Seagreen Wind Energy Ltd

July 2012

Seagreen Firth of Forth Offshore Wind Farm Development

Offshore Transmission Assets Project - Ornithological Technical Report

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Contents

Glossary

AC	Alternating Current
BTO	British Trust for Ornithology
DC	Direct Current
ECR	Export Cable Route
ESAS	European Seabirds at Sea
Firth of Forth Zone	Zone 2 of The Crown Estate Round 3 offshore wind leasing programme
HDD	Horizontal Directional Drilling
HV	High Voltage
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
MHWS	Mean High Water Springs
OFTO	Offshore Transmission Owner
OSP	Offshore Substation Platform
Seagreen	Seagreen Alpha Wind Energy Limited and Seagreen Bravo Wind Energy Limited
Seagreen Project	Phase One of development in the Firth of Forth Zone, comprising Project Alpha, Project Bravo and the Transmission Assets
SNH	Scottish Natural Heritage
SPA	Special Protection Area (Natura 2000/European site)
Transmission Asset Project	The OFTO assets that will be applied for under Marine Licensing. These include the OSPs, converter station, HV cabling and the ECR to MHWS.
VP	Vantage Point
WeBS	Wetland Bird Survey

1. Introduction

1.1. The Seagreen Project

In December 2009, Seagreen Wind Energy Limited (Scottish and Southern Energy plc. and Fluor Ltd) was awarded by The Crown Estate the exclusive development rights for the Firth of Forth Round 3 offshore wind development Zone (Zone 2). Zone 2 is located approximately 25km east of Fife and covers an area of 2,852km^2 in the outer Firth of Forth.

Seagreen plans to develop the Zone in three phases, with Phase 1 in the northern area of the Zone. Phase 1 covers an area of approximately 600km^2, 25km from the Angus coast. Two wind farms are planned for Phase 1: Project Alpha and Project Bravo. These two wind farms plus the Transmission Asset Project are collectively referred to as the Seagreen Project, for which Section 36 consents and Marine Licences are being sought.

1.2. Avifauna of the Firth of Forth region

The Firth of Forth is internationally significant area for of breeding, wintering and passage seabirds. It is a complex estuarine site, stretching for over 100km from the River Forth at Stirling, eastwards past Edinburgh and along the coasts of Fife and East Lothian to a wide mouth. A range of coastal habitats are found within the estuary, including saltmarshes, dune systems, maritime grasslands, heath and fen, cliff slopes, shingle and brackish lagoons. Extensive mudflats in the Inner Firth provide an important food source for migrating and wintering waterbirds in the estuary. In the Outer Firth, the shoreline diversifies, with sandy shores, mussel bed and rocky outcrops (Seagreen, 2012b).

Within this area of interest, the Firth of Forth Zone is deemed to have an area of influence containing eight Special Protection Areas (SPAs). Full details of the SPAs in the region and the features for which they are designated can be found in Seagreen (2012b) and Atmos (2012). The SPAs within the region of the Transmission Asset Project are relevant to all infrastructure components of the project due to their importance for breeding seabirds in addition to wintering and passage waterfowl.

1.2.1. Seabirds

Internationally important seabird colonies occur in the surrounding area of the Firth of Forth. Most notably, the Forth Islands SPA supports around 90,000 individuals as detailed in the 2001 SPA review (Stroud *et al.*, 2001). The SPA lies 53km from the Seagreen Project and holds internationally important breeding numbers of gannet, puffin, shag, lesser black-backed gull, and Arctic tern, roseate tern, common and Sandwich terns. In addition, nationally important numbers of razorbill, guillemot, kittiwake, herring gull, cormorant and fulmar also occur.

The gannet colony at Bass Rock within the SPA is the largest on the UK east coast and has undergone a rapid expansion in recent decades, from 8077 pairs in 1970 (Cramp *et al.* 1974) to 55,482 in 2009[1] . The Isle of May also lies within the SPA and supports 150,000 seabirds including over 56,000 pairs of Puffin, which is the fourth largest UK colony for this species[1].

Fowlsheugh SPA lies 50km further north than the Forth Islands SPA (30km north-west of Seagreen Alpha) and also supports a substantial breeding seabird colony. This includes the third largest guillemot colony in

[1] http://jncc.defra.gov.uk/smp/counts.aspx

the UK (Mitchell *et al.,* 2001), with 50,556 individuals present in 2012[1]. Fowlsheugh also supports internationally important numbers of breeding kittiwakes amongst a total of 170,000 seabirds (Stroud *et al.,* 2001). Further north, and 85km from Seagreen Alpha lies Buchan Ness to Collieston Coast SPA, which does not support any species in internationally important numbers although qualifies through its seabird assemblage of 63,000 individual seabirds including guillemot, kittiwake, herring gull, shag and fulmar.

Several significant SPAs for breeding seabirds lie to the south of the Seagreen Project, including St Abbs Head to Fast Castle SPA (70km from Seagreen Bravo). This site does not support any species in internationally important numbers, although qualifies through its seabird assemblage of 58,000 individual seabirds including razorbill, guillemot, kittiwake, herring gull, and shag. The Farne Islands SPA lies further south and is 101km from Seagreen Bravo; this SPA is internationally important for four species of breeding tern: Arctic, common, roseate and Sandwich tern, in addition to guillemot and puffin. Puffins are the most abundant species with 36,835 pairs in 2008[1] out of the total of 140,930 seabirds present.

Seabird species originating from the SPA sites detailed above have the potential to be impacted by several components of the offshore Transmission Asset Project, namely the Offshore Substation Platforms (OSPs) and converter station within the wind farm footprint, and the seaward section of the Export Cable Route (ECR). The assessment will take into consideration the abundance of species present within the components of the Transmission Asset Project, in addition to other species-specific information such as foraging range (Langston, 2010; Thaxter *et al.,* 2012).

1.2.2. Coastal species – waders and wildfowl

The landfall at Carnoustie lies approximately 2km north-east of the Firth of Tay and Eden Estuary SPA. The SPA supports internationally important breeding little tern and marsh harrier, and is also internationally important for two wader species (bar-tailed godwit and redshank) and two wildfowl species (greylag goose and pink-footed goose) over the wintering period. The Estuary regularly supports 34,074 individual waterfowl including velvet scoter, cormorant, shelduck, eider, common scoter, black-tailed godwit, goldeneye, red-breasted merganser, goosander, oystercatcher, grey plover, sanderling, dunlin and long-tailed duck. The SPA stretches for 35km, with the most extensive intertidal flats being found on the north side west of Dundee.

Montrose Basin lies 25km north of the landfall at Carnoustie and takes the form of a tidal basin fed by the River South Esk and contains areas of mud-flat, marsh and agricultural land. The site is internationally important for wintering pink-footed and greylag geese, in addition to two wader species: knot and redshank. Additional notable species within the assemblage include dunlin, oystercatcher, eider, wigeon and shelduck.

The Firth of Forth SPA lies 35km due south of Carnoustie and consists of a complex of estuarine habitats stretching for over 100km from the River Forth at Stirling past Edinburgh and along the coasts of Fife and Lothian. The Firth is of major importance for a rich assemblage of waterfowl in wintering and passage periods, including sea-duck, divers and Sandwich tern during the breeding season. During winter periods, internationally important numbers of bar-tailed godwit, golden plover, red-throated diver, slavonian grebe, knot, pink-footed goose, redshank, shelduck and turnstone occur. The estuary regularly supports 86,067 birds each year according to Stroud *et al*. (2001), including the additional species: great crested grebe, cormorant, curlew, eider, long-tailed duck, common scoter, velvet scoter, goldeneye, red-breasted merganser, oystercatcher, ringed plover, grey plover, lapwing, dunlin and wigeon.

The Ythan Estuary, Sands of Forvie and Meikle Loch SPA is located approximately halfway between Aberdeen and Peterhead some 73km from the Seagreen Project. Meikle Loch is an important winter roost site for pink-footed geese, while the SPA also supports important wintering numbers of eider, lapwing and redshank, which together total 51,265 individual birds (Stroud *et al*. 2001). The Sands of Forvie supports important numbers of breeding terns, including the largest Sandwich and little tern colonies in Scotland, totalling 590 and 36 pairs respectively in 2011.

Qualifying features from the SPAs listed above (particularly those from the Firth of Tay and Eden Estuary SPA) have the potential to be impacted by coastal and near-shore works involving the ECR. The majority of qualifying species are migratory by nature and may also interact with the Seagreen Project footprints during their twice yearly movements. Further migratory movements of wildfowl species which traverse the Firth of Forth region but are features of SPAs further afield should also be taken into consideration.

Inland of the Firth of Forth, the Slamannan Plateau SPA supports the largest of only two regular wintering flocks in Britain of taiga bean goose, which migrate to Scotland from their Arctic breeding grounds in Scandinavia and Western Russia. On the west coast, the Upper Solway Flats and Marshes SPA supports virtually all of the Svalbard population of barnacle goose during the winter. Satellite tracking has shown that in the autumn these geese come ashore at various locations along the east coast of Scotland, before moving southwest towards the Solway Firth (Griffin *et al*. 2011). Migrating whooper swans may also cross the Firth of Forth as they migrate along the east coast (Griffin *et al*. 2010; 2011). Inland from the Tay Estuary, South Tayside Goose Roosts, Loch Leven, Cameron Reservoir and Loch of Kinnordy SPAs support wintering pink-footed geese while both South Tayside Goose Roosts and Loch of Kinnordy SPAs also support wintering greylag geese, numbering 3,667 and 1,000 respectively (Stroud *et al*. 2001).

Interaction with the Transmission Asset Project components within the wind farm (i.e. the OSPs and converter station) is likely to be limited for migratory species, although an attempt is made to quantify these within this report.

1.3. Technical Report Objectives

This report provides an assessment of the potential ornithological impacts of the Transmission Asset Project which relates to OFTO assets that will be applied for under Marine Licensing. It forms part of the ornithological assessment of the proposed Seagreen Project.

The Transmission Asset Project components for assessment are:

- The Offshore Substation Platforms (OSPs): collector and converter station platforms within the wind farm footprint
- Associated High Voltage cabling between OSPs;
- The seaward portion of the ECR corridor; and
- The ECR corridor up to MHWS.

This assessment therefore comprises a combination of different habitat Zones, involving offshore marine habitat within the wind farm footprint and the main portion of the ECR corridor, and intertidal habitat within the coastal portion of the ECR corridor.

The purpose of this report is to:

- Determine the regional context in which the Transmission Asset Project can be assessed;
- Collate all ornithological data gathered for the site and surrounding areas;
- Establish the ornithological significance of the proposed Transmission Asset Project site for breeding, wintering and migratory birds; and
- Predict potential ornithological impacts of the construction, operational and decommissioning phases that may require further assessment as part of an Environmental Impact Assessment (EIA).

Ornithological assessment of the offshore wind farm area and surrounding buffer has been undertaken by ECON Ltd (ECON, 2011; Seagreen, 2012b). Atmos Consulting have completed ornithological assessment of the intertidal area up to 2km from the landfall point at Carnoustie (Atmos, 2012). Specific surveys of the ECR between the intertidal area and the wind farm footprint were deemed not to be required by SNH (ECON, 2011) and as such the assessment of this section of the Transmission Asset Project is based on a desk study of existing relevant information.

This report comprises the NIRAS ornithological assessment of the Transmission Asset Project (as outlined above), which draws together information from the ECON and Atmos assessments, as relevant to the Transmission Asset Project.

Figure 1 presents the extent of the Transmission Asset Project boundary and includes the ECR corridor to Carnoustie.

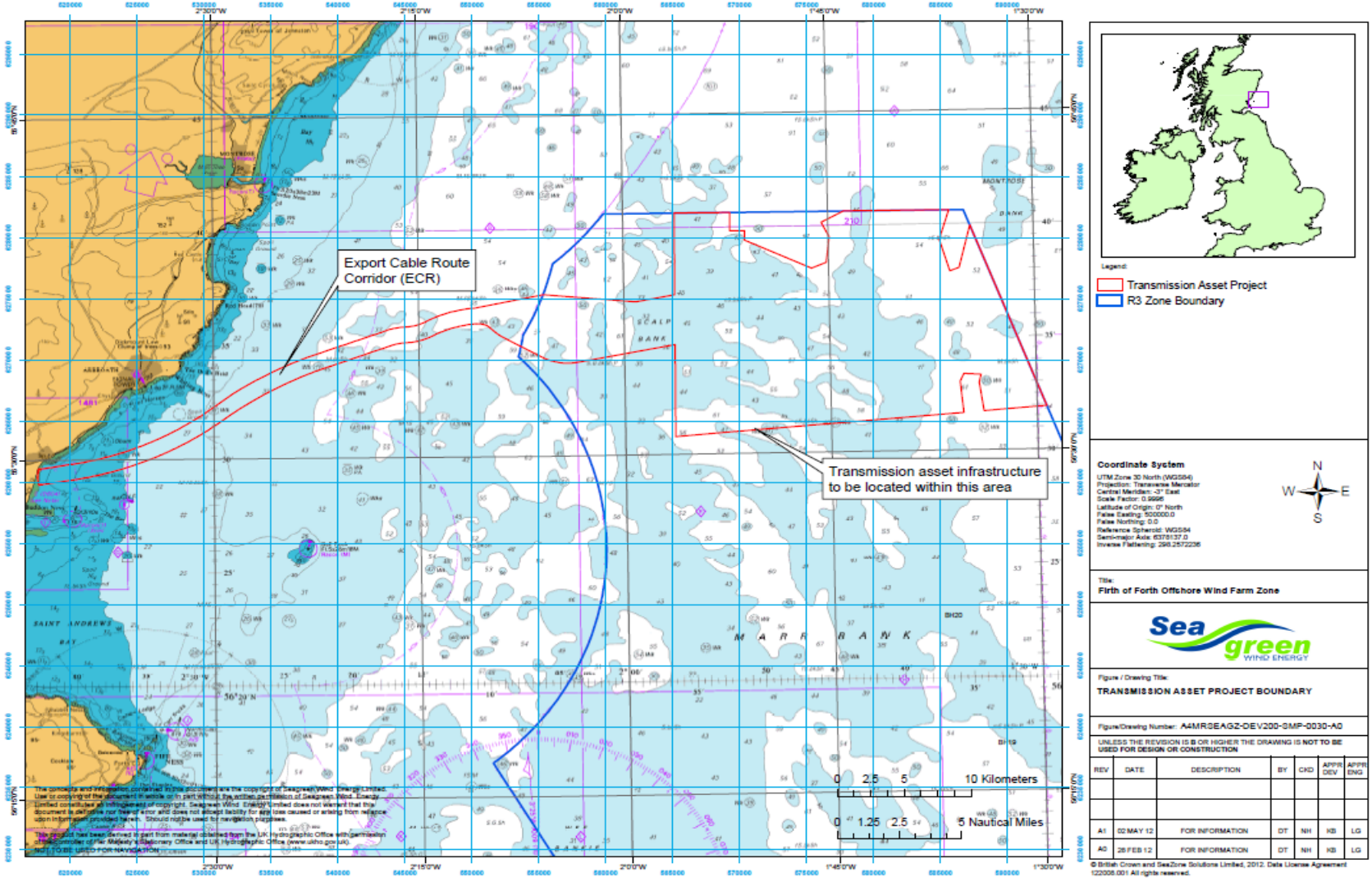

Figure 1: Seagreen Transmission Asset Project boundary (Figure from Seagreen, 2012b).

