	Medium	Medium	Low	Medium	Medium	Boat-based survey data indicate the species' distribution during the Year 1 breeding season to be concentrated in the northern half of the Study Area, largely over shallow waters of less than 20 m depth. In Year 2 no such pattern is visible. During the non-breeding season the species is widely distributed across the Study Area. The peak in observations is most likely to coincide with activity by breeding birds from Tiree or Mull
Puffin	1,863	n/a	Medium	Low	Low	Low	Medium	Medium	Boat-based survey data indicate the species' is widely distributed across the Study Area during the breeding season, and mostly absent during other

TABLE 4: SPA SPECIES CHARACTERISTICS AND SENSITIVITY									
Species	Peak abundance estimate (breeding season)	Population Trends	Sensitivity to potential impacts						Site usage
			Habitat loss	Disturbance	Displacement	Collision risk	Barrier Effect	Indirect Effects	
Seabirds									
									times of year. The distribution of flight direction in the breeding season is dominated by a north-south axis, in all likelihood involving birds flying to and from the large colonies on Mingulay and Berneray
Guillemot	2,963	+4% (-24%)	Medium	Medium	Medium	Low	Medium	Medium	Boat-based survey data indicate the species' distribution during the breeding season to be concentrated over the shallow waters of the Study Area. During the non-breeding season the species has a largely similar distribution. There were no large aggregations of guillemot observed on site with the majority of observed flocks comprising five or fewer individual birds. Flight directionality implies flights to and from the nearest seabird colony at Ceann a' Mhara on Tiree.
Non-seabirds									
Greenland white-fronted goose	11 (autumn radar) 26 (VP) 16 (boat)	Decline	Very low	Very low	Very low	Medium	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 30% of migratory goose flights may be at risk height.
Greenland barnacle goose	2,347 (autumn radar) 38 (VP) 123 (boat)	Increase	Very low	Very low	Very low	Medium	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 30% of migratory goose flights may be at risk height.
Canadian light-bellied brent goose	775 (autumn radar) 7 (VP)	Increase	Very low	Very low	Very low	Medium	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 30% of migratory goose flights may be at risk height.
Pink-footed goose	313 (autumn radar)	Increase	Very low	Very low	Very low	Medium	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 30% of migratory goose flights may be at risk height.
Whooper swan	32 (autumn radar) 4 (VP)	Increase	Very low	Very low	Very low	High	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 50% of migratoryswan flights may be at risk height.
Corncrake	0	Increase	Very low	Very low	Very low	Medium	Low	Very low	No birds recorded during baseline surveys (nocturnal migration possible). Evidence in Wright *et al.* (2012) suggests that 50% of migratory corncrake flights may be at risk height.
Ringed plover	5 (boat)	Decline	Very low	Very low	Very low	Low-Medium	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 25% of migratory goose flights may be at risk height.
Turnstone	3 (boat)	Stable	Very low	Very low	Very low	Low-Medium	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 25% of migratory goose flights may be at risk height.
Dunlin	10 (boat)	Decline	Very low	Very low	Very low	Low-Medium	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 25% of migratory goose flights may be at risk height.
Redshank	7 (boat)	Increase	Very low	Very low	Very low	Low-Medium	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 25% of migratory goose flights may be at risk height.
Oystercatcher	6 (VP)	Stable	Very low	Very low	Very low	Low-Medium	Low	Very low	Recorded transiting the site during migration. Evidence in Wright *et al.* (2012) suggests that 25% of migratory goose flights may be at risk height.

UK seabird population trends from 2000-2012 in JNCC (2013), with Scottish trends in parenthesis from1986-2011 in SNH (2012). Wildfowl trends from WWT Species Accounts http://monitoring.wwt.org.uk/species.php. Wader and corncrake trends based on difference in UK population estimates in Baker *et al.* (2006) and Musgrove *et al.* (2013).

SPA Conservation Objectives

3.8 Together with the Habitats Directive, the Birds Directive has established a network of internationally important sites designated for their ecological status. As part of this, conservation objectives are required for all of these sites.

3.9 Conservation objectives are defined in Planning Policy Statement (PPS) 9: Biodiversity and Geological Conservation (ODPM, 2005) as the reasons for which the site was classified or designated. As such the conservation objectives define the conservation status and the integrity of the site. The effects of the proposed development should be assessed against these conservation objectives depending on the current condition of the site, current anthropogenic and environmental pressures and the future aspirations for the site.

3.10 For all Scottish SPAs considered in this HRA report, the Conservation Objectives are as follows (taken from SNH's SiteLink website):

> (i) To avoid deterioration of the habitats of the qualifying species;
> (ii) To avoid significant disturbance to the qualifying species;
>
> To ensure for the qualifying species that the following are maintained in the long term:
> (iii) Population of the species as a viable component of the site;
> (iv) Distribution of the species within site;
> (v) Distribution and extent of habitats supporting the species;
> (vi) Structure, function and supporting processes of habitats supporting the species; and
> (vii) Repeat of (ii): No significant disturbance of the species.

It is important to recognise that the conservation objectives primarily offer site-based protection and that some of them will not directly apply to species when they are out with the boundaries of their SPA. This is particularly true for the objectives (i), (v) and (vi) relating directly to the supporting habitats within the SPA.

3.11 Factors / events outside a site boundary may have the capacity to affect the long term viability of bird populations within an SPA, and this is reflected in objective (iii). It encompasses direct impacts such as disturbance, or indirect impacts such as loss of supporting habitats outside of the SPA. There is also the potential for factors / events outside a site boundary to have the capacity to affect the long term distribution of bird species within an SPA (objective iv).

3.12 It should be noted that some SPAs from Northern Ireland, England and the Republic of Ireland have been screened into this assessment, and that the conservation objectives of these sites (where available) are likely to differ somewhat from Scottish sites. It is however considered that a sufficiently robust assessment of site integrity can be made for each SPA by using the Scottish SPA conservation objectives as a surrogate.

Site integrity

3.13 The integrity of a site is defined as the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified (ODPM, 2005, SNH, 2010b). If the conservation objectives are met, then the integrity will be maintained and deterioration of habitat or habitat of species or significant disturbance of species avoided. An adverse effect on integrity is likely to be one

which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of its designation.

Linking potential impacts to conservation objectives

3.14 Each of the impacts identified above are considered below in Table 5 in the context of an SPA's conservation objectives, to demonstrate potential impact pathways. Whilst some impacts may act upon each conservation objective in subtle or indirect ways (e.g. it could be argued that disturbance effectively results in habitat loss), the main impact pathways are presented below.

3.15 Only collision risk and barrier effects are considered to be relevant to the migratory species that pass briefly through and do not forage within the development site, and are therefore unlikely to be disturbed or displaced from foraging or loafing habitat.

TABLE 5: IDENTIFICATION OF IMPACT PATHWAYS FROM EFFECTS OF THE ARGYLL ARRAY WIND FARM ACTING ON SPA CONSERVATION OBJECTIVES							
Conservation Objective	**Potential impact pathway**						
	Habitat loss/gain	**Disturbance**	**Displacement**	**Collision risk**	**Barrier effects**	**Indirect Effects**	**Rationale**
(i) To avoid deterioration of the habitat of the qualifying species	X	X	X	X	X	X	Refers only to habitat within an SPA
(ii) To avoid significant disturbance to the qualifying species	X	✓	✓	X	✓	X	It is considered possible that disturbance may occur outside of SPA, during construction, operation and decommissioning.
(iii) Population of the species as a viable component of the site	✓	✓	✓	✓	✓	✓	Encompasses all identified impacts when birds are outside of SPA, during construction, operation and decommissioning.
(iv) Distribution of the species within site	X	X	X	X	X	X	Generally refers only to within SPA distribution, although nearby projects may also affect distribution. In this case, Argyll Array is of sufficient distance from closest SPAs to negate this effect.
(v) Distribution and extent of habitats supporting the species	X	X	X	X	X	X	Refers only to habitats within SPA
(vi) Structure, function and supporting processes of habitats supporting the species	X	X	X	X	X	X	Refers only to habitats within SPA
(vii) No significant disturbance of the species	X	✓	✓	X	✓	X	It is considered possible that disturbance may occur outside of SPA, during construction, operation and decommissioning.
Notes:							

3.16 Since the Argyll Array Offshore Wind Farm site does not overlap in extent with any SPA, then conservation objectives (i), (iv), (v) and (vi) are not considered relevant for any qualifying interests.

Concluding LSE based on sensitivities of qualifying features to impacts

3.17 Based on the determination of potential connectivity to the Argyll Array Offshore Wind Farm with qualifying interests of SPAs listed in Table 2 and Table 3, and the potential impact pathways identified for each of these species, conclusions on LSE can be made. These are presented in Table 6 below.

3.18 Table 7 below summarises the SPAs, where as a result of the screening process above, contain qualifying interests where a LSE cannot be discounted. Although the projects site is beyond likely foraging range of a number of these SPAs for seabird qualifying interests during the breeding season, some of these SPAs cannot be discounted for potential impacts during the non-breeding season when it is assumed that there is a wider distribution and greater intermixing of populations of qualifying species along the west coast of Britain and east coast of Ireland.

3.19 For migratory wildfowl, birds may utilise a number of SPAs along the west coast of Britain or east coast of Ireland during migration and overwinter, and so these have also been retained.

3.20 For breeding waders, where migration to and from wintering sites may be via the project site, only the closest SPA, Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast) where the species is a qualifying interest during the breeding season is considered to have any non-trivial connectivity. Connectivity with the project site for any wader species that qualify for SPA inclusion during the non-breeding season was discounted.

3.21 It is therefore concluded that without further assessment where a LSE has been identified, a compromise of each SPA's conservation objectives cannot be discounted, which may in turn lead to an impact on site integrity.