2. Assessment Methodology

2.1. Overview of Surveys

The Transmission Asset Project covers an extensive Zone from the Seagreen Project (Project Alpha and Project Bravo wind farms) to the landfall point at Carnoustie, and therefore draws upon a diverse range of information in order to determine the extent of effects on ornithological receptors. This includes survey work of both the intertidal section of the ECR corridor and marine surveys of the Firth of Forth Zone, within which the Seagreen Project site lies. The survey work is supported by background information from a variety of sources.

2.1.1. Intertidal Vantage Point Survey (ECR corridor)

Following a desk study of the ECR corridor (ECON, 2011) which recommended counts of birds exploiting the intertidal zone during the key winter period, coastal vantage point (VP) surveys were conducted by Atmos Consulting between October 2011 and March 2012 (inclusive). A simplified 'through the tide' count survey method was used to assess the abundance and spatial distribution of waterfowl and seabirds using the beach and near-shore sea areas, within a 2km radius of the land-based VP at the Carnoustie landfall location (i.e. from the VP out to approximately 2km off the coast). The surveys therefore covered both the intertidal habitat potentially frequented by waders and wildfowl, and the immediate inshore waters that have the potential to support sea-duck and other more marine species.

Counts were conducted twice per month, for three hours at low tide and three hours at high tide. All birds using the beach and near-shore sea area were recorded (standing/resting, swimming or feeding). Each bird or flock was recorded as a single registration. Swimming birds were also tracked, although flights were not specifically targeted. Further information regarding the methodology for coastal VP surveys can be found in Atmos (2012).

The Intertidal VP survey provides data to inform the assessment on intertidal and near-shore marine sections of the ECR corridor.

2.1.2. Offshore Boat-Based Survey (offshore Firth of Forth Zone)

Boat-based surveys were conducted by ECON Ltd in the offshore Firth of Forth Zone (Zone 2), over a two year period from December 2009 to December 2011. Surveys were carried out monthly to correspond with overwintering, spring passage, breeding season and autumn passage periods for both seabirds and migratory coastal, wetland and terrestrial species. Full details of the methodology for the boat-based surveys is given in the Offshore Ornithology Baseline Report (Volume III, Annex E1).

The boat-based survey provides data to inform the assessment on the OSPs and converter station within the wind farm footprint in addition to providing important contextual information for the marine sections of the ECR corridor to be assessed.

2.1.3. Offshore Aerial Survey (offshore Firth of Forth Zone)

A programme of aerial surveys was conducted during 2009/10 covering the Firth of Forth Zone and inshore Scottish Territorial Waters (STW) wind farm sites (including Inch Cape and Neart na Gaoithe). These surveys also cover the ECR corridor up to approximately 10km from coast. Three summer (May – August 2009) and four winter (November 2009 – February 2010) surveys were conducted. Summer surveys were divided into five adjoining blocks with 2km transect spacing, and transect length ranged from 20km to 65km. Winter surveys were divided into six routes with 2km spacing and 8km to 90km transect length. Aerial surveys

followed COWRIE recommendations (Camphuysen *et. al.,* 2004), and were conducted from a Partenavia PN68 high-winged twin-engine aircraft flying at 76m (250ft) altitude. Survey transects were divided into four Distance bands, and birds were assigned to these bands using a clinometer when perpendicular to the aircraft flight path.

Aerial survey records were pooled for DISTANCE analysis, to estimate density and population size for species and species groups wherever possible. Limited species identification in aerial surveys, coupled with the small number of records meant that DISTANCE analysis could only be performed on a limited number of species (gannet and kittiwake), and species groups (auks and gulls).

Detailed information on aerial survey methodology, including the relative importance of population size and the spatial distribution of survey effort, can be found in Seagreen (2012b).

Aerial survey of the near-shore section of the ECR, within Tay Bay, has been conducted by the JNCC to determine the importance of the area for inshore waterbirds outside the breeding season, and to assess its potential to qualify as an offshore SPA. Two strip-transect aerial surveys were carried out between December 2000 and February 2001. Seven line transect aerial surveys were undertaken between 2001 and 2005. Data from the JNCC 2000/01 strip transect aerial surveys comprise total counts of birds in the area surveyed. Further detail and methodology for these surveys can be found in Söhle *et. al.* (2007).

This information has been used primarily to provide context for this assessment of the Transmission Asset Project, particularly with respect to the marine section of the ECR (this region was not covered by the boat-based surveys). Density estimates for species occurring in the ECR area (the ECR route plus 1 km buffer) were obtained from the 2009 – 2010 data to provide information that allows direct comparison with the wider Firth of Forth Zone.

2.2. Other Data Sources and Information

2.2.1. ESAS database

Seabird data is held in the European Seabirds at Sea (ESAS) database, maintained by JNCC. The most recent analysis of the data held within the ESAS database, up to August 2003, was completed by Pollack and Barton (2006). The database contains 3.5 million records of seabirds and cetaceans. Historic versions of the database are represented in '*An atlas of seabird distribution in north-west European waters*' (Stone *et al*. 1995) and '*Important Bird Areas for seabirds in the North Sea*' (Skov *et al*. 1995).

2.2.2. Foraging ranges

In order to provide important context on the potential effects of offshore wind farms on bird species, it is appropriate to determine the foraging range of breeding seabirds and establish whether such ranges from designated sites overlap with the extent of the proposed development (Thaxter *et. al.,* 2012). Representative foraging ranges can therefore assist in highlighting sensitive ornithological receptors.

Of most significance is the Distance at which most foraging flights occur, rather than extreme flight Distances (either maximum or minimum), as the overall flight activity of a species is likely to be most significant in determining the risk associated to each species' population (Langston, 2010). Therefore the mean-maximum foraging ranges presented by Thaxter *et. al.* (2012) are considered to offer the most realistic measure of the potential for an overlap of foraging ranges from a designated site and the extent of the proposed wind farm.

With regards to the Transmission Asset Project, foraging ranges are of value in assessing the seaward section of the ECR corridor and the infrastructure within the wind farm footprint (OSPs and converter station).

2.2.3. Individual tracking of selected bird species

Forth and Tay Developers Group (FTOWDG) commissioned CEH (the Centre for Ecology and Hydrology) to track individual kittiwake, guillemot and razorbill breeding on the Isle of May during 2010, building on previous tracking studies on these species at this site.

Foraging distribution is quantified by attaching miniaturised GPS data loggers to breeding birds. Birds are captured and tagged at the nest, and recapture is necessary later to retrieve the tag and the stored data. In 2010, 74 GPS tags were deployed in kittiwakes, with 38 successfully retrieved. For guillemot, 35 of 46 tags were retrieved, and for razorbill, 18 of 25 tags were recovered. Tag data was presented as shapefiles showing the location of individual birds at regular intervals during each recorded foraging trip. Foraging, as opposed to commuting, is inferred with the location of the tag remains similar for long periods. A detailed distillation of results is given in Seagreen (2012b).

In the absence of boat-based survey data for the area surrounding the ECR corridor, such tracking data provide insight into likely occurrence and movements of breeding seabirds.

2.2.4. Wetland Bird Survey (export cable route)

The information collected on intertidal birds in both surveys areas was analysed by direct comparison with both citation populations for the SPA/Ramsar site and with data sourced from the Wetland Bird Survey (WeBS). WeBS is a joint scheme of the British Trust for Ornithology (BTO), the Wildfowl & Wetlands Trust (WWT), Royal Society for the Protection of Birds (RSPB) and Joint Nature Conservation Committee (JNCC) to monitor waterbirds in the UK to provide the principal data on which the conservation of core populations is based. Monthly coordinated Core Counts are made at over 2000 wetland sites in the UK, and are supported by Low Tide Counts of selected estuaries, including Morecambe Bay (Holt *et. al*., 2011).

Two core count sites are located along the area of Arbroath coastline relevant to this assessment and the Carnoustie landfall site:

- East Haven to Elliot Burn: data from 2008 to 2011 (NO616374);
- Elliot Burn to Boulzie Hill: data from 2009 to 2011 (NO639399); and

The Elliot Burn to Boulzie Hill WeBS count site is centred on the town of Arbroath and is at its western tip, 6km north-east of the Seagreen Project landfall at Carnoustie. WeBS surveys have been undertaken in 2009, 2010 and 2011 for this site and these data were obtained from the BTO.

The East Haven to Elliot Burn count site is contiguous with the previous count site and terminates 2km north-east of Carnoustie. WeBS surveys have been undertaken intermittently at this site from 1991 onwards. Data were obtained from 2008 to 2011 (no surveys were undertaken in 2006 or 2007). No WeBS count site occurs directly in the area of the landfall at Carnoustie.

2.2.5. Reference works

Ad hoc bird sightings made from the shoreline that cover the intertidal Zone and near-shore coastal waters are detailed in local bird reports covering the ECR corridor: the most recent available Angus and Dundee Bird Report covers 2008 (Angus and Dundee Bird Club). Further insight is provided by regional avifauna

works such as Forrester *et al*. (2007) and Brown & Grice (2005). Strategic Ornithological Support Services (SOSS) for the wind farm industry managed by the British Trust for Ornithology (BTO) compiled all available information on migratory routes for 101 species and races to allow the risks of any specific offshore wind farm for particular species to be assessed (Wright *et al.* 2012).

2.2.6. Species populations and conservation status

Regional, national and international population sizes are essential for assigning impact significance levels for species occurring within the Transmission Asset Project. Key references include Wetlands International (2006), Musgrove *et al*. (2011) and Baker *et al*. (2006) with further guidance and BirdLife International (2004), Mitchell *et al.* (2004) and Banks *et. al.* (2007).

In addition to population sizes, guidance has been sought on the legislative conservation status of species recorded in the baseline work for the Transmission Asset Project. Species listed on Annex 1 of the EU Birds Directive or Schedule 1 of the wildlife and Countryside Act (1981, as amended) are deemed to be of higher value. Additional guidance is obtained from Birds of Conservation Concern (BoCC; Eaton *et. al*., 2009) and the UK Biodiversity Action Plan (BAP). Species detailed on the Red and Amber lists of BoCC (and/or are UK BAP Priority Species) are considered to be of moderate value significance, with all other species (Green list) being of lesser value only.

2.3. Summary of application of data sources

Table 1 presents a summary of the Transmission Asset Project components and the applicability of the primary data sources detailed above.

Table 1: Summary of the application of data sources to components of the Transmission Asset Project

Transmission Asset Component	Data Source
OSPs and converter station	Boat-based and aerial surveys (Seagreen, 2012b)
HV export cables	Boat-based and aerial surveys (Seagreen, 2012b)
ECR – seaward element	JNCC aerial survey supported by desk study of additional data sources (ECON, 2011)
ECR – Intertidal and inshore element	Coastal vantage point survey (Atmos, 2012) supported by WeBS and other data sources.

3. The Existing Environment

3.1. Seagreen Project ECR corridor desk study

A desk study (ECON, 2011) has been completed with specific reference to the ECR corridor for the Seagreen Project, both in the offshore/seaward and nearshore / intertidal regions. Table 2 shows the species identified in this report and potentially relevant to the assessment of the ECR corridor component of the Transmission Asset Project.

Table 2: Species relevant to the Seagreen Project Export Cable Route corridor (identified in ECON (2011) desk study)

Group	Species	
	Intertidal/nearshore	**Seaward portion**
Wildfowl	Pink-footed goose *Anser brachyrhynchus* Greylag goose *Anser anser* Shelduck *Tadorna tadorna* Eider *Somateria mollissima*	Eider *Somateria mollissima* Long-tailed duck *Clangula hyemalis* Goldeneye *Bucephala clangula* Red-breasted merganser *Mergus serrator* Goosander *Mergus merganser* Common scoter *Melanitta nigra* Velvet scoter *Melanitta fusca*
Seabirds	Herring gull *Larus argentatus* Black-headed gull *Chroicocephalus ridibundus* Little tern *Sterna albifrons* Cormorant *Phalacrocorax carbo*	Herring gull *Larus argentatus* Kittiwake *Rissa tridactyla* Little gull *Larus minutus* Common gull *Larus canus* Great black-backed gull *Larus marinus* Lesser black-backed gull *Larus fuscus* Guillemot *Uria aalge* Razorbill *Alca torda* Puffin *Fratercula arctica* Manx shearwater *Puffinus puffinus* Fulmar *Fulmaris glacialis* Shag *Phalacrocorax aristotelis* Cormorant *Phalacrocorax carbo* Gannet *Morus bassanus* Red-throated diver *Gavia stellata*
Waders	Dunlin *Calidris alpina* Redshank *Tringa totanus* Oystercatcher *Haematopus ostralegus* Curlew *Numenius arquata* Sanderling *Calidris alba* Lapwing *Vanellus vanellus* Bar-tailed godwit *Limosa lapponica* Ringed plover *Charadrius hiaticula* Black-tailed godwit *Limosa limosa*	n/a

A number of species have the potential to occur in both the nearshore and seaward areas of the ECR corridor. These include gull species (particularly herring gull) and sea-duck (notably eider).

3.2. Intertidal Vantage Point Survey (ECR corridor)

Through the tide surveys were carried out twice monthly (at high and low tide respectively) between October 2011 and March 2012. Twenty five 'primary target' species were identified during the surveys. These included the following species holding notable conservation status:

- Bar-tailed godwit: Annex 1 listed species;
- Great northern diver and red-throated diver: Annex 1 and Schedule 1 listed species;
- Common scoter and long-tailed duck: Schedule 1 listed species;
- Curlew and herring gull: UK Biodiversity Action Plan (UKBAP) and Scottish Priority listed species;
- Black-headed gull: Scottish Priority listed species; and
- Sixteen further Birds of Conservation Concern (BoCC) Amber listed species, and four species of lower conservation value.

In addition, two species that are included as qualifying features of the adjacent Firth of Tay and Eden Estuary SPA occurred: bar-tailed godwit and redshank. Seven species that are listed in the SPA assemblage were noted: long-tailed duck, cormorant, eider, common scoter, red-breasted merganser, oystercatcher and sanderling.

The most frequently recorded species was eider, followed by common scoter and herring gull. Seabirds were widely recorded during the surveys with razorbill, guillemot, shag and gannet present throughout. Red-throated diver was also seen in moderate numbers, while great northern diver was recorded on a single occasion. Low numbers of waders were observed using the foreshore areas, with the most common species being oystercatcher. Wildfowl were relatively numerous and were dominated by sea-duck, including eider, long-tailed duck, common scoter and red-breasted merganser.

The survey observations recorded at the Carnoustie VP are detailed in Table 3.

Table 3: Primary target species recorded during the Carnoustie vantage point survey (Oct '11 to Mar '12)

Species		Number of Records	Total no. of Birds	Max Birds
Wildfowl	Common scoter *Melanitta nigra*	34	745	108
	Eider *Somateria mollissima*	52	562	49
	Long-tailed duck *Clangula hyemalis*	19	29	5
	Red-breasted merganser *Mergus serrator*	8	18	3
	Wigeon *Anas penelope*	4	96	41
Seabirds	Razorbill *Alca torda*	8	15	3
	Guillemot *Uria aalge*	17	29	4
	Cormorant *Phalacrocorax carbo*	18	28	11
	Shag *Phalacrocorax aristotelis*	22	35	5
	Gannet *Morus bassanus*	3	112	105
	Great Northern diver *Gavia immer*	1	1	1
	Red-throated diver *Gavia stellata*	18	22	3
	Herring gull *Larus argentatus*	23	1317	230
	Kittiwake *Rissa tridactyla*	5	74	42
	Black-headed gull *Chroicocephalus*	4	156	80

	ridibundus			
	Common gull *Larus canus*	5	349	205
	Great black-backed gull *Larus marinus*	3	12	8
	Little gull *Larus minutus*	2	26	18
Waders	Bar-tailed godwit *Limosa lapponica*	1	3	3
	Curlew *Numenius arquata*	4	19	9
	Knot *Calidris canuta*	2	6	9
	Oystercatcher *Haematopus ostralegus*	9	2	27
	Redshank *Tringa totanus*	2	6	4
	Sanderling *Calidris alba*	3	17	11
	Turnstone *Arenaria interpres*	2	4	3

Table 4 presents the data for high and low tide periods in terms of maximum counts and the cumulative count of birds.

Table 4: Primary target species recorded at low and high tide during the Carnoustie vantage point survey

Species		**Low Tide Total No. Birds**	**Low Tide Max Count**	**High Tide Total No. Birds**	**High Tide Max Count**
Wildfowl	Common scoter *Melanitta nigra*	381	108	364	105
	Eider *Somateria mollissima*	401	42	161	49
	Long-tailed duck *Clangula hyemalis*	19	5	10	3
	Red-breasted merganser *Mergus serrator*	9	3	9	3
	Wigeon *Anas penelope*	12	12	84	41
Seabirds	Razorbill *Alca torda*	5	3	10	3
	Guillemot *Uria aalge*	13	3	16	4
	Cormorant *Uria aalge*	18	11	10	1
	Shag *Phalacrocorax aristotelis*	22	5	13	2
	Gannet *Morus bassanus*	0	0	112	105
	Great Northern diver *Gavia immer*	1	1	0	0
	Red-throated diver *Gavia stellata*	12	3	10	2
	Herring gull *Larus argentatus*	1037	230	280	90
	Kittiwake *Rissa tridactyla*	17	17	57	42
	Black-headed gull *Chroicocephalus ridibundus*	80	80	76	55
	Common gull *Larus canus*	86	76	263	205
	Great black-backed gull *Larus marinus*	12	8	0	0
	Little gull *Larus minutus*	26	18	0	0
Waders	Bar-tailed godwit *Limosa lapponica*	3	3	0	0
	Curlew *Numenius arquata*	12	9	7	7
	Knot *Calidris canuta*	6	6	9	9
	Oystercatcher *Haematopus ostralegus*	73	27	17	17

	Redshank *Tringa totanus*	4	4	2	2
	Sanderling *Calidris alba*	17	11	0	0
	Turnstone *Arenaria interpres*	4	3	0	0

The majority of wader species were less abundant during high tide surveys, with three species absent entirely (bar-tailed godwit, sanderling and turnstone). This indicates that the intertidal area and the immediate vicinity do not provide high tide roosting opportunities for wader species. Sea-duck were found in moderate numbers in both high and low tide surveys, while seabird records were heavily biased to high tide surveys. Gannets, for example were unsurprisingly not recorded during low tide and was present in moderate (albeit inconsistent) numbers at high tide. Gull species were present throughout, although two species (great black-backed gull and little gull) were not recorded at high tide.

3.3. Offshore Boat-Based Survey (offshore Firth of Forth Zone)

Data from offshore boat-based surveys of the Firth of Forth Zone Seagreen Project cover the Project Alpha and Project Bravo wind farm sites and the OSPs and HV cabling elements of the Transmission Asset Project.

A detailed description of survey results is provided in the assessment of offshore ornithological impacts at Project Alpha and Project Bravo (Seagreen, 2012b), and summarised here in Table 5.

Table 5: Maximum density and maximum population size of all bird species recorded at the Seagreen Project site (Alpha and Bravo) during boat-based surveys from December 2009 to 2011

Species		Project Alpha		Project Bravo	
		Maximum Density	Maximum Population	Maximum Density	Maximum Population
Wildfowl	Mallard *Anas platyrhynchus*			0.12	23
	Common Eider *Somateria mollissima*	-	9		
	Unidentified duck			-	3
Seabird	Red-throated Diver *Gavia stellata*	-	3	0.025	5
	Unidentified diver *Gavia sp.*	-	3		
	Northern Fulmar *Fulmaris glacialis*	2.519	497	2.606	505
	Great Shearwater *Puffinus gravis*	-	3		
	Sooty Shearwater *Puffinus griseus*	0.398	78	0.143	28
	Manx Shearwater *Puffinus puffinus*	0.053	10	0.130	25
	European Storm Petrel *Hydrobates pelagicus*	0.468	92	0.078	15
	Unidentified petrel	-	3		
	Northern Gannet *Morus bassanus*	13.776	2,716	7.608	1,474
	Great Cormorant *Phalcrocorax carbo*	-	6		
	European Shag *Phalacrocorax aristotelis*	-	6		
	Pomarine Skua *Stercorarius pomarinus*	0.058	11		
	Arctic Skua *Stercorarius parasiticus*	0.056	11	-	6
	Great Skua *Stercorarius skua*	0.081	16	0.058	11

Species		Project Alpha		Project Bravo	
		Maximum Density	Maximum Population	Maximum Density	Maximum Population
	Unidentified skua *Stercorarius sp.*			-	3
	Black-legged Kittiwake *Rissa tridactyla*	52.675	10,386	31.492	6,099
	Black-headed Gull *Chroicocephalus ridibundus*	0.430	85	0.056	11
	Little Gull *Larus minutus*	0.051	10	0.108	21
	Common Gull *Larus canus*	0.231	45	0.056	11
	Lesser Black-backed Gull *Larus fuscus*	0.498	98	0.698	135
	European Herring Gull *Larus argentatus*	0.614	121	0.994	193
	Great Black-backed Gull *Larus marinus*	1.301	257	1.266	245
	Unidentified large gull *Larus spp.*	0.170	34	0.116	23
	Unidentified small gull *Larus spp.*	-	3	-	53
	Sandwich Tern *Sterna sandvicensis*	-	3		
	Common Tern *Sterna hirundo*	0.335	66	0.056	11
	Arctic Tern *Sterna paradisaea*	1.810	357	4.132	800
	Unidentified tern *Sterna spp.*	-	361		
	Common Guillemot *Uria aalge*	37.916	7,476	62.993	12,200
	Razorbill *Alca torda*	7.826	1,543	7.540	1,460
	Little Auk *Alle alle*	3.713	732	2.649	513
	Atlantic Puffin *Fratercula arctica*	14.134	2,787	25.922	5,020
	Unidentified auk	5.905	1,164	7.674	1,486
Wader	Northern Lapwing *Vanellus vanellus*	0.050	10	0.056	11
	Eurasian Curlew *Numenius arquata*	0.537	106	0.056	11
	Ruddy Turnstone *Arenaria interpres*			-	12
	Grey Phalarope *Phalaropus fulicarius*	-	3	0.159	31
	Unidentified wader	-	50	0.053	10
	Eurasian Oystercatcher *Haematopus*	-	9		
	European Golden Plover *Pluvialis*	0.461	91	-	12
Raptor	Merlin *Falco columbarius*			-	3
Passerine	Feral Pigeon *Columba livia*	0.025	5	-	3
	Common Swift *Apus apus*	-	18		
	Goldcrest *Regulus regulus*			0.058	11
	Eurasian Skylark *Aluada arvensis*			0.277	54
	Barn Swallow *Hirundo rustica*	-	3	-	3
	Common Starling *Stuma vulgaris*	0.026	5	0.113	22
	Common Blackbird *Turdus merula*			-	6
	Fieldfare *Turdus pilaris*			0.055	11
	Song Thrush *Turdus philomelos*	0.053	10		
	Redwing *Turdus iliacus*	0.058	11	-	47
	Unidentified thrush *Turdus sp.*	-	3	0.053	10

Species		Project Alpha		Project Bravo	
		Maximum Density	Maximum Population	Maximum Density	Maximum Population
	Spotted Flycatcher *Muscicapa striata*			0.053	10
	Meadow Pipit *Anthus pratensis*	0.056	11	0.051	10
	Unidentified pipit *Anthus sp.*	0.055	11		
	Brambling *Fringilla montfringilla*	0.082	16		
	Unidentified passerine	0.058	11		

3.4. Offshore Aerial Survey (offshore Firth of Forth Zone)

Data from aerial surveys of the Firth of Forth Zone and inshore Scottish Territorial Waters (see Section 2.1.3) covered Project Alpha, Project Bravo and elements of the Transmission Asset Project: the OSPs, HV cabling and seaward portion of the ECR corridor (Project Alpha boundary to approximately 10km from the coast).

A detailed description of survey results is provided in the assessment of offshore ornithological impacts at Project Alpha and Project Bravo (Seagreen, 2012b), and summarised here in Tables 6 and 7.

Table 6: Maximum counts of bird species recorded during aerial surveys of the Firth of Forth Zone

Species		Maximum count
Wildfowl	Eider *Somateria mollissima*	16
	Long-tailed Duck *Clangula hyemalis*	1
	Common Scoter *Melanitta migra*	1
	Unidentified duck	2
Seabirds	Red-throated Diver *Gavia stellata*	2
	Unidentified diver *Gavia spp.*	2
	Fulmar *Fulmaris glacialis*	368
	Fulmar or unidentified gull	22
	Manx Shearwater *Puffinus puffinus*	329
	Storm Petrel *Hydrobates pelagicus*	8
	Unidentified petrel	3
	Gannet *Morus bassanus*	8746
	Cormorant *Phalacrocorax carbo*	1
	Shag *Phalacrocorax aristotelis*	7
	Cormorant / shag	1
	Unidentified medium sized wader	3
	Great Skua *Stercorarius skua*	2
	Unidentified skua *Stercorarius spp*	1
	Little Gull *Hydrocoloeus minutus*	4

	Black-headed Gull *Chroicocephalus ridibundus*	4
	Common Gull *Larus canus*	53
	Lesser Black-backed Gull *Larus fuscus*	39
	Herring Gull *Larus argentatus*	203
	Great Black-backed Gull *Larus marinus*	18
	Kittiwake *Rissa tridactyla*	5224
	Unidentified black backed gull *Larus sp.*	25
	Unidentified grey gull *Larus sp.*	45
	Unidentified gull *Larus sp.*	1410
	Unidentified large gull *Larus sp.*	103
	Unidentified small gull *Larus sp.*	143
	Little Tern *Sterna albifrons*	9
	Sandwich Tern *Sterna sandvicensis*	5
	Arctic Tern *Sterna paradisaea*	9
	'Commic' tern	988
	Unidentified tern *Sterna spp.*	65
	Guillemot *Uria aalge*	8
	Razorbill *Alca torda*	6
	Black Guillemot *Cepphus grylle*	1
	Little Auk *Alle alle*	9
	Puffin *Fratercula arctica*	3
	Unidentified auk	24,519

Table 7: Peak mean density of key seabird species observed during aerial survey

Species	**Peak Mean Density (individuals per km^2)**
Auk *sp.*	25.980
Gull *sp.*	1.161
Northern gannet *Morus bassanus*	4.728
Kittiwake *Rissa tridactyla*	4.629

3.5. Offshore Aerial data – analysis of ECR corridor

Data from the aerial surveys was extracted for the ECR route and a 1km buffer to provide maximum populations and densities for the species occurring within the area of this component of the Transmission Asset Project. Data was too few to allow correction via Distance software and thus the results given here are

not corrected for detection errors. Aerial surveys of the seaward portion of the ECR corridor recorded 17 seabird species during the 22 surveys undertaken in 2009-2010 (Table 8), with auk species occurring in the highest density. The largest flock of any one species observed was Manx shearwater. Numerous gull species were observed using the ECR region.

The distributions of the following species along the ECR are displayed in Appendix A: auk species; fulmar; gannet; kittiwake; large gull species; and Manx shearwater. The total number of individual birds along the cable route is also shown. Auk species (Appendix A1) and kittiwake (Appendix A4) show relatively uniform distribution along the ECR corridor. Fulmar (Appendix A2) and large gull species (Appendix A5) were observed more frequently at the offshore extent of the ECR corridor. Gannet (Appendix A3) are distributed along the length of the ECR corridor, with prevalence at the offshore extent. Manx shearwaters (Appendix A6) were not observed frequently during survey, with a large flock recorded at the inshore end of the ECR corridor and three smaller flocks at the offshore end. Appendix A7 shows that, in general, birds are evenly distributed along the length of the ECR corridor from inshore to offshore, with a slight concentration at the offshore extent.

Table 8: Seabird species recorded in aerial survey of the seaward portion of the Export Cable Route Corridor 2009-2010.

Species	Max Count	Max Density (birds / km^2)
Manx shearwater *Puffinus puffinus*	200	4
Fulmar *Fulmaris glacialis*	4	25
Gannet *Morus bassanus*	50	12.5
Shag *Phalacrocorax aristotelis*	1	0.25
Diver *sp. Gavia spp.*	1	0.25
Common gull *Larus canus*	2	0.75
Great black-backed gull *Larus marinus*	1	0.25
Grey gull spp. (herring or common)	3	0.75
Herring gull *Larus argentatus*	8	2.25
Lesser black-backed gull *Larus fuscus*	1	0.5
Large gull *sp. Larus spp.*	2	0.75
Small gull sp. *Larus spp.*	6	1.5
Kittiwake *Rissa tridactyla*	8	91
Arctic/Common tern *Sterna paradisaea*	1	2

Auk *sp.*	35	8.75
Guillemot *Uria aalge*	2	0.5

3.6. Wetland Bird Survey Data

Table 9 presents maximum counts for all species recorded in the two WeBS count sectors adjacent to the landfall area at Carnoustie.

Table 9: Maximum counts during WeBS surveys of East Haven to Elliot Burn and Elliot Burn to Boulzie Hill sectors.

Species	**East Haven to Elliot Burn 2008-2011**	**Elliot Burn to Boulzie Hill 2009-2011**
Grey Heron *Ardea cinerea*	7	5
Cormorant *Uria aalge*	16	12
Red-throated diver *Gavia stellata*	2	0
Greylag goose *Anser anser*	61	1
Pink-footed Goose *Anser brachyrhynchus*	240	0
Shelduck *Tadorna tadorna*	8	0
Mallard *Anas platyrhynchos*	84	2
Teal *Anas crecca*	69	0
Goldeneye *Bucephala clangula*	2	0
Eider *Somateria mollissima*	20	20
Red-breasted merganser *Mergus serrator*	2	0
Oystercatcher *Himantopus ostralegus*	131	61
Lapwing *Vanellus vanellus*	92	0
Golden plover *Pluvialis apricaria*	3	10
Grey Plover *Pluvialis squaterola*	7	0
Ringed plover *Charadrius hiaticula*	40	25
Bar-tailed godwit *Limosa lapponica*	9	1
Curlew *Numenius arquata*	126	11
Knot *Calidris canuta*	50	4
Dunlin *Calidris alpina*	112	5
Purple sandpiper *Calidris maritima*	0	4
Redshank *Tringa totanus*	153	39
Sanderling *Calidris alba*	200	21
Turnstone *Arenaria interpres*	41	11
Black-headed gull *Chroicocephalus ridibundus*	0	120
Lesser black-backed gull *Larus fuscus*	0	11
Herring gull *Larus argentatus*	0	150
Great black-backed gull *Larus marinus*	0	4

No species recorded in the WeBS surveys of the two count sectors occurred in numbers of national importance (Holt et al., 2011) during the most recent years of survey.