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TABLE 6: DETERMINATION OF LSE FOR SPA QUALIFYING INTERESTS

Species	Sensitivity to potential impacts						Conclusion for LSE	Rationale
	Habitat loss	Disturbance	Displacement	Collision risk	Barrier Effect	Indirect Effects		
Seabirds								
Manx shearwater	x	x	x	x	x	x	No LSE	This wide-ranging species is not considered to be sensitive to wind farm impacts beyond close proximity to any breeding colony, where individuals may congregate in rafts. Nearly all flights were recorded below risk height during baseline surveys. With the closest SPA c.51km away, the site is unlikely to be of any particular importance to the species.
Gannet	x	x	✓	✓	x	x	LSE cannot be ruled out	The project site lies within the foraging range of two large colonies at St Kilda and Ailsa Craig. Species was recorded in high numbers throughout the summer surveys, and this is likely to include breeding adults. Evidence suggests that this species may be susceptible to displacement and collision mortality (e.g. Krijgsveld et al. 2011 and Cook *et al.* 2012), although as a wide-ranging species, other impacts are considered to be insignificant.
Fulmar	x	x	x	x	x	x	No LSE	The nearest SPA is c.34km away, and the species is generally not sensitive to wind farm impacts. As might be expected from a wide-ranging species, data from boat-based surveys show fulmar to be widely distributed across the Study Area. Most birds area likely to be from the non-designated Ceann a Mhara colony on Tiree which holds 1,400 pairs. Nearly all flights were below risk height..
Kittiwake	x	x	x	✓	x	x	LSE cannot be ruled out	Although the site does not appear to be of real importance to the species, the potential collision risk, and decline in populations across Scotland and the UK means that a LSE cannot be ruled out for SPA qualifying interests. Evidence from operational wind farms (e.g. Krijgsveld *et al.* 2011) suggests that gulls such as kittiwake are unaffected by disturbance-displacement, and are able to obtain mobile prey species from across a wide area.
Lesser black-backed gull	x	x	x	✓	x	x	LSE cannot be ruled out	Like other gulls the species is not considered sensitive to most impacts, except for collision risk. Although peak numbers may reflect presence of non-SPA birds that breed closer to the project site, a LSE cannot be discounted.
Herring gull	x	x	x	✓	x	x	LSE cannot be ruled out	Like other gulls the species is not considered sensitive to most impacts, except for collision risk. Although peak numbers most likely represent transient wintering birds, and not a SPA population consistently using the site, a LSE cannot be discounted.
Storm petrel	x	x	x	x	x	x	No LSE	This relatively wide-ranging species is not considered to be sensitive to wind farm impacts such as disturbance-displacement beyond close proximity to any breeding colony. The closest SPA is 27 km away. No flights were recorded at risk height.
Guillemot	x	✓	✓	x	x	x	LSE cannot be ruled out	Although locally, nearly 4,000 birds breed on the cliffs at Ceann A'Mhara on Tiree, it cannot be ruled out that the site is used by SPA birds. The species is relatively sensitive to disturbance-displacement impacts and so a LSE cannot be ruled out. Due to the distance from closest SPA (34km), and since the species' mobile prey distribution varies within and between years, all other impacts are considered insignificant.
Razorbill	x	✓	✓	x	x	x	LSE cannot be ruled out	Although many birds present are likely to be from the cliffs at Tiree, it cannot be ruled out that the site is used by more distant SPA birds. The species is relatively sensitive to disturbance-displacement impacts and so a LSE cannot be ruled out.

TABLE 6: DETERMINATION OF LSE FOR SPA QUALIFYING INTERESTS								
Species	Sensitivity to potential impacts						Conclusion for LSE	Rationale
	Habitat loss	Disturbance	Displacement	Collision risk	Barrier Effect	Indirect Effects		
Seabirds								
								Due to the distance from closest SPA (34km), and since the species' mobile prey distribution varies within and between years, all other impacts are considered insignificant.
Puffin	x	✓	✓	x	x	x	LSE cannot be ruled out	Although peak populations are most likely breeding adults from one of the colonies on Mull, The species is relatively sensitive to wind farm impacts. Due to the distance from closest SPA (34km), and since the species' mobile prey distribution varies within and between years, all other impacts are considered insignificant.
Non-seabirds								
Greenland white-fronted goose	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Greenland barnacle goose	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Canadian light-bellied brent goose	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Pink-footed goose	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Whooper swan	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Corncrake	x	x	x	✓	x	x	LSE cannot be ruled out	During consultation it was agreed that despite a lack of evidence, collisions cannot be ruled out during the nocturnal migration periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Ringed plover	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Turnstone	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Dunlin	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Redshank	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.
Oystercatcher	x	x	x	✓	x	x	LSE cannot be ruled out	Potential for collision mortality during migratory periods. Barrier effects considered to be negligible in comparison with overall length of migration route.

TABLE 7: SPAS THAT HOST QUALIFYING INTEREST WHERE A LSE COULD NOT BE DISCOUNTED					
SPA	**Distance from development site**	**Qualifying interest where a LSE could not be ruled out**	**Cited SPA population**	**Current SPA population**	**Conservation Status**
Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast)	3.5 km E	Greenland white-fronted goose	1,419 i	888i (all Tiree)	Favourable maintained
		Greenland barnacle goose	1,456 i	3,872 i (all Tiree)	Favourable maintained
		Ringed plover (breeding)	160 p	No data	Favourable maintained
		Dunlin (breeding)	125 p	No data	Favourable maintained
		Redshank (breeding)	140 p	No data	Unfavourable, recovering
		Oystercatcher (breeding)	160 p	No data	Favourable maintained
		Turnstone	700 i	No data	Favourable maintained
Tiree (corncrake)	5.5 km E	Corncrake	44 males	389 males	Favourable maintained
Coll	20 km E	Greenland white-fronted goose	789 i	411 I (all Coll)	Favourable maintained
		Greenland barnacle goose	1,029 i	1,176 i	Favourable maintained
Coll (corncrake)	25 km E	Corncrake	24 i	134 males (all Coll)	Favourable maintained
Treshnish Isles	27 km E	Greenland barnacle goose	82 i	207 i **	Unfavourable, no change
Mingulay and Berneray	34 km NW	Kittiwake	8,600 p	2,852 p	Unfavourable declining
		Guillemot	30,900 p	21,124 i	Unfavourable declining
		Puffin	4,000 p	3,816 p	Favourable maintained
		Fulmar	10,450 p	7,516 p	Favourable maintained
		Razorbill	11,323 p	16,569 i	Unfavourable declining
Rum	51 km NE	Kittiwake	1,500 p	788 p	Unfavourable no change
		Guillemot	2,454 i	2,454 i	Unfavourable no change
North Colonsay and Western Cliffs	52 km SE	Kittiwake	4,512 p	5,563 p	Favourable maintained
		Guillemot	6,656 i	15,912 i	Favourable maintained
Eoligarry, Barra	56 km NW	Corncrake	28 i	72 males (all Barra)	Favourable maintained
Canna and Sanday	60 km NE	Kittiwake	930 p	1,083 p	Favourable maintained
		Guillemot	5,800 i	5,841 i	Favourable maintained
		Puffin	1,200 i	20 p	Favourable maintained
		Herring gull	1,300 i	83 p	Unfavourable declining
Kilpheder to Smerclate, South Uist	62 km N	Corncrake	20 i	119 males (all South Uist)	Favourable maintained
Gruinart Flats, Islay	64 km SE	Greenland white-fronted goose,	1,000 i	7,952 i (all Islay)	Favourable maintained
		Greenland barnacle goose,	20,000 i	45,627 i (all Islay)	Favourable maintained
		Canadian pale-bellied brent goose	300 i	No data	Favourable maintained
Rinns of Islay	65 km SE	Greenland white-fronted goose	1,600 i	7,952 i (all Islay)	Favourable maintained
		whooper swan	140 i	No data	Favourable maintained
Bridgend Flats, Islay	75 km SE	Greenland barnacle goose	6,700 i	45,627 i (all Islay)	Favourable maintained
Laggan, Islay	78 km SE	Greenland white-fronted goose	300 i	7,952 i (all Islay)	Favourable maintained
		Greenland barnacle goose	1,800 i	45,627 i (all Islay)	Favourable maintained

TABLE 7: SPAS THAT HOST QUALIFYING INTEREST WHERE A LSE COULD NOT BE DISCOUNTED					
SPA	**Distance from development site**	**Qualifying interest where a LSE could not be ruled out**	**Cited SPA population**	**Current SPA population**	**Conservation Status**
Eilean na Muice Duibhe/Duich Moss, Islay	81 km SE	Greenland white-fronted goose	600 i	7,952 i (all Islay)	Favourable maintained
Aird and Borve, Benbecula	97.5 km N	Corncrake	19 i	35 males (all Benbecula)	Favourable maintained
North Uist Machair and Islands	105 km N	Corncrake	25 i	112 males (all North Uist)	Favourable maintained
		Greenland barnacle goose	1,500 i	2,816 i (all North Uist)	Favourable maintained
Kintyre Goose Roosts	111 km SE	Greenland white-fronted goose	2,323 i	1,050 i (Rhunahaorine)	Favourable maintained
Horn Head to Fanad Head	113 km SE	Puffin	189 p	189 p	No data
		Kittiwake	3,853 p	4,251 p	No data
		Guillemot	4,387 p	4.060 i	No data
		Fulmar	1,974 p	1,756 p	No data
		Razorbill	4,515 p	6,739 i	No data
		Greenland white-fronted goose	196 i	169 i (Dunfanaghy)**	No data
		Barnacle goose	160 i	320 i (Dunfanaghy) **	No data
Rathlin Island	120 km SE	Fulmar	1,482 p	1,518 p	No data
		Lesser black-backed gull	127 p *	36 p	No data
		Guillemot	28,064 p	130,445 i	No data
		Razorbill	5,978 p	22,975 i	No data
		Kittiwake	6,822 p	7,922 p	No data
		Herring gull	14 p *	28 p	No data
Lough Foyle	124 km S	Whooper swan	890 i	883 i **	No data
		Canadian pale-bellied brent goose	3,730 i	2,898 i	No data
Tory Island	127.5 km SW	Puffin	1,402 p	1,402 p	No data
		Kittiwake	408 p	408 p	No data
		Guillemot	568 i	352 i	No data
		Razorbill	1,002 i	1,002 i	No data
		Fulmar	641 p	685 p	No data
Inishtrahull	150.5 km SW	Kittiwake	43 p	15 p	No data
		Fulmar	95 p	21 p	No data
		Greenland barnacle goose	77 i	0 **	No data
The Shiant Isles	152 km NE	Puffin	76,100 p	65,170 p	Favourable maintained
		Kittiwake	2,006 p *	549 p	Favourable maintained
		guillemot	16,456 I *	7,684 i	Unfavourable declining
		Fulmar	6,820 p	6,820 p	Favourable maintained
		Greenland barnacle goose	172 i	224 i **	Unfavourable declining
		Razorbill	7,337 p	6,340 i	Unfavourable declining
St Kilda	155 km NW	Puffin	155,000 p	133,699 p	Favourable maintained
		Kittiwake	3,886 p *	957 p	Favourable maintained
		Guillemot	23,393 i *	23,393 i	Favourable maintained
		Fulmar	68,448 p *	67,654 p	Favourable maintained
		Gannet	60,400 p	59,622 p	Favourable