4. Defining species importance

To provide a structure to the assessment of impacts, a recognised matrix-based approach was used (Percival *et al.*, 1999). The assessment broadly defines the nature of the impact upon a sensitive receptor and involves three stages:

i) Determination of the significance of the feature potentially affected;

ii) Identification of the magnitude of potential impacts of the proposed development; and

iii) Assessment of the significance of the potential impacts.

Once this was determined, consideration of current knowledge of relevant aspects of species behavioural ecology and conservation status, plus experiences at other constructed sites in Europe were used to qualify the significance of any potential impacts.

Table 10 outlines the potential ornithological impacts which were assessed using this approach, and highlights the corresponding phase of development during which this issue was of concern.

Table 10: The potential ornithological effects assessed for the Transmission Asset Project

Phase of development	Potential impacts
Construction	- Disturbance, such as movement of vessels and piling (OSP installation) - Displacement (due to cable and OSP installation) resulting in loss of foraging/roosting area - Indirect effects, such as changes in habitat or abundance and distribution of prey
Operation	- Collisions with OSPs - Direct habitat loss (e.g. from OSP footprint) - Displacement due to presence of OSPs , resulting in loss of foraging/roosting area - Indirect effects, such as changes in habitat or abundance and distribution of prey - Disturbance from OSP maintenance vessels
Decommissioning	- Disturbance, such as movement of OSP maintenance vessels - Displacement, resulting in loss of foraging/roosting area

The sensitivity of bird species observed in the Transmission Asset Project areas of the Seagreen Project was defined according to a range of criteria including: the conservation status of the species as a whole; whether the species is cited as an interest feature of a site of national (e.g. SSSI) or international (e.g. SPA) importance; and the numbers of birds at the site as a proportion of the population of importance. Table 11 defines the criteria for each level of sensitivity ranging from Negligible to High. This methodology is based

upon the matrix-based approach of Percival *et al.* (1999) and allows direct comparison with the assessments provided for all ornithological components of the Seagreen Project assessment.

The conservation status of each species incorporates whether it is cited as an interest feature in a site of international (i.e. SPA, Ramsar) or national (i.e. SSSI, NNR) significance. The foraging range of species provides key guidance on the likely origin of species recorded within any survey area, and as such whether there is the potential to affect the integrity of designated sites. . Additional guidance is sought from Annex 1 of the EU Birds Directive and Schedule 1 of the Wildlife and Countryside Act (1981) in addition to Birds of Conservation Concern (BoCC; Eaton *et. al*., 2009) and the UK Biodiversity Action Plan (BAP). Species detailed on the Red and Amber lists of BoCC are considered to be of low sensitivity, with all other species (green list) being of negligible sensitivity only.

The population size of individual species recorded in the offshore Transmission Asset Project area is compared to 1% threshold levels for international and national importance in order to provide further evidence of the value of the species involved. Threshold levels were taken from Wetlands International (2006) and Baker et al. (2006) with further guidance and BirdLife International (2004), Mitchell et al. (2004) and Banks *et. al.* (2007). ECON (in Seagreen (2012b) determine thresholds for international, national and regional importance, with the latter based on interpretation of results from Stone *et al.,* (1995).

The industry standard definitions of the magnitude of an effect follow a five-point scale from Negligible to Very High according to the proportion of the 'population' or 'habitat' lost. These definitions are outlined in Table 12 and serve as generic guidelines that can be adapted to suit the different types of impact.

Table 11: Definition of terms relating to the sensitivity of bird species adapted from Percival *et al*. (1999)

Sensitivity	Definition
High	Cited interest of a connected SPA(s), including species identified in the review by Stroud et al. (2001) and those within the assemblage of an SPA Internationally important numbers of a species within the site
Medium	Cited interest of a connected SSSI(s) EU Birds Directive Annex 1, EU Habitats Directive priority habitat/species and/or Wildlife and Countryside Act Schedule 1 species Nationally important numbers of a species present within the site
Low	Red and amber-listed species of BoCC UK BAP priority species Regionally important numbers of a species within the site
Negligible	Species listed under Article 1 of the Birds Directive Green listed species of BoCC

Table 12: Definition of terms relating to the magnitude of the impact upon bird species adapted from Percival et al. (1999)

Magnitude	Definition
High	Total loss or very major alteration to key elements/features of the baseline conditions such that post development character/composition/attributes will be fundamentally changed and may be lost from the site altogether. Guide: > 80% of habitat / >1% population lost
Medium	Major alteration to key elements/features of the baseline (pre-development) conditions such that post development character/composition/attributes will be fundamentally changed. Guide: 20 – 80% of habitat / 0.5-1% population lost
Low	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed. Guide: 5 – 20% of habitat / 0.1-0.5% population lost
Negligible	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. Guide: 1 – 5% of habitat / <0.1% population lost

5. Transmission Asset Project: Important Ornithological Receptors

Important ornithological receptors to be carried forward for assessment in this report and Environmental Statement were identified according to the general criteria given in Table 10. Further guidance on assigning sensitivity to species is provided in the technical annexes for offshore (Seagreen, 2012b) and onshore ornithology (Atmos, 2012).

Species recorded within the surveys involving the Transmission Asset Project and therefore potentially important ornithological receptors are listed in Table 13. Sixteen species of passerine were observed in boat-based survey of the offshore Seagreen Project Zone, and these are not considered to be sensitive receptors for the Transmission Asset Project: feral pigeon; common swift; goldcrest; skylark; barn swallow; starling; blackbird; fieldfare; song thrush; unidentified thrush species; redwing; spotted flycatcher; meadow pipit; unidentified pipit; brambling; and other unidentified passerine species. Six wildfowl species are noted in the desk study of the seaward portion of the ECR corridor (ECON, 2011), which were not observed in boat-based surveys: common scoter; velvet scoter; long-tailed duck; red-breasted merganser; goldeneye; and goosander.

Table 13: Potential Important ornithological receptors associated with the Transmission Asset Project: [1] VP survey (Atmos, 2012); [2] Offshore aerial survey (Section 2.1.3); [3] Firth of Forth boat-based survey (Seagreen 2012b).

	Ornithological receptor	
Export Cable Route corridor: intertidal region[1]		
Seabirds	Gannet Herring gull Kittiwake Black-headed gull Common gull Great black-backed gull Little gull	Great northern diver Red-throated diver Razorbill Guillemot Cormorant Shag
Wildfowl	Common scoter Eider Long-tailed duck	Red-breasted merganser Wigeon
Waders	Bar-tailed godwit Curlew Knot Oystercatcher	Redshank Sanderling Turnstone
Export Cable Route corridor: seaward portion[2]		
Seabirds	Guillemot Common gull Great black-backed gull Herring gull Lesser black-backed gull	Kittiwake Shag Fulmar Gannet Manx shearwater Arctic/Common tern
Offshore Substation Platforms, Converter Station and HV cabling[3]		
Seabirds	Manx shearwater Sooty shearwater European storm petrel Shag Great cormorant Pomarine skua Arctic skua Great skua Guillemot Razorbill Puffin Little auk Gannet	Fulmar Kittiwake Little gull Herring gull Common gull Great black-backed gull Lesser black-backed gull Black-headed gull Sandwich tern Common tern Arctic tern Red-throated diver
Wildfowl	Mallard Eider	
Waders	Oystercatcher Golden plover Lapwing	Turnstone

	Curlew	

As detailed in Table 11, in order to determine the sensitivity of a receptor, the threshold levels of international, national and regional importance are an essential reference source. ECON (in Seagreen, 2012b) sourced population thresholds for seabird species for breeding and wintering periods and these are reproduced below (Tables 14 and 15).

Table 1: International, national and regional population size derived from foraging radii for breeding seabirds alongside the appropriate 1% criteria for each population scale. Source: Seagreen (2012b).

	European[2] breeding population	1%	National[3] breeding population	1%	Regional [4]breeding population	1%
Fulmar	7,200,000	72,000	1,009,512	10,095	958,556	9,586
Manx shearwater	740,000	7,400	599,424	5,994	0	
European storm-petrel	940,000	9,400	51,300	513	0	
Gannet	610,000	6,100	437,092	4,371	153,022	1,530
Shag	156,000	1,560	54,954	550	120	1
Arctic skua	90,000	900	4,272	43	-	
Great skua	32,000	320	19,268	193	-	
Kittiwake	5,100,000	51,000	759,784	7,598	124,684	1,247
Black-headed gull	3,700,000	37,000	276,028	2,760	40	<1
Common gull	2,090,000	20,900	97,440	974	408	4
Lesser black-backed gull	650,000	6,500	224,148	2,241	39,546	396
Herring gull	2,160,000	21,600	278,618	2,786	47,164	472
Great black-backed gull	290,000	2,900	34,320	343	288	3
Sandwich tern	212,000	2,120	24980	250	0	
Common tern	840,000	8,400	23,676	237	67	<1
Arctic tern	1,400,000	14,000	106,776	1,068	58	<1
Common guillemot	4,700,000	47,000	1,420,900	14,209	206,736	2,067
Razorbill	1,200,000	12,000	188,576	1,886	19,395	194
Puffin	13,000,000	130,000	1,161,598	11,616	232,828	2,328

Table 25: International (European), sub-International (North Sea) and National (Great Britain*) wintering population sizes (individuals) and appropriate 1% criteria, for seabirds occurring in winter (defined as December to March). Source: Seagreen (2012b).

	European wintering population[5]	1%	North Sea wintering population[6]	1%	National wintering population[7]	1%

[2] BirdLife International (2004)
[3] Baker et al (2006)
[4] SMP database or mean maximum foraging range (Thaxter et al., 2012)

Red-throated diver	>51,000	510	48,4954	485	17,000	170
Fulmar	>1,500,000	15,000	1,872,000	18,72	-	-
Manx shearwater	-	-	-	-	-	-
European storm-petrel	-	-	51,300	513	-	-
Gannet	-	-	157,800	1,578	-	-
Cormorant	>420,000	4,200	14,315	143	35,000	350
Shag	>92,000	920	29,115	291	110,000	1,100
Great skua	-	-	1,000	10	-	-
Kittiwake	>200,000	2,000	1,032,690	10,32	-	-
Black-headed gull	>3,200,000	32,000	276,028	2,760	2,200,000	22,000
Little gull	>11,000	110	5,370	54		
Common gull	>910,000	9,100	175,530	1,755	700,000	7,000
Lesser black-backed gull	>130,000	1,300	15,315	153	120,000	1,200
Herring gull	>800,000	8,000	971,700	9,717	730,000	7,300
Great black-backed gull	>150,000	1,500	299,900	2,999	76,000	760
Guillemot	>4,300,000	43,000	1,562,400	15,62	-	-
Razorbill	>500,000	5,000	324,000	3,240	-	-
Little auk	-	-	852,690	8,527	-	-
Puffin	-	-	74,600	746	-	-

For wader and wildfowl species relevant to the ECR corridor and, to a lesser extent the Transmission Asset Project components within Project Alpha and Project Bravo, international and national threshold populations are given in Table 15.

Table 36: International and National population sizes (individuals) and appropriate 1% criteria, for waterfowl occurring in winter with in the ECR and surveys of Alpha and Bravo.

	International Population[8]	**1%**	**National wintering population[9]**	**1%**
Mallard	2,000,000	20,000	680,000	6800
Wigeon	1,500,000	15,000	444,000	4400
Eider	1,285,000	12,850	55,000	550
Common scoter	1,600,000	16,000	100,000	1000
Long-tailed duck	2,000,000	20,000	11,000	110
Red-breasted merganser	170,000	1,700	8400	84
Oystercatcher	1,020,000	10,200	320,000	3200

[5] Birdlife International (2004)
[6] Skov et al. (1995)
[7] Musgrove et al., (2011)
[8] Wetlands International (2006) / Holt et al., (2011)
[9] Musgrove et al., (2011)

Golden plover	930,000	9300	400,000	4000
Lapwing	2,000,000	20,000	620,000	6200
Curlew	850,000	8500	140,000	1400
Bar-tailed godwit	120,000	1200	38,000	380
Redshank	280,000	2800	120,000	1200
Knot	450,000	4500	320,000	3200
Sanderling	120,000	1200	16,000	160
Turnstone	150,000	1500	48,000	480

5.1. Species Accounts – OSPs and HV cables

The ornithological baseline assessment of the Project Alpha and Project Bravo wind farm footprints is reported in Seagreen (2012b). Data relevant to the Transmission Asset Project within the baseline assessment are repeated here to provide the context in which the potential impacts of OSPs and HV export cables (which are located within the Alpha and Bravo footprints) can be assessed.

5.1.1. Gannet

The global breeding population of gannet has shown a long-term increase and range expansion, and recent estimates suggest 418,000 pairs (Wanless *et al.* 2005). Europe supports 75% of this population that is currently classified as 'Secure' (BirdLife International, 2004). The UK supports 225,046 pairs (and therefore 53.9% of the World population). Gannet is a species of conservation concern with Amber status (Wanless *et al.* 2005; Eaton et al., 2009). The gannet colony on the Bass Rock (48,065 pairs in the latest survey in 2004 (SMP Online Database 2011) is the largest in the North Sea and the second largest in the east Atlantic after St Kilda.

The boat-based surveys of Seagreen Alpha noted that gannet were present within the site boundary in all surveys with peak populations achieved during the breeding season (Seagreen, 2012b). The peak population estimate was recorded in June 2010 at 2,716 individuals, exceeding the 1% regional threshold of 1,530. The peak value in 2011 was in May (1,841 ind.), comparable to that recorded in 2010 (1,543 ind.). Densities reached 6-9 individuals per km^2 at peak in the breeding season, which accords closely with the range to >10 individuals per km^2 presented by Camphuysen (2011) in the Firth of Forth. Gannet were also ever present in the boat-based surveys of Seagreen Bravo and whilst peak numbers were recorded during the breeding season, the general pattern of abundance differed somewhat from Alpha. Population size also essentially increased each month in 2010, reaching a peak in August compared to June in Alpha. Despite the proximity of Bass Rock, the 1% regional threshold for the breeding season was not exceeded in either year within Bravo.

Since regionally important numbers of gannet occurred within Seagreen Alpha, and individuals from Bass Rock (within the Forth Islands SPA) could be affected, gannet is therefore carried forward as a sensitive receptor for the OSPs and converter station components of the Transmission Asset Project in the Impact Assessment of the ES Ornithology chapter.

5.1.2. Fulmar

The UK population of fulmar peaked at 505,073 pairs (mostly in Scotland) at the end of the 1990s (Mitchell *et al.,* 2004) and has since declined by 38% by 2010 (JNCC, 2010). Fulmar is of conservation concern in the

UK (Amber status) also on account of more than 50% of the breeding population occurring in ten or fewer sites.

The majority of British breeding fulmars occur in Scotland, with the English population estimated at 6,000 pairs (Brown & Grice 2005). Fulmars are present year-round in UK waters, with dispersal from breeding colonies occurring after the breeding season, with a return early the following year. Non-breeding densities are highest around the Northern Isles, at the edge of the continental shelf off northwest Scotland and on the Dogger Bank in the North Sea.

Skov *et al*. (1995) reported a maximum density of 9.99 individuals per km^2 for March and June in a region covering the whole of the ECR scoping corridor, whereas Stone *et al*. (1995) gave a maximum density of 0.99 individuals per km^2 in the same region throughout the year. Fulmars were observed within the Seagreen Alpha site boundary in all surveys over the two year study period. Whilst estimated population size was higher during the breeding season, the 1% threshold was not exceeded as a consequence of the large foraging range encompassing an extremely large regional population. As with the data derived for Seagreen Alpha, fulmars were ever present in the surveys of Seagreen Bravo over the study period. In general, the densities derived from each survey followed a similar pattern and were generally low in context with other parts of the species' range. The resultant population sizes were slightly greater in Bravo compared to Alpha.

As the threshold for regional importance for this species was not exceeded (despite the large number of colonies within foraging range of Seagreen Alpha and Bravo), fulmar is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.1.3. Manx shearwater

Manx shearwaters are highly oceanic seabirds that make nocturnal visits to breeding colonies on land only. The majority of the world population occurs in the UK: 300,000 out of 338,000-411,000 pairs, with the remainder breeding in Iceland, France, the Faeroes, the Atlantic islands and a small population in the North-eastern North America. Over 90% of the British population are found on the islands of Rum in the Inner Hebrides and the Pembrokeshire islands of Skomer, Skokholm and Middleholm.

Manx shearwaters return to British seas from their wintering quarters in early March, remaining in the vicinity until early October (Brown & Grice, 2005). The species is rarely encountered in British waters between late November and late February, with the majority of the population having moved to areas off the east coast of South America.

Manx shearwater has no breeding colonies along the east coast of the UK, but it has been identified by the RSPB as a key passage species through the Firth of Forth Zone (Langston, 2010). The boat-based surveys of Seagreen Alpha and Bravo recorded low densities of this species and population estimates did not exceed thresholds of significance.

As the threshold for regional importance for this species was not exceeded (despite the large number of colonies within foraging range of the Project), Manx shearwater is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.1.4. Shag

The (European) shag is endemic to the northeast Atlantic and the Mediterranean. The British population of 27,176 pairs (Mitchell *et al*., 2004) compares to the northeast Atlantic population of 66,000 – 73,000 pairs. Shag breed on ledges of steep mainland and island cliffs and disperse widely along the coast during the

autumn. Approximately 3,500 pairs of Shag breed in north-east Scotland (Mitchell *et al.* 2004). Skov et al. (1995) only reported a maximum all-year density of 0.99 individuals per km^2, whereas Camphuysen (2005) did not encounter any shags during the June and July surveys in the area of sea covered by the ECR scoping corridor.

Population estimates of this species within both the wind farm footprint of Seagreen Alpha and Bravo were extremely low and did not breach any thresholds of significance. As a result this species is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.1.5. Kittiwake

Kittiwakes are the most numerous gull in the world, with the North Atlantic biogeographic population providing up to 3,000,000 of the total c.5200, 000 pairs. Kittiwakes are highly pelagic and rarely seen inland, breeding on coastlines of the North Atlantic, North Pacific and Arctic Oceans. The British population is estimated at 415,995 (Mitchell *et al*., 2004), although recent downward trends at key colonies have led to the species being Amber listed on BoCC (Eaton *et al.,* 2009). The Joint Nature Conservation Committee Seabirds Monitoring Programme (SMP) database reports a 40% decline of this species between 1999 and 2009, with the more northerly colonies declining more rapidly. Kittiwakes in these areas are heavily dependent on sandeel, which have shown population fluctuations and redistribution (Coulson, 2011; Furness & Tasker, 2000).

A total of 415,000 pairs of breeding kittiwake are present in the North Sea, most of which breed on the east coast of the UK from Flamborough Head to Shetland (Skov *et al.* 1995). The JNCC has reported a decline of 40% in many UK colonies. The largest colony at Flamborough Head and Bempton Cliffs SPA had 37,617 pairs in the latest survey in 2008, from >80,000 pairs when the site was designated for the species. In the literature, numbers of kittiwake in the summer months are high in the region covered by the ECR scoping corridor, with Skov *et al*. (1995) reporting a density of 12.12 individuals per km^2 from April to September. In the same region, Camphuysen (2005) reported densities exceeding 10 individuals per km^2 from ship-based surveys conducted in June and July from 1991 to 2004, whereas Stone *et al.* (1995) gave densities >5 individuals per km^2 between June and October.

Kittiwakes were present in all boat-based surveys of Seagreen Alpha, although estimated population size fluctuated between surveys, seasons and years. In 2010, the population estimates decreased over the breeding period and the two peak values were recorded in the passage period (September) and during the winter (2010). In contrast, densities were generally higher during the breeding season of 2011 although numbers fluctuated between April and August, and the lowest estimates were recorded in September and November. Despite the presence of the two major colonies of Fowlsheugh to the northeast and the Forth Islands to the west, the regional 1% threshold during the breeding season was only exceeded on one occasion in July 2011 (1,871 ind.). The regional 1% threshold of kittiwake for the passage period was exceeded in both September and October of 2010 (1,409 and 296 ind. respectively), whereas the winter threshold was exceeded on the majority (eight or 89%) of winter surveys between 2009 and 2011.

The seasonal pattern of abundance of kittiwakes in Seagreen Bravo was similar to that of Alpha, although in 2010, there was a decrease in populations across the breeding season until November when the highest population estimate was recorded. An overall peak density of 4.6 birds per km^2 was recorded during the surveys. In 2011, the population estimated reached 2,774 individuals in June, which corresponds to a population of national importance.

It is considered that in the breeding season it would seem most likely that adult kittiwakes represented at the Seagreen Project are a mixture of birds from as far away as the Isle of May (52km), from Fowlsheugh (30km) as well as nine other non-SPA colonies at similar range (28-48 km) (Seagreen, 2012b).

Densities within the ECR and 1 km buffer taken from aerial data were lower than the wider Firth of Forth Zone peaking at 2 birds per km^2, although this density may be limited by identification issues in aerial survey work. Tracking of kittiwakes from key colonies in the Firth of Forth area suggests that the ECR is within regular commuting range of kittiwakes, although the areas is one holding some of the lowest densities of activity within the region (Seagreen, 2012b; Figure 6.17).

Kittiwake has a high conservation status in the region and with the numbers recorded in all surveys, potential impacts include displacement and indirect effects on foraging habitat. As a result this species is carried forward for further assessment of the Transmission Asset Project in the ES Ornithology chapter with regards to the OSP/Converter Station and HC cable components.

5.1.6. Herring gull

Herring gulls are a widespread breeding species in Britain, although they have undergone a recent population decline leading to their inclusion on the BoCC Red List (Eaton *et al.,* 2009) and being a UK BAP Priority Species. As a breeding bird, herring gulls are distributed throughout the Holarctic with a global population of over 1 million pairs (Mitchell *et al.,* 2004). It is a taxonomically complicated 'species', with British breeding birds belonging to the subspecies *argenteus*, with 131,500 pairs present. Numbers have fluctuated, but with an underlying increase, and therefore the European breeding population of 760,000-1,400,000 pairs is classed as 'Secure' (BirdLife International, 2004).

In contrast, in the UK the breeding population of the race *argenteus* estimated at 139,200 pairs (18.5% of the European breeding population and 12.1% of the world population) had declined by more than 50% since 1969 by Seabird 2000 (Mitchell et al. 2004). Decline has continued with a further 38% loss between 2000 and 2010 (JNCC, 2011).

At Seagreen Alpha herring gull was consistently present throughout the two year study period In 2010, with the exception of three surveys. Population estimates were stable during the winter period, but fluctuated during the breeding season. In 2011, abundance was generally lower, but relatively consistent throughout both the winter and breeding periods. The peak population estimate of 121 individuals was recorded in June 2010 (57% adults). The mean monthly densities for Alpha ranged from 0.03 to 0.37 ind. km^2 with the higher densities in the breeding season. These densities are lower than those reported in the general literature, with a density of 1.1 ind. per km^2 in the breeding season for the western North Sea (Stone *et al.* 1995) matched by a density of 1.63 ind. per km^2 for the Firth of Forth to North East Bank in May to June (Skov *et al.* 1995). The densities in Seagreen Alpha during the winter mirror those over a very large of the North Sea incorporating the Firth of Forth at 0.35 individuals per km^2 reported by Skov *et al.* (1995) and are slightly lower than the range from 0.4 to 0.8 individuals per km^2 for the Western North Sea reported by Stone *et a*l. (1995).

The seasonal distribution of herring gull within the Seagreen Bravo site boundary was more sporadic than that of Alpha, with no birds recorded in seven surveys during the two year study period. No herring gulls were recorded in the April or August surveys in the breeding season in either year, with otherwise patchy occurrence. As in Alpha, the highest population estimates in the breeding season were in June of both years in the chick provisioning period, but again did not reach the 1% threshold for a regionally important population, with a highest value of 193 birds in June 2011.

Even with apparently high susceptibility to collision effects (Garthe & Hüppop, 2004), given the low density of herring gulls in both seaward and nearshore areas the likelihood of significant ecological impact was considered to be very low. As a result this species is not carried forward for further assessment of the Transmission Asset Project in the ES Ornithology chapter.

5.1.7. Lesser black-backed gull

Lesser black-backed gulls have a more restricted global distribution than either herring or great black-backed gulls and as such, breeding colonies in Britain have increased significance. The species breeds from Iceland to Western Siberia and southwards to northern Iberia. All birds breeding in Britain are of the *graellsii* subspecies and number 110,000 pairs (Mitchell *et al.*, 2004). This compares with a European population of 300,000 – 350,000 pairs (Birdlife International, 2004). Lesser black-backed gull is listed on the Amber list of BoCC due to the presence of over 20% of the European population and the fact that over 50% breed at ten or fewer sites (Eaton *et al.*, 2009).

At Seagreen Alpha only 42 lesser black-backed gulls were observed in ten boat-based surveys. In 2010, the species was present from February through to October, incorporating winter, breeding and passage periods. In 2011, lesser black-backed gull was only present at the start of the breeding season, from April to June. A similar seasonal pattern was recorded for Bravo as Alpha. Lesser black-backed gulls were present in 2010 from February, through the breeding season with the last birds recorded in October. In 2011, birds were present in the breeding season (May and June), but also during the passage in September and October.

The mean monthly densities derived for the Seagreen Alpha development site were generally low, with a range from 0.01 to 0.3 ind. per km^2 when lesser black-backed gulls were present. The densities for April and June at <0.1 ind. km^2 are comparable to the general densities for the western North Sea (Stone *et al*. 1995).

Considering the low density of lesser black-backed gulls in both seaward and nearshore areas, the likelihood of significant ecological impact was considered to be very low. As a result, this species is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.1.8. Great black-backed gull

Great black-backed gulls have a large range within the North Atlantic and have a global population of 170,000 – 180,000 pairs. Within Britain, the majority are found in northern and western Scotland, where they nest on rocky coastlines with stacks and cliffs. British breeding birds disperse relatively short Distances after breeding, with these individuals joined by large numbers of birds from northern Europe between July and October. A large proportion of these birds over-winter on the east coast of England.

Great black backed gull is Amber listed as a species of conservation concern in the UK due to a moderate (>25% but <50%) decline in the non-breeding population over the past 25 years (Eaton *et al*. 2009). Moreover, the UK breeding population of great black backed gull declined by 14% between 2000 and 2010 (JNCC 2011).

The boat-based surveys of Seagreen Alpha indicated that the great black backed gull was predominantly present in the winter period. In 2010 the species was also present during the spring and early summer, with great black backed gulls observed up to and including the June survey. The peak population estimate in October 2010 was 257 individuals, which exceeded the 1% regional threshold for the passage period. No other population estimate in the passage or winter period reached regionally important numbers. Numbers in the breeding season did surpass the 1% breeding season estimate on occasion although the threshold is very low (Seagreen, 2012b).

The same seasonal pattern to that observed in Seagreen Alpha was recorded in Bravo. Great black backed gulls were present in the initial surveys up to and including June 2010. From September 2010, they were again present until April where after they were absent until September. As with Alpha, the peak population estimate, 245 individuals, was recorded in October 2010 and exceeded the 1% threshold for regional numbers during the passage period. A regionally important winter population (>119 individuals) was also recorded in January 2011 with an estimate of 135 individuals.

With regionally important numbers of great black-backed gulls occurring with the Seagreen Project area, this species is carried forward for further assessment of the for the OSP and converter station components of the Transmission Asset Project in the ES Ornithology chapter.

5.1.9. Other gull species

Three additional species of gull were recorded in the surveys of Seagreen Alpha and Bravo; black-headed gull, common gull and little gull. The maximum population sizes of all species did not exceed thresholds of regional importance. As a result these species are not carried forward for further assessment of the Transmission Asset Project in the ES Ornithology chapter.

5.1.10. Terns

Two species of tern were recorded in the boat-based surveys of Seagreen Alpha and Bravo; Arctic and common tern. Both species were considered to have potential to be a sensitive receptor for the wind farm footprint in the passage period only.

With a global population of some 460,000-620,000 pairs (Mitchell *et al*. 2004) common tern is not of conservation concern (Birdlife International, 2012). In turn, the large European population of 270,000-570,000 pairs is regarded as Secure (Birdlife International, 2004), although common tern is listed under Annex 1 of the EC Birds Directive requiring the designation of SPAs.

At Seagreen Alpha, common tern were observed at the end of the breeding season and in the passage period in August and September in 2010, whereas in 2011, they were only observed in what could be described as during the breeding season (May, July and August). Only two population estimates could be calculated from the small number of birds seen. These were populations of 66 and 43 individuals in September 2010 and May 2011 respectively. Both estimates suggested regionally important numbers for the breeding season and for the passage period.

Europe accounts for less than 25% of the global breeding range of Arctic tern. The population of >500,000 pairs of Arctic tern was categorised as Secure despite recent decline in some parts of its range (BirdLife International, 2004). It is, however, listed under Annex 1 of the EC Birds Directive requiring the designation of SPAs. Arctic tern is the most common breeding tern in the UK with 53,400 pairs comprising 4.7% of the European and 3.1% of the global population.

In Seagreen Alpha, the seasonal distribution of Arctic tern was similar in both years, with a similar peak in abundance in August, with some extension of passage into September in 2010 and with a few birds in July 2011. A little spring passage was recorded in May 2011. The peak population estimate was 227 individuals in August 2011, with 224 individuals estimated to be present in August 2010. As the regional 1% threshold was very low, estimates in the passage period invariably exceeded the threshold (Seagreen, 2012b).

At Seagreen Bravo the seasonal distribution of Arctic tern was similar to Alpha in that the peak occurrence was during autumn passage in August although the size of the peaks was very different. Furthermore,

whereas in Alpha the small amount of spring passage was in 2011, in Bravo this was in 2010, with autumn passage beginning in July in 2010 rather than 2011. No birds were recorded in September in Seagreen Bravo.

No breeding sites for Arctic or common tern lie within mean maximum foraging range of the wind farm site and it is expected that there is very low potential for significant ecological impact upon either species populations through collision, displacement, barrier effects or indirect effects within the wind farm. As a result these species are not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.1.11. Skuas

Three species of skua were recorded during the boat-based surveys of Alpha and Bravo – great and Arctic skuas during passage and breeding periods, with pomarine skua recorded in passage periods only. Estimated population sizes were below thresholds of regional importance.

Seagreen Alpha and Bravo lie beyond the maximum foraging range of the two skua species breeding in the UK (Arctic and great skuas). In light of the very limited potential for impacts these species are not carried forward for further assessment of the Transmission Asset Project in the ES Ornithology chapter.