TABLE 7: SPAS THAT HOST QUALIFYING INTEREST WHERE A LSE COULD NOT BE DISCOUNTED					
SPA	**Distance from development site**	**Qualifying interest where a LSE could not be ruled out**	**Cited SPA population**	**Current SPA population**	**Conservation Status**
					maintained
		Razorbill	2,425 i *	2,521 i	Favourable maintained
Ailsa Craig	165 km SE	Gannet	23,000 p	27,130 p	Favourable maintained
		Kittiwake	1,675 p *	428 p	Unfavourable declining
		Guillemot	9,415 I *	11,668 i	Favourable maintained
		Herring gull	1,450 p *	131 p	Unfavourable declining
Lough Neagh and Lough Beg	172 km S	Whooper swan	1,031 i	1,803 I **	No data
Larne Lough	184 km SE	Canadian pale-bellied brent goose	227 i	375 i	No data
Flannan Isles	192 km N	Puffin	15,761 p *	15,632 p	Favourable maintained
		Kittiwake	1,392 p *	1,392 p	Unfavourable declining
		Guillemot	14,638 i *	14,638 i	Unfavourable declining
		Razorbill	1,569 i *	1,569 i	Unfavourable declining
		Fulmar	7,735 p *	8,262 p	Favourable maintained
Outer Ards	200 km SE	Canadian pale-bellied brent goose	245 i	701 i	No data
Ness and Barvas, Lewis	203 km N	Corncrake	18 males	118 males (all Lewis)	Unfavourable recovering
Loch of Inch and Torrs Warren	204 km SE	Greenland white-fronted goose	534 i	244 i (Stranraer)**	Favourable maintained
Strangford Lough	213 km SE	Canadian pale-bellied brent goose	10,527 i	26,188 i	No data
Upper Lough Erne	222 km SW	Whooper swan	352 i	799 i **	No data
Handa	229 km NE	Fulmar	3,550 p *	1,915 p	Unfavourable declining
		Kittiwake	7,013 p *	4,466 p	Unfavourable declining
		Guillemot	76,105 p	56,706 i	Unfavourable declining
		Razorbill	10,432 p	7,709 i	Favourable declining
Loch Ken and River Dee Marshes	229 km SE	Greenland white-fronted goose	350 i	190 i **	Favourable maintained
		Greylag goose	1,000 i	135 i **	Favourable maintained
Killough Harbour	246 km S	Canadian pale-bellied brent goose	354 i	282 i	No data
Carlingford Lough	254 km S	Canadian pale-bellied brent goose	319 i	495 i	No data
Cape Wrath	256 km NE	Fulmar	1,859 p *	1,859 p	Favourable maintained
		Kittiwake	10,316 p *	10,344 p	Favourable maintained
		Guillemot	40,785 i *	40,835 i	Favourable maintained
		Razorbill	2,972 i *	2,992 i	Favourable maintained
		Puffin	1,602 p *	1,602 p	Unfavourable declining
Castle Loch, Lochmaben	260 km SE	Pink-footed goose	5,450 i	No data	Unfavourable, no change
Upper Solway Flats and Marshes	260 km SE	Pink-footed goose	15,983 i	18,140 i	Favourable maintained
		Whooper swan	117 i	200 i	Favourable recovered
Illanmaster	265 km SW	Fulmar	1,367 p	9 p	No data
		Greenland barnacle goose	50 i	0 **	No data

TABLE 7: SPAS THAT HOST QUALIFYING INTEREST WHERE A LSE COULD NOT BE DISCOUNTED					
SPA	**Distance from development site**	**Qualifying interest where a LSE could not be ruled out**	**Cited SPA population**	**Current SPA population**	**Conservation Status**
North Rona and Sula Sgeir	285 km N	Gannet,	9,000 p	9,225 p	No data
		Fulmar	3,520 p *	6,976 p	Unfavourable declining
		Kittiwake	4,604 p *	4,119 p	Unfavourable declining
		Razorbill	1,625 i *	1,625 i	Unfavourable declining
		Guillemot	28,944 i	26,990 i	Unfavourable declining
		Puffin	5,442 p *	5,442 p	Unfavourable no change
Skerries Islands	309 km S	Fulmar	35 p	30 p	No data
		Canadian pale-bellied brent goose	242 i	222 i **	No data
		Herring gull	250 p	8 p	No data
Lambay Island	319.5 km S	Fulmar	635 p	385 p	No data
		Greylag goose	311 i	18 i **	No data
		Herring gull	1,806 p	492 p	No data
		Kittiwake	4,091 p	4,216 p	No data
		Guillemot	59,824 i	67,314 i	No data
		Razorbill	4,337 i	6,399 i	No data
		Puffin	<20 p	85 p	No data
Sule Skerry and Sule Stack	312.5 km NE	Gannet	4,890 p	4,675 p	Favourable maintained
		Guillemot	11,393 i	1,512 i	Favourable maintained
		Puffin	43,380 p	59,471 p	Favourable maintained
Howth Head Coast	320 km S	Fulmar	33 p	41 p	No data
		Kittiwake	2,329 p	2,732 p	No data
		Guillemot	995 i	1,023 i	No data
		Razorbill	416 i	406 i	No data
Ireland's Eye	328.5 km S	Fulmar	70 p	55 p	No data
		Gannet	142 p	375 p	No data
		Kittiwake	941 p	633 p	No data
		Guillemot	2,191 i	2,341 i	No data
		Razorbill	522 i	546 i	No data
		Puffin	10-20 i	18 p	No data
Morecambe Bay	334 km SE	Pink-footed goose	2,475 i	7,116 i	No data
Wicklow Head	378 km S	Fulmar	62 p	21 p	No data
		Kittiwake	956 p	743 p	No data
		Guillemot	420 i	699 i	No data
		Razorbill	186 i	228 i	No data
Ribble and Alt Estuaries	382 km SE	Pink-footed goose	11,764 i	49,438 i (Southwest Lancashire) **	No data
		Whooper swan	182 i	1,864 i (includes Martin Mere)	No data
Martin Mere	400 km SE	Pink-footed goose	25,779 i	49,438 i (Southwest Lancashire) **	No data
		Whooper swan	621 i	1,864 i (includes Ribble Estuary)	No data

Notes: distances shown are minimum distance across land. i = individuals, p = pairs.

Concluding LSE based population size attributable to an SPA

3.22 The text above described how LSE can be assessed by firstly considering connectivity between the population at the project site and the SPA being appraised; and secondly by identifying the sources of impact on the population due to the project. The third aspect recommended by SNH - determining population size attributable to the SPA being appraised to see if non-trivial numbers may be exposed to impacts – is considered in this section.

Methods

Seabirds

3.23 During the breeding season seabirds generally have a recognised foraging range from home colonies and based on the distance from the project site and population sizes of each colony, an attempt can be made to apportion birds recorded within the study area to a particular colony (either an SPA or a non-SPA). This procedure has been undertaken using an apportioning calculator developed by RPS (via consultation with SNH and Natural England, and used in various offshore renewables projects) which is described in Appendix 1 From the results of this, it can be determined whether a particular SPA contributes trivial or non-trivial numbers of birds to a typical flock found within the project site (using peak seasonal population estimates) compared to the overall SPA population, whilst also considering the site condition of the qualifying interest population. From this a LSE can or cannot be ruled out.

3.24 The apportioning calculator assumes that in general, breeding seabirds are more likely to be from a particular colony if it is close to the project site, and larger in size than other colonies within foraging range. With greater distance from the site, the likelihood of birds being from a particular colony decreases quickly, based on the assumption that birds are less likely to travel such a distance, and that with a radial foraging range, there is greater alternative foraging area available.

3.25 Breeding populations of qualifying features at SPAs are afforded protection throughout the year, and so 'off-site' impacts to these populations outside of the breeding season are assessed separately to breeding season impacts. Interim guidance provided by JNCC and Natural England (2013) on screening for seabirds in the non-breeding season highlights the requirement for determining a Biologically Defined Minimum Population Scale (BDMPS), which is likely to be different from the foraging range during the breeding season, since birds are likely to disperse further from colonies.

3.26 When the BDMPS (and its associated estimated population size) is established, all breeding seabird SPAs within this geographic area and/or contributing individuals to this non-breeding population are identified and attributed to the relevant colonies. As per JNCC and Natural England (2013) guidance, there is an assumption of equal mixing of all birds from all identified sources (including non-SPA colonies) within the BDMPS, and so apportioning is based solely on colony size, not distance from site.

3.27 For the purposes of this HRA screening report, the maximum BDMPS in the non-breeding season for any qualifying interest considered is based on the total breeding population found within Regions 7 (Minches and West Scotland) and 6 (Irish Sea) of seas around the UK, as defined by JNCC (Figure 2) which is based on biogeographically determined regional areas

using primarily the factors of temperature, depth and currents. Due to the likelihood of greater dispersal within west coast waters however, the part of Region 8 (Scottish Continental Shelf) that incorporates the north coast of Scotland is also included. It was considered that birds moving southward from more north-easterly parts (e.g. Orkney and Shetland Isles) would be more likely to be found within the North Sea during winter months and so connectivity would be trivial at best for any SPA population. For some wide ranging species (e.g. fulmar, gannet), this maximum BDMPS is relevant, whereas for other more sedentary species (e.g. herring gull) a smaller region is more applicable, and has been used.

3.28 The most recent population data on breeding seabirds within the BDMPS have been obtained from the JNCC Seabird Monitoring Programme (SMP) database. In addition, the total population attributed to each SPA in the non-breeding season has been corrected for the presence of non-breeders based on literature evidence where available. Poot *et al.* (2011) present proportions of non-breeding adults for a number of species, and these proportions have been considered here. This is likely to result in precautionary total population estimates since juveniles and sub-adults (which are not part of the cited SPA population) are also likely to be present in winter months.

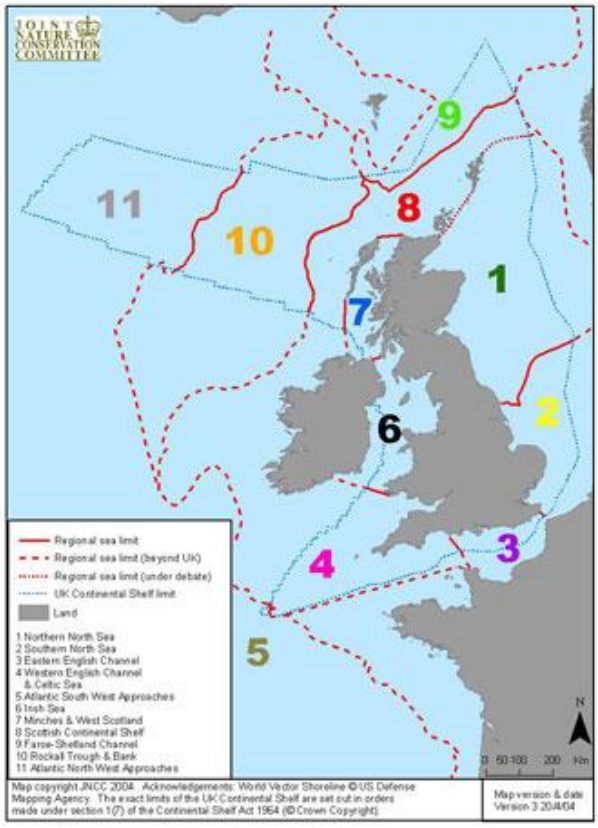

Figure 2: Regional seas around the UK. From http://jncc.defra.gov.uk/page-1612

1 = Northern North Sea
2 = Southern North Sea
3 = Eastern English Channel
4 = Western English Channel & Celtic Sea
5 = Atlantic South West Approaches
6 = Irish Sea
7 = Minches and West Scotland
8 = Scottish Continental Shelf
9 = Faroe-Shetland Channel
10 = Rockall Trough and Bank
11 = Atlantic North West Approaches

Migratory non-seabirds

3.29 Migratory wildfowl and waders are likely to pass through the wind farm site only briefly on passage to and from wintering grounds. The dispersal of birds between SPAs is species-specific

(e.g. pink-footed geese may be found at a number of sites through winter, whereas others may remain at one site) and so a different approach has been taken for different qualifying features, based on recommendations in Wright et al. (2012). These are as follows:

- **Greenland white-fronted goose, Greenland barnacle goose, Canadian light-bellied brent goose and corncrake**: simplified apportioning calculations based on distance of SPA from project site and population size of SPA in relation to overall flyway population through project site. Assumption that majority of birds are site-faithful and greater likelihood of a bird passing through project site that belongs to a SPA that is close by.
- **Pink-footed goose and whooper swan**: simple apportioning based on relative population sizes with no distance component considered. With relatively widespread migratory movements, assumption that birds are just as likely to be a qualifying feature of any SPAs in the UK and Ireland, within migratory route.
- **Wader species** – assumption that all birds are from closest SPA (Tiree Wetlands and Coast SPA).

Results

Gannet

3.30 Table 8 below presents results of apportioning of gannets from colonies within foraging range recorded within the project Study Area during the breeding season. From a peak population estimate of 1,735 individuals, the vast majority of birds were predicted to be from the large St. Kilda SPA colony and smaller Ailsa Craig SPA colony. Both peaks were close to 1% of the total SPA breeding population, although when considering non-breeding birds the proportions are likely to be lower. Although the SPAs are in favourable condition (Table 7), a LSE cannot be discounted for collision risk in particular, where an additive effect may occur on a greater proportion of the SPA population.

TABLE 8: PROVENANCE OF GANNET INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE

Colony	Current breeding population (pairs)	Distance from edge of development site (km)	Proportion within population	Number within wind farm (peak estimate)	Proportion of population	FCS?	Potential for a significant effect
Flannan Isles	2,760	194.5	0.017	30	0.54%	-	-
St. Kilda	59,622	167.8	0.677	1175	0.99%	Y	Y
Berneray	4	38.8	0.002	3	37.50%	-	-
Ailsa Craig	27,130	169.2	0.299	518	0.95%	Y	Y
Monrieth Cliffs + Scar Rocks	2,500	236.4	0.005	8	0.16%	-	-

Notes: Peak population estimate of 1,735 individuals within study area. SPA colonies are shaded

3.31 In the non-breeding season, complete intermixing of populations is assumed because of the wide ranging nature of the species. A total BDMPS of 106,291 pairs is predicted to occur within regional sea sectors 6, 7 and part of 8. Again, the majority of birds are from St. Kilda and Ailsa Craig SPAs. The proportion of each SPA predicted to be present is 0.99% of its total population.

TABLE 9: PROVENANCE OF GANNET INDIVIDUALS WITHIN WIND FARM DURING THE NON-BREEDING SEASON, BASED ON REGIONAL COLONY SIZES

Colony	Current breeding population (pairs)	Distance from edge of development site (km)	Proportion of breeding pairs within wind farm population	Number of birds within wind farm	Number of breeding adults within wind farm	FCS?	Potential for a significant effect
Flannan Isles	2,760	194.5	1.9%	25	15	-	-
St. Kilda	59,622	167.8	40.1%	536	322	Y	Y
Berneray	4	38.8	0.0%	0	0	-	-
Ailsa Craig	27,130	169.2	18.2%	244	146	Y	Y
Monrieth Cliffs + Scar Rocks	2,500	236.4	1.7%	22	13	-	-
North Rona and Sula Sgeir	9,225	285	6.2%	83	50	No data	Y
Sule Skerry and Sule Stack	4,675	312.5	3.1%	42	25	Y	Y
Ireland's Eye	375	328.5	0.3%	3	2	No data	N

Notes: Peak population estimate of 1,338 individuals within Study Area. SPA colonies are shaded. 40% of birds found within study area are non-breeding adults.

3.32 If an additional 40% of non-breeding adults (Poot et al. 2011) is considered then the number of breeding birds predicted to be affected reduces proportionately.

3.33 Results from Table 9 indicate that a LSE cannot be ruled out in the non-breeding season for all SPAs considered, apart from Ireland's Eye, where due to the distance from the project site and small numbers likely to be found there, connectivity is likely to be trivial.

Kittiwake

3.34 Table 10 below presents results of apportioning of kittiwake from colonies within foraging range recorded within the project Study Area during the breeding season. From a peak population estimate of 181 individuals, the vast majority of birds were predicted to be from the nearby non-designated colony on Tiree (166 birds, or 92%).

3.35 Of the SPAs within foraging range, small numbers were attributed to each and it is concluded that no LSE will result during the breeding season on any SPA.

TABLE 10: PROVENANCE OF KITTIWAKE INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE

Colony	Current breeding population (pairs)	Distance from edge of development site (km)	Proportion within population	Number within wind farm (peak estimate)	Proportion of population	FCS?	Potential for a significant effect
North Colonsay and Western Cliffs	5,563	53.1	0.0279	5	0.04%	Y	N
Mingulay and Berneray	2,852	38.8	0.0353	6	0.11%	N	N
Canna & Sanday	1,083	65.5	0.0019	0	0.00%	Y	N
Isle of Colonsay	819	53.1	0.0031	1	0.06%	-	-
Rum	788	67.6	0.0012	0	0.00%	N	N
Tiree	719	4.8	0.9187	166	11.54%	-	-
Islay - East (Port Askaig to Bowmore)	488	91.9	0.0002	0	0.00%	-	-
Treshnish Isles - Lunga and Sgeir a' Chaisteil	392	31.6	0.0082	1	0.13%	-	-
Islay - East (Port Askaig to Bowmore)	384	73.9	0.0008	0	0.00%	-	-

TABLE 10: PROVENANCE OF KITTIWAKE INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE							
Colony	**Current breeding population (pairs)**	**Distance from edge of development site (km)**	**Proportion within population**	**Number within wind farm (peak estimate)**	**Proportion of population**	**FCS?**	**Potential for a significant effect**
Isle of Colonsay	298	53.4	0.0011	0	0.00%	-	-
Other non-SPA colonies	431	-	0.0009	0	0.00%	-	-
Notes: Peak population estimate of 181 individuals within study area. SPA colonies are shaded							

3.36 In the non-breeding season, according to the SMP database, the total breeding population within the maximum BDMPS region (see above) is 71,450 pairs (Table 11). Assuming that 53,461 pairs belong to SPA colonies, a non-SPA population of 17,989 pairs are potentially found within the project site during winter months.

3.37 From a peak population estimate of 946 individuals within the study area in the non-breeding season (October 2010), the largest number of SPA breeding birds is predicted to be from Cape Wrath SPA (14.5%), although non-SPA birds are predicted to account for more than this (25%). The proportion of each SPA present is an estimated 0.66% of its total population. If it is assumed that 38% are non-breeding adults (Poot *et al.* 2011) then the numbers attributable to breeding SPA birds decrease accordingly.

TABLE 11: PROVENANCE OF KITTIWAKE INDIVIDUALS WITHIN WIND FARM DURING THE NON-BREEDING SEASON, BASED ON REGIONAL COLONY SIZES							
Colony	**Current breeding population (pairs)**	**Distance from edge of development site (km)**	**Proportion of breeding pairs within wind farm peak population**	**Number of birds within wind farm**	**Number of breeding adults within wind farm**	**FCS?**	**Potential for a significant effect?**
Mingulay and Berneray	2,852	34 km	4.0%	38	23	N	Y
Rum	788	51 km	1.1%	10	6	N	Y
North Colonsay and Western Cliffs	5,563	52 km	7.8%	74	46	Y	Y
Canna and Sanday	1,083	60 km	1.5%	14	9	Y	Y
Horn Head to Fanad Head	4,251	113 km	5.9%	56	35	No data	Y
Rathlin Island	7,922	120 km	11.1%	105	65	No data	Y
Tory Island	408	127.5 km	0.6%	5	3	No data	N
Inishtrahull	15	150.5 km	0.0%	0	0	No data	N
The Shiant Isles	549	152 km	0.8%	7	5	Y	Y
St Kilda	957	155 km	1.3%	13	8	Y	Y
Ailsa Craig	428	165 km	0.6%	6	4	N	N
Flannan Isles	1,392	192 km	1.9%	18	11	N	Y
Handa	4,466	229 km	6.3%	59	37	N	Y
Cape Wrath	10,344	256 km	14.5%	137	85	Y	Y
North Rona and Sula Sgeir	4,119	285 km	5.8%	55	34	N	Y
Lambay Island	4,216	319.5 km	5.9%	56	35	No data	Y
Howth Head Coast	2,732	320 km	3.8%	36	22	No data	Y
Ireland's Eye	633	328.5 km	0.9%	8	5	No data	N
Wicklow Head	743	378 km	1.0%	10	6	No data	N
Non-SPA colonies	17,989	-	25.2%	238	148	-	-
Notes: Peak population estimate of 946 individuals within Study Area. 38% of birds found within study area are non-breeding adults.							

3.38 Results from indicate that a LSE cannot be ruled out in the non-breeding season for all SPAs considered, apart from Inishtrahull, Ireland's Eye, Wicklow Head, Tory Island and Ailsa Craig, where due to the location (south of the wind farm), distance from the project site and small numbers likely to be found there, connectivity is likely to be trivial. For others, a combination of higher numbers and/or unfavourable condition of the population means that they cannot be screened out at this stage.

Herring gull

3.39 Table 10 below presents results of apportioning of herring gull from colonies within foraging range recorded within the project Study Area during the breeding season. From a peak population estimate of 18 individuals, no birds were predicted to come from SPAs, with the closest, Canna and Sanday, being near the limit of foraging range. No LSE is therefore predicted.

TABLE 12: PROVENANCE OF HERRING GULL INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE

Colony	Current breeding population (pairs)	Distance from edge of development site (km)	Proportion within population	Number within wind farm (peak estimate)	Proportion of population	FCS?	Potential for a significant effect
Tiree	61	4.3	0.3233	6	4.92%	-	-
Tiree	114	11.2	0.0826	1	0.44%	-	-
Tiree	20	4.8	0.0843	2	2.50%	-	-
Lochan An Chuirn	325	22.1	0.0550	1	0.15%	-	-
Tiree	26	8.5	0.0334	1	1.92%	-	-
Tiree	6	4.2	0.0325	1	8.33%	-	-
Canna and Sanday	83	83	0.0009	0	0%	N	N
All other colonies	7,732	-	0.3880	6	0%	-	-

Notes: Peak population estimate of 18 individuals within study area. SPA colonies are shaded

3.40 Since UK herring gulls are relatively sedentary in winter months (Wernham *et al.* 2002), the non-breeding season BDMSP is taken to be the foraging range used for breeding season impacts (mean maximum + 1 SD, 105.1 km). The total breeding population within this region is 8,367 pairs (SMP database).

3.41 From a peak population estimate of 239 individuals within the Study Area (October 2010), it is evident that birds are likely to come from a wide variety of relatively small colonies. From Canna and Sanday SPA, only two birds are predicted to be present. When taking into consideration the presence of non-breeders, sub-adults and juveniles, no LSE is predicted on this population, even when considering annual impacts in the breeding and non-breeding seasons combined.