5.1.12. Guillemot

Guillemots are abundant seabirds that have a breeding population of 1.32 million individuals (with the European and world populations being 2.8 and 7.3 million respectively). Guillemots are widely distributed across the North Atlantic and Pacific Oceans. Britain holds 1.32 million guillemots constituting around 30% of the North Atlantic population (Brown & Grice, 2005). As a result of the presence of internationally important numbers of birds in a few colonies, guillemot is of conservation concern in the UK with an Amber status (Eaton *et al.* 2009)

Guillemots nest in most places around the coastline where there is suitable cliff habitat; as such, the majority of the British population nests in Scottish colonies. Many adults remain in the vicinity of their colonies year-round, although they begin to visit the nesting ledge in January and February, and by March and April large congregations gather in the waters surrounding colonies. Adults disperse in July and moult, hence becoming flightless for a period of 6-7 weeks. By August, large concentrations are found in several areas. Between November and February they become more widespread and can occur in all inshore waters from Norway south to Iberia.

Skov *et al.* (1995) reported guillemot densities of: 19.41 individuals per km^2 in July; 23.45 individuals per km^2 in August within the Firth of Forth; 5.60 individuals per km^2 in September and October; 7.52 individuals per km^2 from November to February; and 10.09 individuals per km^2 in May and June. Camphuysen (2005) recorded densities >10 individuals per km^2 from ship-based surveys conducted in June and July from 1991 to 2004. Stone *et al*. (1995) reported densities >5 individuals per km^2 from May to October.

The regional threshold for the passage period was not exceeded during the study period, although the winter threshold was exceeded in 2010 and 2011, with estimates of 1,721 and 2,862 individuals in 2010 and 2,378 and 5,193 individuals in 2011 after birds had returned to colonies. Monthly mean densities calculated for Alpha using DISTANCE for birds on the water, were higher than typical values for the North Sea. For example, densities of 7.7 and 7.5 individuals per km^2 for June and July were derived by Stone *et al*. (1995), compared with 29.4 and 19.4 individuals per km^2 within Alpha.

A similar seasonal distribution to that of Alpha was observed within Seagreen Bravo. In essence, numbers increased over the winter period peaking in March, corresponding to the return of birds to the colonies. Abundance then declined at the start of the breeding season before peaking in June in both years, with relatively low numbers recorded during the autumn passage and early winter. The peak population estimate of 14,301 birds just surpassed the 1% national threshold for the breeding season. This was a result of the DISTANCE estimate of 72.1 individuals per km^2. Using the simple correction factors derived from data gathered in the Firth of Forth Round 3 Zone, the density for birds on the water in June 2011 was 61.3 individuals per km^2, thus not achieving nationally important numbers (Seagreen, 2012b).

Based on flight direction, guillemots in Alpha and Bravo are most likely to originate from Fowlsheugh SPA, with some contribution from smaller colonies in Kincardine and Deeside and Angus. Tracking studies from the Isle of May failed to show birds approaching the wind farm footprint, nor indeed the ECR. The flight direction of birds in Seagreen Alpha reinforces this conclusion with a clear flight axis from southeast (from the colony) and especially northwest to the colony. Within the ECR and 1km buffer, density of unidentified auks (i.e. guillemots and razorbills) reached 8.75 individuals per km^2, with species present widely in each transect (Appendix A1).

It is considered that there is potential for significant ecological impact on birds resulting from displacement, barrier effects and indirect effects on breeding birds resulting from the OSP/converter station components of the Transmission Asset project. Guillemot is therefore taken forward as a sensitive receptor in the ES Ornithology chapter

5.1.13. Razorbill

As a breeding bird, razorbills are restricted to the North Atlantic, where there is a population of 610,000-630,000 pairs (Mitchell *et al.*, 2004). Britain supports an estimated 110,000 pairs, which is approximately 18% of the world population. Razorbill is therefore regarded as of conservation concern in a British and European perspective.

Razorbills nest on small ledges or in cracks on rocky cliffs, and most in Britain are found on the Northern Isles and in Northwest Scotland.

Razorbill was observed within the Seagreen Alpha site boundary in all boat-based surveys, with some differences in seasonal patterns between the two years. In both years however, estimates were relatively high immediately before and at the start of the breeding season followed by a decline during the incubation/chick provisioning periods in May and June.

A peak in abundance followed at the end of the breeding season in July in 2011, with the peak after the breeding season in August in 2010. Populations then remained relatively high during autumn passage period in 2010, whereas they were generally lower in 2011. The overall peak population estimate recorded in July 2011 of 2,091 Razorbill, exceeded the national 1% breeding threshold of 1,886 birds, resulting from a DISTANCE corrected density for birds on the water of 10.6 ind. per km^2. With the exception of October 2011, the regional 1% threshold for the passage period was exceeded in every monthly survey, to a peak estimate of 1,535 birds in August the highest value for 2010.

The seasonal pattern established from boat-based surveys at Bravo largely corresponds to that for Alpha, with the exception that the numbers continued to increase from June through to September in 2010. The seasonal pattern, of a peak at the end of the winter period and then at the end of the breeding season, with

an overall peak recorded during the dispersal from colonies, was observed in both years (In general, the higher peaks were recorded in 2010.

Population estimates were generally lower within Seagreen Bravo than in Alpha, although the 1% regional threshold for the breeding season was still exceeded on most occasions (with the exception of June 2010 and May 2011) with a range of 98 to 791 birds in 2010, and 158 to 517 birds in 2011.

In terms of the origin of razorbills at Alpha and Bravo, it would seem that although birds from Fowlsheugh are likely to form the bulk of the relatively low density of birds in the breeding season present, some birds originate from other smaller, non-designated colonies as well as from the Forth Islands SPA (at least the Isle of May) may reach the site.

The aerial survey work is unable to distinguish between guillemots and razorbills and therefore as a precautionary measure the figure for unidentified auks can be referred to. Razorbills are clearly less abundant than guillemots, and of the peak density of unidentified auks (8.75 individuals per km^2), razorbill will account for a small proportion.

Considering the nationally important numbers of razorbill present, this species is taken forward as a sensitive receptor in the ES ornithology chapter for the OSP / converter station components and the seaward ECR.

5.1.14. Puffin

Puffins breed on both sides of the North Atlantic, although 95% of the global population of 5.5-6.6 million pairs is found in the European north-east Atlantic. An estimated 580,000 pairs breed in Britain, largely in northern Scotland and in Northumberland. Puffin has Amber status of conservation concern in the UK as a result of being of European conservation concern and having a localised breeding population with at least 50% of birds breeding at 10 or fewer sites (Eaton *et al.* 2009).

The Isle of May supported 56,867 pairs of Puffin in 2009, making it currently the fourth largest colony in Britain (SMP Online Database 2011). Puffin densities are highest in the summer, with a density of 3.29 individuals per km^2 from April to July for an area that partly lies within the vicinity of the ECR (Skov *et al*. 1995). For a similar area, Stone *et al*. (1995) provided densities >5 individuals per km^2 for June and July.

The seasonal pattern of puffin in Seagreen Alpha differed from the other auks, in that low numbers were present at the start of the year, before increasing midway through the breeding season during the chick provisioning period and maintaining relatively high numbers through to the passage period, dropping dramatically over winter. Puffins were consistently more abundant in Alpha in 2010, although the peak population estimate was recorded in June 2011. The 1% regional population threshold was only exceeded once in the breeding season, with a population estimate of 2,666 individuals in June 2011. In 2010, the estimates ranged from 68 (May) to 1,850 birds (August), some 500 birds short of the threshold. The maximum density derived from DISTANCE was of 12.9 ind. per km^2. The peak monthly mean densities between April and July are generally lower than those by Skov *et al*. (1995) for the area immediately around the Isle of May at this time (16.3 individuals km^2), and more typical of those derived for the wider Forth (3.3 individuals per km^2, apart from June).

The seasonal pattern of abundance of Puffins in Bravo was similar to that from Alpha apart from the lack of a peak in June 2010. The population estimate for June 2011 was 5,583 individuals, more than double the 1% threshold for the breeding season. The vast majority of the density was derived from birds on the water

with a DISTANCE corrected value of 28.6 ind. per km^2. As with Alpha, all four surveys conducted during the passage period exceeded the 1% regional threshold, with estimates ranging from 260 to 5,370 individuals.

Within mean maximum foraging range Puffin is designated at the Forth Islands SPA and the Farne Islands SPA, and a further four SSSIs. Flight directions of puffins in Alpha and Bravo suggested that the most likely origin was the Forth Islands SPA.

Considering the regionally important numbers of puffin present, this species is taken forward as a sensitive receptor in the ES ornithology chapter for the OSP / converter station components and the seaward ECR.

5.1.15. Divers

Red-throated divers that winter in north-west Europe breed in Scandinavia, Russia and Greenland and to a lesser extent northern Scotland, Orkney and Shetland (Forrester *et al.,* 2008). In the UK, the breeding population is estimated at 1255 pairs (Dillon *et al.,* 2009). They are almost entirely marine in the winter months, with the vast majority of the population wintering in the North Sea and Baltic Seas (Brown & Grice, 2005).

The British wintering population is aggregated in notable numbers in several areas, from the Moray Firth in the north to Norfolk and the Thames Estuary off Kent and Essex. They are generally less abundant (although still common) on the west coast. Red-throated divers generally arrive in English (or Welsh) waters in mid to late September, with numbers peaking in December, January or early February. Numbers subsequently fall in late February to early March as birds depart for their breeding grounds (Brown & Grice, 2005). The British winter population is currently estimated at 17,166 individuals (O'Brien *et al.,* 2008) which represents between 10% and 19% of the north-west Europe biogeographical non-breeding population. Offshore surveys (particularly for wind farm developments) have led to the identification of much larger numbers of this species than previously known.

Red-throated divers were found to be present in Tay Bay in numbers exceeding the 1% threshold of the UK wintering population (then thought to be <5,000) in three of the five winters surveyed between 1997/98 and 2004/05 (Söhle *et al.* 2007). In this study the mean of peak estimates across seasons was 437 birds, with a peak density of 3.05 individuals per km^2 in February 2004. Red-throated divers were distributed throughout Tay Bay, with the main concentrations being fairly mobile throughout, both within and across years.

Within the boat-based surveys of Seagreen Alpha and Bravo, red-throated divers were recorded at very low estimated population sizes (3 and 5 individuals for the two projects respectively. With the low numbers of diver species associated with the OSP / HV cable components of the Transmission Asset Project, there is a limited potential for impacts. It is therefore considered appropriate not to carry this species forward for further assessment in the ES ornithology chapter with respect to this component of the Transmission Asset Project.

5.1.16. Wildfowl

Two species of wildfowl were observed in the boat-based surveys of Alpha and Bravo; mallard and eider. Both species were present in low densities and peak numbers did not approach those of regional importance. These species are therefore not considered further in the assessment of the OSPs / HV cable components of the Transmission Asset project.

5.1.17. Wading birds

Oystercatcher, golden plover lapwing curlew, turnstone and grey phalarope were recorded in flight during the boat-based surveys of Seagreen Alpha and Bravo. These species were present in very small numbers below the threshold of national importance and are not considered further with respect to the Transmission Asset Project components within the wind farm foot print (OSPs and HV cables).

5.2. Species Accounts – ECR corridor seaward element

5.2.1. Gannet

Camphuysen (2005b) reported a maximum density of 4.99 individuals per km^2 in a region covered by the outer ECR scoping corridor, based on June and July surveys conducted between 1991 and 2004. Skov *et al*. (1995) stated a density of 1.28 individuals per km^2 from May to August in an area in the vicinity of the ECR scoping corridor, whereas Stone *et al.* (1995) gave a maximum density of 1.99 individuals per km^2 from May to August within the ECR scoping corridor. A count of 150 gannets feeding in Carnoustie Bay was made on 6 August 2007 (Angus & Dundee Bird Report, 2008).

Within aerial surveys covering the ECR, a maximum count of 50 individuals occurred in the summer breeding months (at a density of 12.5 birds per km^2), compared with 3 during the winter period. The vast majority of records of gannet during the aerial surveys occurred in the most easterly areas (i.e. areas further offshore) with fewer records in more inshore waters (Appendix A3). The estimated numbers for the summer breeding period accords closely with that presented by Camphuysen (2011) in the Firth of Forth.

Due to the combination of the likely origin of birds from the adjacent Forth Islands SPA, and the potential for a regionally important population being present in the vicinity of the ECR, gannet is therefore carried forward as a sensitive receptor for the seaward ECR component of the Transmission Asset Project in the Impact Assessment of the ES Ornithology chapter.

5.2.2. Fulmar

Numbers extracted from aerial survey data for the ECR were similarly insignificant as found for the Alpha and Bravo footprints; a maximum count of 4 birds was recorded, while the species was unrecorded in the VP surveys from the Carnoustie landfall. Fulmar is therefore not carried forward as a sensitive receptor for this component of the Transmission Asset Project.

5.2.3. Manx shearwater

Stone *et al*. (1995) reported a density >5 individuals per km^2 for July and August in a region covering the inner ECR scoping corridor. Density estimated for the ECR from aerial survey data were larger than recorded for the wider Firth of Forth Zone, with a scattering of occasional records (Appendix A6). These numbers were not however found to exceed thresholds of importance.

As the threshold for regional importance for this species was not exceeded (despite the large number of colonies within foraging range of the Project), Manx shearwater is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.2.4. Shag

Population estimates of this species within the seaward element of the ECR were extremely low and did not breach any thresholds of significance. As a result this species is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.2.5. Kittiwake

Densities within the ECR corridor taken from aerial data were lower than the wider Firth of Forth Zone peaking at 2 birds per km^2, although this density may be limited by identification issues in aerial survey work. Tracking of kittiwakes from key colonies in the Firth of Forth area suggests that the ECR is within regular commuting routes of kittiwakes, although the areas is one holding some of the lowest densities of activity within the region (Seagreen, 2012b; Figure 6.17).

Kittiwake has a high conservation status in the region and with the numbers recorded in all surveys, potential impacts include displacement and indirect effects on foraging habitat. As a result this species is carried forward for further assessment of the Transmission Asset Project in the ES Ornithology chapter with regards to the seaward ECR component.

5.2.6. Herring gull

Densities of herring gulls within the ECR corridor aerial surveys were similarly low to the Alpha and Bravo zones, with a maximum count of 8 birds recorded. Impacts on this species resulting from the seaward ECR corridor are therefore considered to be unlikely. As a result this species is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.2.7. Lesser black-backed gull

Densities of lesser black-backed gull were found to be present in very low densities within the ECR corridor, which therefore closely matches the results found for Alpha and Bravo, taken from the aerial surveys of the Zone Considering the low density of lesser black-backed gulls in both seaward areas, the likelihood of significant ecological impact was considered to be very low. As a result, this species is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.2.8. Great black-backed gull

Within the seaward section of the ECR corridor, great black backed gulls were found to be rare densities not approaching thresholds of regional importance; this species is not considered further for the assessment of this component of the Transmission Asset Project.

5.2.9. Terns

The seaward element of the ECR corridor lies closer to breeding sites for Arctic and common tern (i.e. Montrose Basin and Imperial Dock SPAs) than Projects Alpha and Bravo, although the aerial survey work only recorded two records of single Arctic/common terns within the area surrounding the ECR corridor. As a result these species are not carried forward for further assessment of the Transmission Asset Project in the ES Ornithology chapter.