TABLE 13: PROVENANCE OF HERRING GULL INDIVIDUALS WITHIN WIND FARM DURING THE NON-BREEDING SEASON, BASED ON REGIONAL COLONY SIZES

Colony	Current breeding population (pairs)	Distance from edge of development site (km)	Proportion of pairs within wind farm peak population	Number of individuals within wind farm	FCS?	Potential for a significant effect
Garvan Islands	531	99.2	6.3%	15	-	-
Scarba	363	76.7	4.3%	10	-	-
Lochan An Chuirn	325	22.1	3.9%	9	-	-
Oronsay	314	58.5	3.8%	9	-	-

TABLE 13: PROVENANCE OF HERRING GULL INDIVIDUALS WITHIN WIND FARM DURING THE NON-BREEDING SEASON, BASED ON REGIONAL COLONY SIZES						
Colony	**Current breeding population (pairs)**	**Distance from edge of development site (km)**	**Proportion of pairs within wind farm peak population**	**Number of individuals within wind farm**	**FCS?**	**Potential for a significant effect**
Shian Bay	240	71.8	2.9%	7	-	-
Loch Sunart	170	62.7	2.0%	5	-	-
Coll	160	41.1	1.9%	5	-	-
Coll	160	30.6	1.9%	5	-	-
Garvellachs	158	70.1	1.9%	5	-	-
Lochna Criadhach Mhoir	150	52.4	1.8%	4	-	-
Mull	149	61.4	1.8%	4	-	-
Isle of Colonsay	135	54.3	1.6%	4	-	-
Eigg	130	67.9	1.6%	4	-	-
Sound of Luing	120	75.5	1.4%	3	-	-
North Mull	119	44.2	1.4%	3	-	-
Tiree	114	11.2	1.4%	3	-	-
Islay - East (Port Askaig to Bowmore)	114	94.5	1.4%	3	-	-
Barra & Vatersay	107	55.4	1.3%	3	-	-
South Uist	96	60.5	1.1%	3	-	-
Isle of Colonsay	91	54.6	1.1%	3	-	-
Mull	90	38.2	1.1%	3	-	-
Sound of Barra	85	59.8	1.0%	2	-	-
Isle of Colonsay	84	54.7	1.0%	2	-	-
Canna & Sanday	83	65.5	1.0%	2	N	N
All other colonies	4,279	-	51.1%	122	-	-
Notes: Peak population estimate of 239 individuals within Study Area. SPA colonies are shaded						

Lesser black-backed gull

3.42 Table 14 below presents results of apportioning of lesser black-backed gull from colonies within mean maximum foraging range (141 km) recorded within the project Study Area during the breeding season. From a peak population estimate of 73 individuals, no birds were predicted to come from SPAs, with the closest, Rathlin Island, being near the limit of foraging range. No LSE is therefore predicted.

TABLE 14: PROVENANCE OF LESSER BLACK-BACKED GULL INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE							
Colony	**Current breeding population (pairs)**	**Distance from edge of development site (km)**	**Proportion within population**	**Number within wind farm (peak estimate)**	**Proportion of population**	**FCS?**	**Potential for a significant effect**
Tiree (all colonies)	522	4-16	0.9792	67	6.4%	-	-
Coll	160	30.6	0.0188	1	0.3%	-	-
Lochan An Chuirn	40	22.1	0.0095	1	1.3%	-	-
Stac Mhic Mhurchaidh, Reidh Eilean, Eilean Annraidh, Eilean Chalba	50	26.5	0.0089	1	1.0%	-	-
Rathlin Island	36	125	0.0001	0	0.0%	No data	N

TABLE 14: PROVENANCE OF LESSER BLACK-BACKED GULL INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE							
Colony	**Current breeding population (pairs)**	**Distance from edge of development site (km)**	**Proportion within population**	**Number within wind farm (peak estimate)**	**Proportion of population**	**FCS?**	**Potential for a significant effect**
All other colonies	2,478		0.0420	3	0.1%	-	-
Notes: Peak population estimate of 73 individuals within study area. SPA colonies are shaded							

3.43 In the non-breeding season most lesser black-backed gulls migrate southwards Iberia and northern Africa (Wernham *et al.* 2002), and although there is an increasing tendency for birds to remain in the UK throughout winter, dispersal southwards is still likely. With the species being almost absent within the study area between September and February, it appears that this is the case for the local population. No LSE is therefore predicted for any SPA population during neither the non-breeding season, nor annually when combined with the breeding season.

Guillemot

3.44 Table 10 below presents results of apportioning of guillemot from colonies within mean maximum foraging range + 1 SD (134.3 km) recorded within the project Study Area during the breeding season. From a peak population estimate of 2,963 individuals in May 2010, the large majority of birds were predicted to be from the nearby non-designated colony on Tiree (1,930 individuals, 4.8 km away). Indeed because of the close proximity, the number initially predicted was above the likely maximum numbers of adults present away from colonies within the breeding season. To be biologically meaningful in this case, the colony population was multiplied by a correction factor of 0.67 (as per Mitchell *et al.* 2004 to convert numbers of individuals recorded at a colony to breeding pairs). This gives the probable maximum number present within the wind farm by assuming that up to two thirds of the colony may be present at any time (half of breeders plus non-breeders). Following this correction, apportioning was conducted for all other colonies using the standard procedure in Appendix 1.

3.45 Of the SPAs within foraging range, the largest predicted numbers were from the closest, which is Mingulay and Bernaray SPA. It was concluded that a LSE could not be ruled out for this SPA, or for North Colonsay and Western Cliffs, Canna & Sanday and Rum SPAs. All others are likely to contribute relatively very small numbers to the population within the study area, due to their larger distance from the project site.

TABLE 15: PROVENANCE OF GUILLEMOT INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE							
Colony	**Current breeding population (individuals)**	**Distance from edge of development site (km)**	**Proportion within population**	**Number within wind farm (peak estimate)**	**Proportion of population**	**FCS?**	**Potential for a significant effect**
Tiree	1930	4.8	-	1293 *	67.0%	-	-
Mingulay and Bernaray	21,124	38.8	0.4529	756	3.6%	N	Y
Treshnish Isles - Lunga and Sgeir a' Chaisteil	7699	31.6	0.2162	361	4.7%	-	-
North Colonsay and Western Cliffs	15,912	53.1	0.1621	271	1.7%	Y	Y
Rathlin Island	130,445	126.0	0.0698	117	0.1%	No data	N
Isle of Colonsay	6636	53.1	0.0450	75	1.1%	-	-

TABLE 15: PROVENANCE OF GUILLEMOT INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE

Colony	Current breeding population (individuals)	Distance from edge of development site (km)	Proportion within population	Number within wind farm (peak estimate)	Proportion of population	FCS?	Potential for a significant effect
Canna & Sanday	5,841	65.5	0.0233	39	0.7%	Y	Y
Rum	2,454	67.6	0.0090	15	0.6%	N	Y
Isle of Colonsay	1083	53.4	0.0072	12	1.1%	-	-
Islay - West (Port Askaig to Bruichladdich)	407	64.9	0.0025	4	1.0%	-	-
Horn Head to Fanad Head	4,060	125.3	0.0022	4	0.1%	No data	N
Islay - East (Port Askaig to Bowmore)	271	73.9	0.0012	2	0.7%	-	-
Muck	137	58.6	0.0011	2	1.5%	-	-
Treshnish Isles	40	32.1	0.0011	2	5.0%	-	-
Islay - East (Port Askaig to Bowmore)	471	91.9	0.0010	2	0.4%	-	-
Skye: Hoe Point to Meanish	514	95.1	0.0009	2	0.4%	-	-
Isle of Colonsay	136	53.2	0.0009	2	1.5%	-	-
Muck	107	60.3	0.0005	1	0.9%	-	-
Treshnish Isles	12	25.8	0.0005	1	8.3%	-	-
Islay - West (Port Askaig to Bruichladdich)	82	65.8	0.0005	1	1.2%	-	-
Muck	79	58.8	0.0004	1	1.3%	-	-
Muck	74	60.9	0.0004	1	1.4%	-	-
Skye	132	87.8	0.0003	1	0.8%	-	-
Islay - East (Port Askaig to Bowmore)	74	74.3	0.0003	1	1.4%	-	-
Sheep Island, Causeway Coast	439	127.1	0.0002	0	0.0%	-	-
Skye	108	92.7	0.0002	0	0.0%	-	-
Causeway Coast	185	128.7	0.0001	0	0.0%	-	-
Tory Island	352	127.7	0.0001	0	0.0%	No data	N
Skye	12	93.0	0.0000	0	0.0%	-	-
Skye: Hoe Point to Meanish	14	99.3	0.0000	0	0.0%	-	-
Islay - East (Port Askaig to Bowmore)	4	88.2	0.0000	0	0.0%	-	-

Notes: Peak population estimate of 2,963 individuals within study area. SPA colonies are shaded. * = maximum biologically meaningful population attributed to colony

3.46 In the non-breeding season, according to the SMP database, the total breeding population within the whole BDMPS region (described above) is 540,808 individuals. Assuming that 427,782 individuals belong to SPA colonies, a non-SPA population of 113,026 individuals are potentially found within the project site during winter months (Table 16).

3.47 From a peak population estimate of 1,477 individuals within the study area in March 2010, the largest number of SPA breeding birds is predicted to be from Rathlin Island SPA (24%). The proportion of each SPA present is an estimated 0.27% of its total population. If it is assumed that 50% are non-breeding adults (Poot *et al.* 2011) then the numbers attributable to breeding SPA birds decrease accordingly.

TABLE 16: PROVENANCE OF GUILLEMOT INDIVIDUALS WITHIN WIND FARM DURING THE NON-BREEDING SEASON, BASED ON REGIONAL COLONY SIZES

Colony	Current breeding population (individuals)	Distance from edge of development site (km)	Proportion of breeding individuals within wind farm peak population	Number of birds within wind farm	Number of breeding adults within wind farm	FCS?	Potential for a significant effect?
Mingulay and Berneray	21,124	34	3.9%	57	29	N	Y
Rum	2,454	51	0.5%	7	3	N	N
North Colonsay and Western Cliffs	15,912	52	2.9%	43	22	Y	Y
Canna and Sanday	5,841	60	1.1%	16	8	Y	N
Horn Head to Fanad Head	4.060	113	0.0%	0	0	No data	N
Rathlin Island	130,445	120	24.0%	354	177	No data	Y
Tory Island	352	127	0.1%	1	0	No data	N
The Shiant Isles	7,684	152	1.4%	21	10	N	Y
St Kilda	23,393	155	4.3%	64	32	Y	Y
Ailsa Craig	11,668	165	2.1%	32	16	Y	Y
Flannan Isles	14,638	192	2.7%	40	20	N	Y
Handa	56,706	229	10.4%	154	77	N	Y
Cape Wrath	40,835	256	7.5%	111	55	Y	Y
North Rona and Sula Sgeir	26,990	285	5.0%	73	37	N	Y
Lambay Island	67,314	319	12.4%	183	91	No data	Y
Sule Skerry and Sule Stack	1,512	312	0.3%	4	2	Y	N
Howth Head Coast	1,023	320	0.2%	3	1	No data	N
Ireland's Eye	2,341	328	0.4%	6	3	No data	N
Wicklow Head	699	378	0.1%	2	1	No data	N
Non-SPA birds	113,026	-	20.8%	307	153	-	-

Notes: Peak population estimate of 1,477 individuals within Study Area. 50% of birds found within study area are non-breeding adults.