5.2.10. Guillemot

Tracking studies from the Isle of May failed to show birds approaching the seaward extent of the ECR corridor. The flight direction of birds in Seagreen Alpha reinforces this conclusion with a clear flight axis from southeast (from the colony) and especially northwest to the colony. However, within the ECR corridor and 1km buffer, density of unidentified auks (i.e. guillemots and razorbills) reached 8.75 individuals per km^2; with species present widely in each transect (Appendix A1). This density is comparable with those found

elsewhere in the region and considering auk species sensitivity to displacement (Furness & Wade, 2012) there is potential for significant ecological impact on birds resulting from this in addition to from barrier and indirect effects. Guillemot is therefore taken forward as a sensitive receptor in the ES Ornithology chapter for this component of the Transmission Asset project.

5.2.11. Razorbill

Although Razorbills were not specifically identified from aerial survey work, considering the results of the boat-based surveys at Alpha and Bravo, the species is likely to be widely present although in lower densities than guillemot. As a precautionary measure (with this species sensitive to displacement (Furness & Wade, 2012)) this species is carried forward as a sensitive receptor for this component of the Transmission Asset project.

5.2.12. Puffin

Densities of auks were moderate within the ECR corridor and 1 km buffer, although it may be expected that the area within which the seaward element ECR corridor is situated would have a similar importance to the area within which Alpha and Bravo are situated. Considering the regionally important numbers of puffin present at Alpha and Bravo, as a precautionary measure this species is taken forward as a sensitive receptor for this component of the Transmission Asset project.

5.3. Species Accounts – ECR intertidal / nearshore element

5.3.1. Gannet

Gannet is not of interest to any assessment of intertidal habitat, although numbers of this species were recorded during the VP high tide species survey at Carnoustie, including a count of 105 birds on 18th October 2011 (Atmos, 2012). Gannets are sporadic in their occurrence and the nearshore element of the ECR corridor is not considered to provide extensive foraging opportunities. Gannet is therefore not taken forward as a sensitive receptor for the nearshore element of the ECR corridor.

5.3.2. Kittiwake

Densities of kittiwakes from the Carnoustie vantage point surveys were insignificant with no numbers of regional importance present. Impacts on this species resulting from the seaward ECR corridor are therefore considered to be unlikely. As a result this species is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.3.3. Herring gull

Densities of herring gulls from the Carnoustie vantage point surveys were insignificant with no numbers of regional importance present. Impacts on this species resulting from the seaward ECR corridor are therefore considered to be unlikely. As a result this species is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.3.4. Lesser black-backed gull

Lesser black-backed gull species was only recorded on a single occasion at the VP surveys at Carnoustie.

Densities of lesser black-backed gull were found to be present in very low densities within the ECR corridor, which therefore closely matches the results found for Alpha and Bravo, taken from the aerial surveys of the Zone Considering the low density of lesser black-backed gulls in both seaward areas, the likelihood of

significant ecological impact was considered to be very low. As a result, this species is not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.3.5. Great black-backed gull

Great black-backed gulls were present in low numbers only during the he VP surveys at Carnoustie (maximum count of 8 birds); this species is not considered further for the assessment of this component of the Transmission Asset Project.

5.3.6. Other gull species

Three additional species of gull were recorded in the surveys of VP surveys of Carnoustie; black-headed gull, common gull and little gull. The maximum population sizes of all species did not exceed thresholds of regional importance. As a result these species are not carried forward for further assessment of the Transmission Asset Project in the ES Ornithology chapter.

5.3.7. Auks

Both guillemot and razorbill were present in low numbers during the vantage point surveys at Carnoustie. Maximum counts were low (4 and 3 birds respectively) and as a result these species are not carried forward for further assessment of this component of the Transmission Asset Project in the ES Ornithology chapter.

5.3.8. Divers

Red-throated divers were regular in the VP surveys at Carnoustie, at both high and low tide (18 records of up to 3 birds). A single great northern diver was also recorded during the vantage point surveys. Red-throated diver is listed as a qualifying species for the Firth of Forth SPA and sensitive to disturbance (Garthe & Hüppop, 2004). The Firth of Forth SPA is distant from the ECR corridor (25km at its closest point) and the ECR corridor area is of low value for the species. It is therefore considered appropriate not to carry this species forward for further assessment in the ES ornithology chapter with respect to this component of the Transmission Asset Project.

5.3.9. Wildfowl

Wildfowl species were principally recorded in association with nearshore areas of the ECR corridor, although a small number of eider were recorded flying during the boat-based surveys of Project Alpha and Bravo.

The UK breeding population of eider is estimated at 31,650 pairs, mostly in Scotland and north-east England (Baker *et al*. 2006). The largest wintering flock of eider in the UK occurs at the mouth of the Tay Estuary at Abertay Sands, a wide area of shallow water with extensive mussel beds. In the early 1970s, there were estimates of 17,000 to 20,000 birds, and 20,000 for the period 1985-95. However, the maximum count since 1995 has been 15,000, in November 1997 and November 2003 (Forrester *et al.* 2007). Skov *et al.* (1995) reported a density of 363.64 individuals per km^2 from October to February for an area extending to the outer Tay Estuary and including inshore waters in the vicinity of the ECR corridor area. Spring and summer densities were somewhat lower with 10.87 individuals per km^2 in March and April, and 12.73 individuals per km^2 from July to September (Skov *et al.* 1995). Densities reported by Stone *et al.* (1995) were somewhat lower, with a maximum density of 4.99 individuals per km^2 from October to December.

Within the Carnoustie VP surveys, eiders were commonly recorded on each survey at both high and low tide with a maximum count of 49 birds on 18th October 2011. This count does not approach the threshold for national importance, nor does this population appear to represent numbers of regional importance. The wintering population of the Firth of Tay is estimated at a mean of 7,453 birds through 2005/06 to 2009/10 (Holt *et al*., 2011).

Common scoter also occurs in important numbers in the area in winter. Over 30,000 individuals estimated to winter in the British Isles (Skov *et al*. 1995), occurring mostly in water less than 20m deep where they dive on high densities of bivalve molluscs. Stone *et al*. (1995) gave a maximum density of 9.99 individuals per km^2 in May and June for part of the inner ECR scoping corridor, and a maximum density of 4.99 individuals per km^2 for the same area from January to April.

Within the Carnoustie VP surveys, common scoter were commonly recorded on each survey at both high and low tide with a maximum count of 108 birds on 10th February 2012. This number does not approach the threshold for national importance nor does it imply a population of regional importance. The latest estimate of wintering numbers in the region is the Firth of Forth where 1,393 individuals through the winter of 2009/10 (Holt *et al.,* 2011).

For long-tailed duck, Söhle *et al*. (2007) estimated a population of 728 individuals (mean of peaks across the five winters surveyed) for Tay Bay, with most recorded just outside the entrance of the Firth of Tay. This study recorded a peak density of 2.80 individuals per km^2 in December 2001. Long-tailed ducks were recorded in low numbers during the VP surveys at Carnoustie with a maximum count of 5 birds. This population is clearly does not represent one of regional importance. The Forth Estuary has attracted a mean wintering population of 192 birds through 2005/06 – 2009/10.

Some 10,000 red-breasted mergansers winter around the British Isles, with the highest numbers at the mouth of the Firth of Tay (Söhle *et al.* 2007). This study estimated a population of 109 individuals (mean of peaks across the five winters surveyed) for Tay Bay, with a peak density of 0.55 individuals per km^2 in February 2004. Skov *et al.* (1995) reported densities of 32 individuals per km^2 in October and November, and 73.33 individuals per km^2 from December to February. Red-breasted mergansers were present in very low numbers in the VP surveys at Carnoustie, with a maximum count of 3 birds. This population clearly does not represent one of regional importance. The Tay Estuary has attracted a mean wintering population of 102 birds through 2005/06 – 2009/10 (Holt *et al.,* 2011).

Two species of dabbling duck were recorded in the surveys at Carnoustie; wigeon and mallard. Both species were recorded in low numbers below thresholds of national importance and with both being widespread and abundant winter residents in east Scotland (Forrester *et al.,* 2007) the numbers recorded at Carnoustie were not of regional importance.

In summary, a range of wildfowl were recorded from the VP surveys at Carnoustie including four species of sea-duck and two dabbling duck species within nearshore areas of the ECR corridor. No species were present in regionally important numbers and wildfowl are not taken forward as sensitive receptors for further assessment of the Transmission Asset Project in the ES ornithology chapter.

5.3.1. Waders

Seven wader species were recorded during the VP surveys at Carnoustie (Table 3). These species (oystercatcher, curlew, bar-tailed godwit, redshank, knot, sanderling and turnstone) were all present in numbers considerably lower than thresholds of national importance (Table 15). It is evident that the intertidal area within the ECR corridor does not provide noteworthy habitat for either roosting or foraging wading birds.

Two species recorded are included as qualifying features for the Firth of Tay and Eden Estuary SPA. Bar-tailed godwit is a common winter visitor and passage migrant to Scotland, being frequent in coastal areas mostly in the east. The citation for the SPA details 2,400 individuals of this species which represents 4.5% of

the Great Britain wintering population. The latest counts from the estuary report a mean of 870 birds between 2004/05 to 2009/10 (Holt *et al.,* 2011). The maximum count of just 3 birds at Carnoustie clearly suggests that the ECR will have no impacts on the regional population of this species.

Redshanks are a common resident and winter visitor to Scotland, with local breeding birds supplemented by Icelandic birds in the winter months (Forrester *et al.,* 2007). The citation for the SPA details 1,800 wintering individuals of this species which represents 1.2% of the wintering eastern Atlantic population. The maximum count of just 4 birds at Carnoustie clearly suggests that the ECR corridor will have no impacts on the regional population of this species.

In summary, a range of wader species were recorded within the Transmission Asset Project boundary, specifically the intertidal habitat at the landward end of the ECR corridor. These included two species (bar-tailed godwit and redshank) that are included as qualifying species of the Firth of Tay and Eden Estuary SPA. No species were present in regionally important numbers and wader species are not taken forward as sensitive receptors for further assessment of the Transmission Asset Project in the ES ornithology chapter.

5.4. Summary of sensitive receptors

Table 17 presents a summary of the sensitive receptors highlighted in this report with respect to the Transmission Asset Project. The assessment was divided into the different components of the project with no sensitive receptors identified for intertidal sectors of the ECR corridor, with all species recorded in this Zone being of lower conservation value and/or present in populations that do not reach established thresholds of regional or national importance. The remaining species are those that occur within the seaward sections of the ECR corridor and within the wind farm footprint of the Seagreen Project itself.

Table 47: Sensitivity of species relevant to the Transmission Asset Project

Sensitivity	Species	Populations of relevance to Offshore Transmission Asset Project	Usage of Offshore Transmission Asset Project area
Very High	Gannet	Forth Islands SPA	Regionally important numbers present in Alpha and Bravo throughout the breeding and passage periods. Widespread within ECR including from Carnoustie shore based VP survey. Sensitive receptor for OSPs and seaward ECR.
Very High	Kittiwake	Fowlsheugh SPA	Regionally important populations present throughout at Alpha and Bravo, with June 2001 population at Bravo being of national importance. Regular within the ECR in both nearshore and seaward areas. Sensitive receptor for OSPs and ECR.

Sensitivity	Species	Populations of relevance to Offshore Transmission Asset Project	Usage of Offshore Transmission Asset Project area
Medium	Great black-backed gull	UK wintering population	Common winter and passage visitor to Alpha and Bravo in regionally important numbers; scarce in breeding period. Uncommon in ECR in both seaward and intertidal areas. Sensitive receptor for OSPs.
Very High	Guillemot	Fowlsheugh SPA	Abundant in Alpha, Bravo and seaward sections of the ECR. Regionally numbers reaching peaks in breeding season, nationally important numbers present in Bravo June 2011. Regular but uncommon from Carnoustie ECR vantage point. Sensitive receptor for OSPs and ECR.
High	Razorbill	Assemblage of Fowlsheugh SPA and Forth Islands SPA	Common in Alpha and Bravo, regionally important numbers throughout with nationally important numbers in Alpha July 2011. Regular but uncommon from Carnoustie ECR vantage point. Sensitive receptor for OSPs and ECR.
Very high	Puffin	Forth Islands SPA	Abundant, in regionally important numbers during breeding and passage periods in Alpha and Bravo, less common in winter. Sensitive receptor for OSPs and ECR.

6. Determination of Impacts

6.1. Overview

With respect to the Transmission Asset Project, this section provides an overview of the potential offshore ornithological impacts. These impacts, if considered to require further assessment, will be discussed in the impact assessment. The key impacts that may be associated with the Transmission Asset Project are

disturbance/displacement effects and changes to habitat, as well as any impacts that arise in combination with other plans and projects in the region.

The effects of disturbance and displacement are difficult to quantify, although both seabirds and migratory species are potentially vulnerable to such effects. Habitat loss has the potential to affect birds at different times of their life cycle with foraging, roosting and moulting areas requiring consideration, although such effects are limited to seabirds.

6.2. Worst case scenario for assessment of Transmission Assets

The strategy adopted by Seagreen to retain design flexibility is to adopt a 'Rochdale Envelope' approach. Further details on the Rochdale Envelope approach can be found in the Seagreen Project Phase 1 Environmental Statement (Seagreen, 2012). For a number of the project components for the Transmission Asset Project, engineering decisions regarding preferred options and final design details have not yet been confirmed. This includes decisions on the preferred transmission electrical design (both AC and DC are within the envelope). Retaining flexibility in the selection of preferred design options is a vital mitigation measure in the management of project risks, and enables significant procurement commitments to be made at a more appropriate time later in the process.

There are currently four scenarios for connection design configurations. For the worst case assessment or ornithology, the maximum parameters have been assumed (i.e. up to five OSPs, including: four HVAC Collector Stations and one HVDC Converter Station within Project Alpha and Project Bravo). All worst case Rochdale Envelope design parameters to be assessed in this report for the Transmission Asset Project are presented in Table 18.

Table 58: Worst case scenario parameters for assessment of Transmission Asset Project

Project Component		Dimensions	Legs per platform	Piles per leg	Piles per platform	Total piles	Gravity Base Footprint	Jacket footprint
OSP	HVAC collection platform x 4	40m x 40m x 45m (L/W/H)	6	2	12	48	1,600m^2	20m^2
	HVDC converter platform x 1	100m x 75m x 60m (L/W/H)	12	2	24	24	6,500m^2	40m^2
Max ECR corridor width		1km to 4.5km						
Max no. OSP to OSP cable trenches		10						
Max cable trench width		3m						

Max cable burial depth	3m						
Max ECR length from OSP in Project Alpha to MHWS at Carnoustie	70km						
Max no. export cable trenches in corridor	6						
Max no. HDD bores at beach for cable pull-in	8						

6.3. Potential Impacts of offshore wind farm Transmission Assets on birds

The potential impacts of offshore wind farms on ornithological receptors have been comprehensively reviewed (e.g. Langston, 2010) and include collision, disturbance/displacement, barriers to movement, habitat change and the cumulative/in-combination effects across multiple schemes. Several of these effects may be consistent with the Transmission Asset Project, while others are likely to be significantly reduced (e.g. collision).

Seabirds, in general, are longer lived and consequently a lower annual reproductive output is characteristic of several species. Such species may therefore be more susceptible to effects of increased mortality above background levels. The effects of disturbance and displacement are in comparison, more difficult to quantify, although both seabirds and migratory species are potentially vulnerable to such effects.