3.48 Results from indicate that a LSE can be ruled out in the non-breeding season for Rum, Canna and Sanday, Horn Head to Fanad Head, Tory Island, Sule Skerry and Sule Stack, Howth Head Coast, Ireland's Eye and Wicklow Head, where due to the distance from the project site and/or small numbers likely to be found there, connectivity is likely to be trivial. For others, a combination of higher numbers and/or unfavourable condition of the population means that they cannot be screened out and a LSE is predicted.

Razorbill

3.49 Table 17 below presents results of apportioning of guillemot from colonies within mean maximum foraging range + 1 SD (83.5 km) recorded within the project Study Area during the breeding season. Like guillemot, the large majority of birds were predicted to be from the nearby non-designated colony on Tiree (367 individuals, 4.8km away) and again the numbers predicted were above the biologically meaningful maximum population likely to be from the colony. Therefore a correction factor of 0.67 was applied to the Tiree colony to obtain the likely maximum numbers present.

3.50 Of the colonies within foraging range, the largest predicted numbers were from the only SPA, which is Mingulay and Bernaray. It was concluded that a LSE could not be ruled out for this SPA.

TABLE 17: PROVENANCE OF RAZORBILL INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE

Colony	Current breeding population (individuals)	Distance from edge of development site (km)	Proportion within population	Number within wind farm (peak estimate)	Proportion of population	FCS?	Potential for a significant effect?
Tiree	367	4.8	0.6700	246	67.0%	-	-
Mingulay and Berneray	16,569	38.8	0.8415	1,149	6.9%	N	Y
Treshnish Isles - Lunga and Sgeir a' Chaisteil	566	31.6	0.0435	59	10.4%	-	-
Isle of Colonsay (all)	2505	53.1	0.0679	93	3.7%	-	-
Treshnish Isles	144	32.1	0.0107	15	10.4%	-	-
Canna & Sanday	970	65.5	0.0173	24	2.5%	-	-
Uragaig Cliffs	50	53.4	0.0013	2	4.0%	-	-
Isle of Colonsay	91	53.2	0.0025	3	3.3%	-	-
Sound of Pabbay	24	43.2	0.0010	1	4.2%	-	-
Islay - West (Port Askaig to Bruichladdich)	166	64.9	0.0030	4	2.4%	-	-
Muck (all)	136	58.6	0.0030	4	2.9%	-	-
Treshnish Isles	5	25.8	0.0006	1	20.0%	-	-
Rum National Nature Reserve	94	67.6	0.0016	2	2.1%	-	-
Islay - West (Port Askaig to Bruichladdich)	107	65.8	0.0019	3	2.8%	-	-
Islay - East (Port Askaig to Bowmore)	131	73.9	0.0018	3	2.3%	-	-
Treshnish Isles	6	33.2	0.0004	1	16.7%	-	-
Stac Mhic Mhurchaidh, Reidh Eilean, Eilean Annraidh, Eilean Chalba	2	26.5	0.0002	0	0.0%	-	-
Treshnish Isles	4	33.5	0.0003	0	0.0%	-	-
Sound of Pabbay	4	43.7	0.0002	0	0.0%	-	-
Mull	3	40.9	0.0001	0	0.0%	-	-
Islay - East (Port Askaig to Bowmore)	42	74.3	0.0006	1	2.4%	-	-
Garvellachs	8	69.4	0.0001	0	0.0%	-	-
Jura	7	76.1	0.0001	0	0.0%	-	-
Jura (West)	10	76.9	0.0001	0	0.0%	-	-
Jura (West)	12	76.1	0.0002	0	0.0%	-	-
Islay - East (Port Askaig to Bowmore)	5	68.4	0.0001	0	0.0%	-	-
Jura	3	76.9	0.0000	0	0.0%	-	-
Islay - West (Port Askaig to Bruichladdich)	2	70.0	0.0000	0	0.0%	-	-

Notes: Peak population estimate of 1,611 individuals within study area. SPA colonies are shaded

3.51 In the non-breeding season, according to the SMP database, the total breeding population within the whole BDMPS region (described above) is 98,823 individuals. Assuming that 77,620 individuals belong to SPA colonies, a non-SPA population of 21,203 individuals are potentially found within the project site during winter months (Table 18).

3.52 From a peak population estimate of 718 individuals within the study area in October 2009, the largest number of SPA breeding birds is predicted to be from Rathlin Island SPA (23%). The proportion of each SPA present is an estimated 0.7% of its total population. If it is assumed that 50% are non-breeding adults (Poot *et al.* 2011, as for guillemot) then the numbers attributable to breeding SPA birds decrease accordingly.

TABLE 18: PROVENANCE OF RAZORBILL INDIVIDUALS WITHIN WIND FARM DURING THE NON-BREEDING SEASON, BASED ON REGIONAL COLONY SIZES

Colony	Current breeding population (individuals)	Distance from edge of development site (km)	Proportion of breeding individuals within wind farm peak population	Number of birds within wind farm	Number of breeding adults within wind farm	FCS?	Potential for a significant effect?
Mingulay and Berneray	16,569	34	16.8%	120	60	N	Y
Horn Head to Fanad Head	6,739	113	6.8%	49	24	No data	Y
Rathlin Island	22,975	120	23.2%	167	83	No data	Y
Tory Island	1,002	127	1.0%	7	4	No data	N
The Shiant Isles	6,340	152	6.4%	46	23	N	Y
St Kilda	2,521	155	2.6%	18	9	Y	Y
Flannan Isles	1,569	192	1.6%	11	6	N	Y
Handa	7,709	229	7.8%	56	28	Y	Y
Cape Wrath	2,992	256	3.0%	22	11	Y	Y
North Rona and Sula Sgeir	1,625	285	1.6%	12	6	N	Y
Lambay Island	6,399	319	6.5%	46	23	No data	Y
Howth Head Coast	406	320	0.4%	3	1	No data	N
Ireland's Eye	546	328	0.6%	4	2	No data	N
Wicklow Head	228	378	0.2%	2	1	No data	N
Non-SPA birds	21,203	-	21.5%	154	77	-	-

Notes: Peak population estimate of 718 individuals within Study Area. 50% of birds found within study area are non-breeding adults.

3.53 Results from indicate that a LSE cannot be ruled out in the non-breeding season for all Scottish SPAs that have been screened in, plus Horn Head to Fanad Head. In contrast, for all other Irish sites, namely Tory Island, Howth Head Coast, Ireland's Eye and Wicklow Head, where due to the distance from the project site and/or small numbers likely to be found there, connectivity is likely to be trivial and so no LSE is predicted.

Puffin

3.54 Table 19 below presents results of apportioning of puffins from colonies within mean maximum foraging range + 1 SD (151.4 km) recorded within the project Study Area during the breeding season. From a peak population estimate of 1,863 individuals in April 2010, the majority of birds were predicted to be from the nearby non-designated colonies on the Treshnish Isles, and from the Mingulay and Berneray SPA. It was concluded that a LSE could not be ruled out for this

SPA. For all others within foraging range however, no LSE was concluded, based on the small numbers likely to be present within the project site, and the distance of these SPAs.

TABLE 19: PROVENANCE OF PUFFIN INDIVIDUALS WITHIN WIND FARM DURING THE BREEDING SEASON, BASED ON REGIONAL COLONY SIZES AND AREA OF SEA AVAILABLE

Colony	Current breeding population (pairs)	Distance from edge of development site (km)	Proportion within population	Number within wind farm (peak estimate)	Proportion of population	FCS?	Potential for a significant effect?
Treshnish Isles - Lunga and Sgeir a' Chaisteil	2563	31.6	0.4401	820	16.0%	-	-
Mingulay and Berneray	3,816	38.8	0.4118	767	10.1%	Y	Y
Staffa	532	33.5	0.0600	112	10.5%	-	-
Treshnish Isles	124	25.8	0.0331	62	24.9%	-	-
Stac Mhic Mhurchaidh, Reidh Eilean, Eilean Annraidh, Eilean Chalba	100	26.3	0.0193	36	17.9%	-	-
Treshnish Isles	77	33.5	0.0116	22	14.0%	-	-
Treshnish Isles	40	32.1	0.0066	12	15.4%	-	-
Tory Island	1,402	127.7	0.0051	9	0.3%	No data	N
Muck	100	58.6	0.0041	8	3.8%	-	-
Rathlin Island	695	124.9	0.0028	5	0.4%	-	-
Horn Head and Fanad Coast	189	125.3	0.0011	2	0.5%	No data	N
Rathlin Island (whole coastline and stacks)	281	125.1	0.0011	2	0.4%	-	-
Staffa	8	33.5	0.0009	2	10.5%	-	-
Canna & Sanday	20	65.5	0.0006	1	2.9%	Y	N
Rum National Nature Reserve	17	67.6	0.0005	1	2.6%	-	-
Muck	11	60.3	0.0004	1	3.5%	-	-
Rubha Hunish	110	138.4	0.0003	0	0.2%	-	-
Rathlin Island (whole coastline and stacks)	50	126.4	0.0002	0	0.4%	-	-
Sanda Islands	100	147.5	0.0002	0	0.2%	-	-
Treshnish Isles	1	33.2	0.0002	0	14.3%	-	-
Rathlin Island (whole coastline and stacks)	17	125.1	0.0001	0	0.4%	-	-
Isle of Colonsay	1	53.2	0.0001	0	4.8%	-	-
Islay - East (Port Askaig to Bowmore)	2	91.9	0.0000	0	1.7%	-	-
Sheep Island, Causeway Coast	3	127.1	0.0000	0	0.5%	-	-
Causeway Coast	3	127.7	0.0000	0	0.5%	-	-

Notes: Peak population estimate of 1,863 individuals within study area. SPA colonies are shaded

3.55 In the non-breeding season, according to the SMP database, the total breeding population within the whole BDMPS region (described above) is 308,060 pairs (Table 11). Assuming that 286,546 pairs belong to SPA colonies, a non-SPA population of 21,514 pairs are potentially found within the project site during winter months (Table 16).

3.56 From a peak population estimate of 189 individuals within the study area in October 2010, the largest number of SPA breeding birds is predicted to be from St. Kilda SPA (43%). The proportion of each SPA present is an estimated 0.03% of its total population. If it is assumed that 29% are non-breeding adults (Poot *et al.* 2011) then the numbers attributable to breeding SPA birds decrease accordingly.

TABLE 20: PROVENANCE OF PUFFIN INDIVIDUALS WITHIN WIND FARM DURING THE NON-BREEDING SEASON, BASED ON REGIONAL COLONY SIZES

Colony	Current breeding population (pairs)	Distance from edge of development site (km)	Proportion of breeding individuals within wind farm peak population	Number of birds within wind farm	Number of breeding adults within wind farm	FCS?	Potential for a significant effect?
Mingulay and Berneray	3,816	38.8	1.2%	2	2	Y	N
Canna and Sanday	20	65.5	0.0%	0	0	Y	N
Horn Head to Fanad Head	189	125.3	0.1%	0	0	No data	-
Tory Island	1,402	127.7	0.5%	1	1	No data	-
The Shiant Isles	65,170	152	21.2%	40	28	Y	N
St Kilda	133,699	155	43.4%	82	58	Y	N
Flannan Isles	15,632	192	5.1%	10	7	Y	N
Cape Wrath	1,602	256	0.5%	1	1	N	N
North Rona and Sula Sgeir	5,442	285	1.8%	3	2	N	N
Lambay Island	85	319.5	0.0%	0	0	No data	N
Sule Skerry and Sule Stack	59,471	312.5	19.3%	36	26	Y	N
Ireland's Eye	18	328.5	0.0%	0	0	No data	N
Non-SPA colonies	21,514	-	7.0%	13	9	-	-

Notes: Peak population estimate of 189 individuals within Study Area. 50% of birds found within study area are non-breeding adults.

3.57 Results from Table 20 indicate that a LSE can be ruled out in the non-breeding season for all SPAs. Due to the distances from the project site and relatively small numbers likely to be found there, connectivity is likely to be trivial.

Non-seabirds

3.58 From the results of Table 6 it was concluded that the only impact pathway that would potentially result in a LSE for any non-seabird species was collision risk. Collision risk modelling (CRM) has been undertaken for wildfowl and wader species and is detailed in full in the Argyll Array Offshore Wind Farm Technical Report – Ornithology. The results of this are used to inform whether a LSE can be discounted for any qualifying features, based on apportioning to SPAs.

3.59 In all cases the migration option of the Band (2012) model was used, which considers a flux rate (birds per unit flyway corridor width) rather than a recorded on-site flight density. This helps take into account the full passage of migratory species which is unlikely to have been recorded during boat-based surveys.

3.60 In addition to the migration model, radar data collected during spring and autumn 2012 was used to calculate collision risk for whooper swan, pink-footed goose, Greenland barnacle goose and Canadian pale-bellied brent goose. The directional model of SNH (2010) was followed using the

probability of collision calculation from Band (2012). The results of both models are considered here, with the version that produces the higher estimate used for the assessment.

Whooper swan

3.61 It was predicted using the Band (2012) that 1.5 deaths would occur to migratory whooper swans each year as a result of collisions with the Argyll Array Offshore Wind Farm (at 98% avoidance rate). Using the radar data, 0.3 collisions per year were predicted.

3.62 The mortality rate has been attributed equally among SPAs (Table 21), based on the assumption that the project site forms part of a migratory corridor for a number of SPAs within the west of Britain and east of Northern Ireland (see Griffin *et al.* 2011 for evidence of movements). It shows that less than one collision is predicted from any SPA in any given year, with one every two years predicted at Ribble and Alt Estuaries/Martin Mere SPAs and Lough Neagh and Lough Beg. For the closest SPA, Rinns of Islay, one collision every 27 years is predicted. Although it is possible that this may underestimate the proportion of mortality due to the proximity of the site, no LSE is predicted for any other SPA, with trivial mortality rates assumed.

TABLE 21: PROVENANCE OF WHOOPER SWAN COLLISIONS DURING THE NON-BREEDING SEASON, BASED ON COLONY SIZES WITHIN MIGRATORY CORRIDOR

Population	Population size (individuals)	Distance from edge of development site (km)	Number of annual collisions attributed to SPA	Collision every X years	FCS?	Potential for a significant effect?
Rinns of Islay	140	65	0.04	26.9	Y	N
Lough Foyle	883	124	0.23	4.3	No data	N
Lough Neagh and Lough Beg	1,803	172	0.48	2.1	No data	N
Upper Lough Erne	799	222	0.21	4.7	No data	N
Upper Solway Flats and Marshes	200	260	0.05	18.8	Y	N
Ribble and Alt Estuaries	1,864	382	0.49	2.0	No data	N
Martin Mere		400			No data	N

Notes: Annual mortality rate of 1.5 collisions per year

Pink-footed goose

3.63 It was predicted using the Band (2012) that 6.16 (range 1.0 to 15.4) deaths would occur to migratory pink-footed geese each year as a result of collisions with the Argyll Array Offshore Wind Farm (at a conservative 99% avoidance rate). Using the radar data, 0.02 collisions per year were predicted.

3.64 The mortality rate has been attributed equally among SPAs (Table 21), based on the assumption that the project site forms part of a migratory corridor for a number of SPAs within the west of Britain and east of Northern Ireland. Even with the conservative assumption that all birds within the project site are SPA birds, it shows that up to four collisions are predicted from any SPA in any given year. Although it is possible that this may underestimate the proportion of mortality for closer SPAs due to a potentially greater likelihood of connectivity, no LSE is predicted for any SPA. This is particularly the case if a 99.8% avoidance rate is used for collision mortality calculations, which has been advocated recently by SNH (2013) for grey geese species. This would greatly reduce mortality rates.

TABLE 22: PROVENANCE OF PINK-FOOTED GOOSE COLLISIONS DURING THE NON-BREEDING SEASON, BASED ON COLONY SIZES WITHIN MIGRATORY CORRIDOR						
Population	**Population size (individuals)**	**Distance from edge of development site (km)**	**Number of annual collisions attributed to SPA**	**Collision every X years**	**FCS?**	**Potential for a significant effect?**
Castle Loch, Lochmaben	5,450	260	0.42	2.4	N	N
Upper Solway Flats and Marshes	18,140	260	1.39	0.7	F	N
Morecambe Bay	7,116	334	0.55	1.8	No data	N
Ribble and Alt Estuaries	49,438 (southwest Lancashire)	382	3.80	0.3	No data	N
Martin Mere		400			No data	N
Notes: Annual mortality rate of 6.16 collisions per year						

Greenland barnacle goose

3.65 It was predicted using the Band (2012) that 0.77 (range 0.13 to 1.93) deaths would occur to migratory Greenland barnacle geese each year as a result of collisions with the Argyll Array Offshore Wind Farm (at a conservative 99% avoidance rate). Using the radar data, 0.02 collisions per year were predicted.

3.66 The mortality rate has been apportioned to each relevant SPA using a simple apportioning calculator which considers only population size and distance from project site (Table 23), meaning that individuals from closer SPAs are more likely to be found within the project site, if assuming similar source population sizes to other SPAs. This is based on the assumption that Greenland barnacle geese are relatively site-faithful during winter months, and unlikely to move regularly between SPAs.

3.67 With the conservative assumption that all birds within the project site are SPA birds, it shows that up to one collision is predicted from any SPA in any given year. This, as expected, is from the closest (Tiree Wetlands and Coast SPA). With the population of this site in favourable condition (an increase to 3,872 individuals in all Tiree compared to a cited SPA population of 1,456 individuals) no LSE is predicted for this or any other SPA. This is particularly the case if a 99.8% avoidance rate is used for collision mortality calculations, which has been advocated recently by SNH (2013) for grey geese species.

TABLE 23: PROVENANCE OF GREENLAND BARNACLE GOOSE COLLISIONS DURING THE NON-BREEDING SEASON, BASED ON COLONY SIZES WITHIN MIGRATORY CORRIDOR						
Population	**Population size (individuals)**	**Distance from edge of development site (km)**	**Proportion present**	**Number of annual collisions attributed to SPA**	**FCS?**	**Potential for a significant effect?**
Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast)	3,872	3.5	0.96	0.74	Y	N
Coll	1,176	20	0.01	0.01	Y	N
Treshnish Isles	207	27	0.00	0.00	N	N
Gruinart Flats, Islay	32,019*	64	0.02	0.02	Y	N
Bridgend Flats, Islay	10,726*	75	0.01	0.00	Y	N
Laggan, Islay	2,882*	78	0.00	0.00	Y	N

TABLE 23: PROVENANCE OF GREENLAND BARNACLE GOOSE COLLISIONS DURING THE NON-BREEDING SEASON, BASED ON COLONY SIZES WITHIN MIGRATORY CORRIDOR						
Population	**Population size (individuals)**	**Distance from edge of development site (km)**	**Proportion present**	**Number of annual collisions attributed to SPA**	**FCS?**	**Potential for a significant effect?**
North Uist Machair and Islands	2816	105	0.00	0.00	Y	N
Horn Head to Fanad Head	320	113	0.00	0.00	No data	N
Inishtrahull	0	150.5	0.00	0.00	No data	N
The Shiant Isles	224	152	0.00	0.00	N	N
Illanmaster	0	265	0.00	0.00	No data	N
Notes: Annual mortality rate of 0.77 collisions per year. * = recent WeBS data available for all Islay only. Population divided into component SPAs based on ratio of population sizes given in the citations of each SPA.						

Greenland white-fronted goose

3.68 It was predicted using the Band (2012) that 0.28 (range 0.05 to 0.7) deaths would occur to migratory Greenland white-fronted geese each year as a result of collisions with the Argyll Array Offshore Wind Farm (at a conservative 99% avoidance rate). No estimates were available using radar data.

3.69 Based on similar apportioning conducted for Greenland barnacle goose above, it can be assumed that the greatest likelihood of collision would occur on the nearest SPA, Tiree Wetlands and Coast. An annual collision rate of 0.28 represents one loss every 3-4 years. Although SNH reports the population of the SPA to be in favourable, maintained condition, the most recent WeBS counts (Holt *et al.* 2012) suggest, like the national trend, this is not the case, with a reduction from the cited 1,419 individuals within the SPA, to a five year mean peak of 888 individuals across all of Tiree. Nevertheless, the level of additional loss is within the likely range of natural variation in mortality rate to this population. **No LSE** is therefore predicted for this or any other SPA. This is particularly the case if a 99.8% avoidance rate is used for collision mortality calculations, which has been advocated recently by SNH (2013) for grey geese species. This would greatly reduce mortality rates.

Canadian pale-bellied brent goose

3.70 It was predicted using the Band (2012) that 0.49 (range 0.082 to 1.23) deaths would occur to migratory Greenland white-fronted geese each year as a result of collisions with the Argyll Array Offshore Wind Farm (at a conservative 99% avoidance rate). Using the radar data, 1.08 collisions per year were predicted.

3.71 The mortality rate has been apportioned to each relevant SPA using a simple apportioning calculator as described above for Greenland barnacle goose. With the conservative assumption that all birds within the project site are SPA birds, it shows that despite a number of SPAs being closer to the project site, the SPA with the greatest likelihood of incurring a collision is Strangford Lough (0.71 collisions per year). Although no official data are available, the population appears to be in favourable condition, with an increase from 10,527 to 26,188 individuals since citation. Despite the closest SPA population, Gruinart Flats, Islay being in unfavourable condition, the predicted 0.09 collisions per annum equates to one every 11 years, which is well within natural variation of the mortality rate to the population. As such no LSE is predicted for any SPA. This is particularly the case if a 99.8% avoidance rate is used for collision mortality calculations, which

has been advocated recently by SNH (2013) for grey geese species. This would greatly reduce mortality rates further.

TABLE 24: PROVENANCE OF CANADIAN LIGHT-BELLIED BRENT GOOSE COLLISIONS DURING THE NON-BREEDING SEASON, BASED ON COLONY SIZES WITHIN MIGRATORY CORRIDOR

Population	Population size (individuals)	Distance from edge of development site (km)	Proportion present	Number of annual collisions attributed to SPA	FCS?	Potential for a significant effect?
Gruinart Flats, Islay	300	64	0.08	0.09	N	N
Lough Foyle	2,898	124	0.21	0.23	No data	N
Larne Lough	375	184	0.01	0.01	No data	N
Outer Ards	701	200	0.02	0.02	No data	N
Strangford Lough	26,188	213	0.65	0.71	No data	N
Killough Harbour	282	246	0.01	0.01	No data	N
Carlingford Lough	495	254	0.01	0.01	No data	N
Skerries Islands	222	309	0.00	0.00	No data	N

Notes: Annual mortality rate of 1.08 collisions per year.

Corncrake

3.72 Theoretical CRM presented in the Argyll Array Offshore Wind Farm Technical Report – Ornithology, predicted that when assuming the entire 'at-risk' population (around 900 males, based on O'Brien *et al.* 2006 and RSPB *unpubl.*) flew through the Argyll Array Offshore Wind Farm site during spring and autumn passage, then the loss of 11 birds would occur each year (at a 98% avoidance rate), or 28 with a 95% avoidance rate.

3.73 The mortality rate has been apportioned to each relevant SPA using a simple apportioning calculator as described above for geese, assuming that birds breeding closer to the project site are more likely to be cross the turbine area (Table 25). It shows that all, or nearly all, collisions are likely to be attributable to the Tiree corncrake SPA population. Although this population has increased greatly from 106 calling males in 1991 to 389 in 2009 (RSPB *unpubl. data*), further evidence is required before a LSE can be discounted.

3.74 For all other SPA populations, fewer than one collision per year is required, which is within the range of natural variation in mortality rate (with a adult survival rate of around 0.286 in the Western Isles (Green 2004; O'Brien *et al.* 2006). With populations generally in favourable condition, no LSEs are therefore predicted for any other SPA.

TABLE 25: PROVENANCE OF CANADIAN LIGHT-BELLIED BRENT GOOSE COLLISIONS DURING THE NON-BREEDING SEASON, BASED ON COLONY SIZES WITHIN MIGRATORY CORRIDOR

Population	Population size (calling males)	Distance from edge of development site (km)	Proportion present	Number of annual collisions attributed to SPA	FCS?	Potential for a significant effect?
Tiree (corncrake)	389	5.5	0.98	27.43	Y	Y
Coll (corncrake)	134	26	0.02	0.42	Y	N
Eoligarry, Barra	72	56.5	0.00	0.05	Y	N
Kilpheder to Smerclate, South Uist	119	62	0.00	0.07	Y	N
Aird and Borve, Benbecula	35	97.5	0.00	0.01	Y	N

TABLE 25: PROVENANCE OF CANADIAN LIGHT-BELLIED BRENT GOOSE COLLISIONS DURING THE NON-BREEDING SEASON, BASED ON COLONY SIZES WITHIN MIGRATORY CORRIDOR						
Population	**Population size (calling males)**	**Distance from edge of development site (km)**	**Proportion present**	**Number of annual collisions attributed to SPA**	**FCS?**	**Potential for a significant effect?**
North Uist Machair and Islands	112	105	0.00	0.02	Y	N
Ness and Barvas, Lewis	18	203	0.00	0.00	N	N
Notes: Annual mortality rate of 28 collisions per year at 95% avoidance rate.						

Waders

3.75 For all breeding wader species it has previously been determined that only the closest SPA, Tiree and Wetlands and Coast may have any non-trivial connectivity with the project site, when migrating birds may be at risk of collision when passing through the site. This is also the case for turnstone, which is a qualifying feature during the non-breeding period only. No recent trends or population data are available for any of the wader species' populations, and so the cited SPA totals have been considered here. According to SNH however, all species' populations are in favourable condition, except for redshank which is unfavourable, recovering.

3.76 Collision estimates for waders were derived from the Band (2012) migration model, as detailed in the Argyll Array Offshore Wind Farm Technical Report – Ornithology. A 98% avoidance rate was used for each species, which resulted in the annual mortality rates in Table 26.

TABLE 26: ESTIMATED COLLISION MORTALITY FOR WADERS IN RELATION TO SPA SIZE							
Population	**Population size**	**Number of collisions (98% avoidance)**	**Range**	**Adult survival rate**	**Increase in baseline mortality**	**FCS?**	**Potential for a significant effect?**
Oystercatcher	160 p	0.86	172-2.58	0.89	2.4%	Y	N
Ringed plover	160 p	4.4	0.88-13.2	c. 0.70	4.6%	Y	Y
Dunlin	125 p	11.0	2.2-33.1	0.74	16.9%	Y	Y
Redshank	140 p	3.2	0.64-9.6	0.74-0.76	4.6%	N	Y
Turnstone	700 i	1.8	0.3-5.34	c. 0.70 *	0.9%	Y	N
Notes: Adult survival rates given in Sandercock (2003). * = Estimated from similar species.							

3.77 With favourable condition of the SPA populations, and relatively low mortality rates that are likely to be within natural variation, no LSE is predicted for oystercatcher and turnstone. With higher increases in baseline mortality, at this stage without further information an LSE cannot be discounted for ringed plover, dunlin or redshank.

4 PART 3: RE-SCREENING

4.1 When a LSE has not been ruled out by the screening steps in Stage 5 of Figure 1 (Parts 1 and 2 of this report), any straightforward mitigation measures that could be incorporated into the development should be considered (Stage 6) so that the development can be re-screened (Stage 7).

4.2 Based on advice from SNH (letter dated 4 October 2012), for mitigation to be successful at the LSE stage of the HRA, it generally needs to be: sure to succeed, simple to implement, and straightforward in nature, with no need to gather further information. It should also be taken into consideration whether the mitigation avoids the LSE entirely or whether it merely reduces it.

4.3 At the current stage of the Argyll Array project development, mitigation measures are yet to be finalised, and so where an LSE has been determined in Part 1, this will be taken forward to Part 3. As the project develops, and mitigation measures become finalised, a revision of determination of LSE may be required.

4.4 Table 6 and Table 7 therefore form the scope of the Appropriate Assessment to be carried out on the Argyll Array Offshore Wind Farm.

5 CONCLUSIONS

5.1 Based on the screening process outlined above, a LSE could not be discounted for the following qualifying interests of SPAs, based on their sensitivity to identified impacts associated with the Argyll Array Offshore Wind Farm either alone or in-combination, and the numbers of birds present within the project site that are attributable to SPAs:

Seabirds:

- Gannet (operational displacement and collision risk);
- Kittiwake and herring gull (collision risk)
- Guillemot, razorbill and puffin (construction disturbance and operational displacement).

Non-seabirds (collision risk only):

- Corncrake;
- Ringed plover;
- Dunlin; and
- Redshank.

5.2 The list of relevant SPAs to be considered as part of the Appropriate Assessment is presented in Table 27 which is derived from the results in Section 3.

TABLE 27: SPAS WHERE A LSE COULD NOT BE DISCOUNTED FOR A QUALIFYING FEATURE

SPA	Distance from development site	Qualifying interest where a LSE could not be ruled out
Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast)	3.5 km E	Ringed plover (breeding)
		Dunlin (breeding)
		Redshank (breeding)
Tiree (corncrake)	5.5 km E	Corncrake
Mingulay and Berneray	34 km NW	Kittiwake
		Guillemot
		Puffin
		Razorbill
Rum	51 km NE	Kittiwake
		Guillemot
North Colonsay and Western Cliffs	52 km SE	Kittiwake
		Guillemot
Canna and Sanday	60 km NE	Kittiwake
		Guillemot
Horn Head to Fanad Head	113 km SE	Kittiwake
		Razorbill
Rathlin Island	120 km SE	Kittiwake
		Guillemot
		Razorbill
The Shiant Isles	152 km NE	Kittiwake
		guillemot
		Razorbill

TABLE 27: SPAS WHERE A LSE COULD NOT BE DISCOUNTED FOR A QUALIFYING FEATURE		
SPA	**Distance from development site**	**Qualifying interest where a LSE could not be ruled out**
St Kilda	155 km NW	Kittiwake
		Guillemot
		Gannet
		Razorbill
Ailsa Craig	165 km SE	Gannet
		Guillemot
Flannan Isles	192 km N	Kittiwake
		Guillemot
		Razorbill
Handa	229 km NE	Kittiwake
		Guillemot
		Razorbill
Cape Wrath	256 km NE	Kittiwake
		Guillemot
		Razorbill
North Rona and Sula Sgeir	285 km N	Razorbill
		Guillemot
Lambay Island	319.5 km S	Kittiwake
		Guillemot
Sule Skerry and Sule Stack	312.5 km NE	Gannet
Howth Head Coast	320 km S	Kittiwake

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7 APPENDIX 1 – APPORTIONING ON-SITE POPULATIONS TO SPA COLONIES

Critical to assessing impacts on the SPA species is the ability to estimate the proportion of the SPA population that is likely to be exposed to the impacts. It is likely that for most species a multitude of breeding colonies within foraging range contribute to the on-site population in the study area during the breeding season, and it is necessary to account for this. Logistical difficulties, together with the potentially variable nature of seabird foraging areas, mean that it is impractical to derive this information from direct monitoring of seabirds across the relevant SPAs. Therefore, the approach taken here to estimating the proportional contribution made by the different SPA populations to the on-site population of each SPA species is based upon adopting a logical approach that considers colony size, amount of potential foraging habitat (i.e. sea) between the colony and the site, and the distance to the site (all of which are likely to influence the extent to which birds from a particular colony use a site).

Therefore, for each species identified as having a potential for LSE in the HRA Screening Report, an 'apportionment calculation' was applied to all colonies within the specified foraging range. There were several steps to this process, as follows:

- First, the colony size was extracted and, on the basis that the proportion of foraging trips from the colony to a range of sites will decline with distance to these sites (all else being equal), the number of birds foraging as far as the proposed project site was estimated. This was achieved using a decay function that was based upon the ratio of the mean maximum foraging distance for the species to the distance from the colony to the site, and an assumption that 15% of all trips were at the mean maximum foraging distance for the species. Distances were measured linearly for colonies with a direct line of flight to the study area.

- Having estimated the number of birds from the colony that could access the site (the 'effective colony size'), each colony within the mean maximum foraging range of the site was given a weighting, based upon the 'effective colony size' and the amount of available foraging habitat between the colony and site. The weighting was calculated by:
  (i) dividing the 'effective colony size' by the square of the distance from the colony to the site (the square of distance being used because of the linear to squared scaling involved); and,
  (ii) for colonies located on mainland coasts (but not offshore islands), dividing the figure from (i) above by two (because they have approximately 50 % of the foraging habitat available as colonies on islands, for a given distance to the site).

- The calculated weights were then summed across colonies and the proportional contribution of the colony to the on-site population calculated as the colony weight expressed as a proportion of the summed weights.

By incorporating all known colonies within foraging range from the study area into the analysis, and with some assumptions about non-breeding birds, this method provides an approximate estimate of the contribution of each colony, including SPAs, to the on-site population.