Barriers to movement can affect migratory birds on their annual flyways and as disruption to functional links, such as between feeding and breeding areas. Habitat loss has the potential to affect birds at different times of their life cycle with foraging, roosting and moulting areas requiring consideration, although such effects are limited to seabirds.

The Transmission Asset Project includes areas of intertidal habitat, and therefore there is some potential for impact impacts on species utilising this habitat (i.e. wildfowl and wading birds through disturbance / displacement effects from construction including HDD bores, in addition to indirect effects from habitat change). However, as detailed in section 5, no species in this Zone were deemed to qualify as sensitive receptors. This leads to the potential effects detailed in Table 10 being limited to marine/seaward components of the Transmission Asset Project. Assessment of intertidal areas is therefore not taken further forward in the assessment

6.4. Impact assessment methodology

The sensitivity of bird species observed within the Transmission Asset Project was defined according to a range of criteria given in Section 4.

The industry standard definitions of the magnitude of an effect follow a five-point scale from Negligible to Very High according to the proportion of the 'population' or 'habitat' lost. These definitions are outlined in Tables 10 and 11, and serve as generic guidelines that can be adapted to suit the different types of impact.

Table 19 sets out the significance matrix determined by the combination of the sensitivity and magnitude ratings. The likely significance of any impact on each species was determined using this matrix. In essence, the approach combines the matrix-based approach of Percival *et al.* (1999) with a rigorous, but qualitative and discursive approach (IEEM, 2010) within an evidence-based and reasoned framework. This allows the assessment to be brought into alignment with that used for other wind farm sites. This version tends to result in a more conservative estimate of significance and provides an equal division of major/moderate vs. minor/negligible.

Potential impacts of major significance do not necessarily require drastic changes to a development, if it can be demonstrated that the effects are reversible and are not damaging in the long term. Effective mitigation measures can reduce the residual impact to an acceptable level. Effects of negligible significance could potentially disguise neutral or even positive impacts.

Table 69: Significance of the effect upon resulting from the combination of sensitivity of bird species with the magnitude of an assessed impact

	Sensitivity			
Magnitude	**High**	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Negligible
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Table 20 provides an interpretation of the significance ratings, Negligible to Major.

Table 20: Interpretation of significance categories

Effect	**Definition**
Major	The effect on birds gives rise to serious concern and should be considered unacceptable
Moderate	The effect on birds gives rise to some concern but it is likely to be tolerable (depending upon its scale and duration)
Minor	The effect on birds is of limited concern
Negligible	The effect on birds is not of concern

Particular attention was paid to those birds potentially linked to the Forth Islands, Fowlsheugh and Firth of Tay and Eden Estuary SPAs. These sites support seabirds as well as a wide range of migratory waterfowl and waders. Designated species were assumed to have Very High sensitivity. In order to focus assessment effort on species of genuine concern, species that occurred in less than regionally important numbers were scoped out of the process.

6.5. Determining disturbance, displacement and avoidance effects

For disturbance, displacement and/or avoidance, the approach used combined empirical data gathered at the site and published literature on the response of birds to types of disturbance associated with different stages of a wind farm project, relevant to the Transmission Asset Project.

This assessment of the Transmission Asset Project considers the disturbance, displacement and avoidance effects related to cable installation activity along the ECR corridor and within the wind farm area (inter-array cabling), as well as the effects related to installation of the OSPs.

The worst case potential cumulative effects of disturbance and displacement have been considered for increased boat traffic related to all installation activities (ECR corridor, HV cabling, OSPs), and for the potential barrier effects to bird movement presented by OSPs. These effects have also been considered in combination with other plans and projects in the Firth of Forth region, including with the other aspects of the Seagreen Project, such as the operational turbines.

6.6. Collision risk

Assessment of the Seagreen Project offshore site has analysed the potential collision risk with turbines for key species observed (Seagreen, 2012b). Five species were identified as being at potential risk of collision at the Seagreen Project: gannet; kittiwake; lesser black-backed gull; European herring gull; and great black-backed gull. Of these species, survey observations showed very low numbers flying above 20m (Seagreen, 2012b).

The worst case scenario number of OSPs in the Transmission Asset Project is five (Table 17). The maximum height of these structures above the sea surface is 60m, and there is no moving structure associated with the OSP. OSPs will be located within the turbine array in the offshore Zone. Considering the low bird numbers seen flying above 20m and that avoidance rates are likely to be higher for OSPs than moving turbines (default rate of 98% avoidance; SNH, 2010), it is unlikely that collision with OSPs represents a significant risk, particularly relative to the risk associated with the turbines themselves.

6.7. Indirect effects

Indirect effects may occur through changes in habitat or in abundance and distribution of prey. Specific considerations were:

i) Effect of construction noise (cable and OSP installation) on the known prey species of sensitive receptors;

ii) Effect of changes in prey distribution and availability on sensitive receptors as interpreted in terms of the species' flexibility in habitat use (Garthe and Hüppop, 2004). Scores ranged from one (very flexible in habitat use) to five (reliant on specific habitat features). This scale was used to infer a magnitude of effect in terms of a species' dependence on a specific food supply, should that be affected; and

iii) Effect of potential change in geomorphological conditions during and after construction that may affect the distribution of prey species and therefore foraging opportunities for sensitive receptors.

iv) Suspended sediment concentration effects on prey species as a result of cabling

The key effect in relation to foraging bird species is the temporary redistribution of prey fish over a relatively large area during piling operation.

The temporary displacement of fish from the immediate area may be of little consequence to birds if they are able to locate suitable habitat nearby and repopulate the affected area once OSP piling has ceased. This is expected to be the case for those species that are most flexible in their habitat use.

7. Assessment of Effects

This section addresses the potential impacts associated with the Transmission Asset Project: disturbance, displacement and indirect effects through potential habitat/prey population changes (outlined in Section 6). The potential for collision risk with OSPs is not considered significant, and has not been assessed further (see section 6.6). Potential impacts have been assessed in relation to the important receptor species identified in Section 5.

7.1. Construction and Decommissioning Phase

7.1.1. Offshore Substation Platforms (collector and converter stations)

This section is informed by survey data detailed in Section 3.3.

Disturbance and displacement

The EIA Construction Methods Report (Seagreen, 2012) provides an indicative construction programme that suggests the likely duration of offshore wind farm construction (installation of substructures and foundations, including wind turbines) is predicted to take no longer than three years in total. This is based on the assumption that offshore construction activity takes place between April and September each year (total construction duration of eighteen months within three year construction period). The overall period of construction could be reduced by extending the working period beyond the summer months. However, weather sensitive activities could take longer to complete if undertaken between October and March.

The minimum timeframe for installation of substructures and foundations is 6 months for the purposes of assessment. A further assumption is that installation of two substructures or foundations could be simultaneous at each wind farm site.

The worst case scenario includes five OSPs (four AC collector stations and one DC converter station). The DC converter station platform will have 12 legs with 2 piles per leg (total 24 piles). AC collector platforms will have 6 legs with 2 piles per leg (total 12 piles). This gives a total of 72 piles required in the construction period.

Foundation options within the Rochdale Envelope include: tubular piles, suction piles and gravity base structures. Foundations will be installed for substructures with steel jackets and/or gravity bases. With respect to the steel jackets, these will be placed onto the seabed and the piles (if tubular) will be 'driven and drilled' through the sleeves connected to the jacket legs via hydraulic hammer.

The whole operation to install one tubular pile takes approximately 13 hours, including positioning the installation vessel and the piling hammer, placing the template or substructure and aligning the pile. Within this overall period the pile driving activity takes place over approximately 1 hour, depending on ground conditions. The complete piling operation for a 12 leg jacket is expected to take approximately 13 days, and for a 6 leg jacket 6.5 days.

The maximum number of piles for the DC converter station and the four AC collector stations is 72. Thus, an approximation of the minimum pile driving time for OSP installation would be in the region of 72 hours (over approximately 39 days). This represents a relatively small proportion of the 6 months total substructure/foundation installation time. The OSP deck and topside structures are likely to be installed via floated crane vessel (self-propelled or towed).

The large foraging range of gannet combined with their predation on a relatively wide spectrum of prey implies that gannets are unlikely to be significantly affected by localised construction effects. The magnitude of any disturbance on this species is therefore considered to be negligible, resulting in a predicted impact of minor significance.

Opportunistic scavenging species such as gulls may benefit from foraging opportunities created by construction works. Great black backed gull, for example, frequently associate with vessels and human activity (e.g. fishing activity) (Mitchell *et al.*, 2004) and may exploit novel foraging opportunities created by construction activities that may make prey more available to them. As such, the magnitude of the potential impact on great black-backed gull and kittiwake is considered to be negligible. This leads to significance of impacts of negligible and minor respectively.

Auks were observed in relatively large numbers throughout the ECR particularly during the breeding period. The limited extent of the construction period of the ECR terms of temporal and spatial spans suggests that impacts by disturbance will be of a negligible magnitude. On this basis the impact is considered to be of minor significance for guillemot and puffin and negligible significance for razorbill.

Indirect effects

The worst case scenario includes five OSPs (four collector stations and one converter station). Scour protection (rock placement) will be installed around each OSP base, if gravity bases are used. The total indicative worst case habitat loss (sum of footprints for gravity bases, plus scour protection – the 'permanent zone of influence') is 29,365m^2 for five OSP structures. Habitat loss associated with OSPs is also discussed in the benthic impact assessment (Seagreen, 2012c).

The jack-up vessel for offshore installation activities is assumed to have six legs, with each leg covering a 4.5m^2 footprint (typical penetration 2m). This suggests that the total area of habitat temporarily disturbed by a single installation vessel at any one time will be a minimum of 27m^2. This would increase if more than one installation vessel was in operation at a given time.

The extent of permanent habitat loss as a result of OSP construction, and the extent of temporary habitat disturbance due to installation vessels, is relatively small in comparison to the total area occupied by turbine foundations and scour protection. Therefore, effects on distribution and abundance of bird prey species are not considered likely to be significant and are not likely to require further assessment in terms of OSPs.

Considering that pile driving is the most likely jacket pile foundation installation method, and that rock placement will be used for scour protection where gravity bases are used, potential increases in suspended sediments during the construction and decommissioning phases are not considered likely to be significant. Potential increases are also likely to be short term and temporary, given the installation timeframe for OSPs. Therefore, suspended sediment effects on bird prey species as a result of OSP installation are also not considered significant, and are not likely to require further assessment.

The maximum number of piles for the 12 leg DC converter station platform and the four 6-leg AC collector platforms is 72 piles. The maximum pile driving time is in the region of 72 hours, and the noise effects of this may have implications for prey fish species. Mobile fish species are likely to move away from significant noise sources, such as the pile driving location. Considering the temporary duration and short term nature of the OSP installation period, it is not considered that the associated potential noise effects could affect prey fish species in terms of death, or permanent/temporary injury. Therefore, the most likely effect of pile driving on prey fish species is a short term displacement effect, and this is not considered likely to be

significant given the duration of effect and location of activity. Potential noise effects on prey fish species are not likely to require further assessment.

7.1.2. High Voltage (HV) Export Cables (OSP to OSP)

Impacts associated with the inter-array (OSP to OSP) HV cables are assessed in the offshore ornithological technical report (Seagreen, 2012b).

7.1.3. ECR: intertidal/nearshore region

This section is informed by survey data detailed in Sections 3.2 and 3.5.

Table 16 defines the worst case scenario for ECR corridor parameters: maximum 70km in length from the indicative OSP location within the Project Alpha site to the Carnoustie landfall. The rate at which the export cable will be trenched is dependent on many factors, including: the trenching tool used and the installation method; the type and properties of the soils along the route; and operational constraints. Table 21 shows the indicative average cable installation rates for three trenching tools.

Table 21: Indicative average cable installation rates for three trenching tools

Trenching tool	Soil description	Average range of trenching speed (m/hr)
Cable plough	Very soft to hard clay Loose to very dense sand	225 - 550 150 – 450
Jet trencher	Very soft to stiff clay Very loose to very dense sand	60 - 250 80 – 560
Cutter	Stiff to hard clay Loose sand	200 - 400 500

Indicative cable installation rates suggest that the installation period for the export cable is significantly less than the construction period for the offshore wind farm itself. Therefore, disturbance to ornithological receptors as a result of installation vessel activity will be temporary and localised. Using the indicative trenching rates in Table 21, installation of the export cable could be completed in a 9 month period. Displacement effects arising from the presence of the cable installation vessel are also considered likely to be temporary and localised, and not likely to result in prolonged displacement of bird species.

Disturbance and displacement

Indicative cable installation rates suggest that the installation period for the export cable is significantly less than the construction period for the wind farm itself. Therefore, disturbance to ornithological receptors as a result of installation vessel activity will be temporary and localised. Using the indicative trenching rates in Table 21, installation of the export cable could be completed in a 9 month period. Displacement effects arising from the presence of the cable installation vessel are also considered likely to be temporary and localised, and not likely to result in prolonged displacement of bird species.

Horizontal Directional Drilling (HDD) in the intertidal area at the landfall location is a noisy activity that has the potential to cause disturbance to ornithological receptors. The presence of HDD barges close to the shore in the intertidal region may also present a disturbance impact. However, as for cable installation

activities further offshore, these activities are considered likely to be temporary and localised. Displacement effects are likely to be localised, and not likely to result in prolonged displacement of species.

No species recorded in the intertidal /nearshore region of the ECR corridor were considered to be of medium sensitivity or above and as such effects resulting from this component of the Transmission Asset Project are all considered to be of negligible significance.

Indirect effects

A low level of indirect effects may derive from HDD by virtue of habitat changes and hence prey availability. No species recorded in the intertidal /nearshore region of the ECR corridor were considered to be of medium sensitivity or above and the area potentially affected was not found to be significant for foraging wading birds. As such effects resulting from this component of the Transmission Asset Project are all considered to be of negligible significance.

7.1.4. ECR corridor: seaward portion

This section is informed by survey data detailed in Sections 3.2 and 3.5 in addition to the worst case scenario of the ECR corridor presented in Tables 18 and 21.

Disturbance and displacement

Indicative cable installation rates suggest that the installation period for the export cable is significantly less than the construction period for the wind farm itself. Therefore, disturbance to ornithological receptors as a result of installation vessel activity will be temporary and localised. Using the indicative trenching rates in Table 21, installation of the export cable could be completed in a 9 month period. Displacement effects arising from the presence of the cable installation vessel are also considered likely to be temporary and localised, and not likely to result in prolonged displacement of bird species.

The large foraging range of gannet combined with their predation on a relatively wide spectrum of prey implies that gannets are unlikely to be significantly affected by construction effects. The timespan for installation of the export cable is limited, with the majority of operations taking the form of vessel presence. Gannet is not known to be sensitive to disturbance from vessels and often follows fishing boats for foraging opportunities (Nelson, 2002). The magnitude of any disturbance effect on this species is therefore considered to be of negligible magnitude, resulting in a predicted impact of minor significance.

As for construction of the OSPs, opportunistic scavenging species (such as gulls) may benefit from the foraging opportunities created by construction activity in the ECR. As such, the magnitude of the potential impact on great black-backed gull and kittiwake is considered to be negligible. This leads to significance of impacts of negligible and minor respectively.

Guillemot, razorbill and puffin were observed in large numbers at Projects Alpha and Bravo during breeding and passage periods while the former two species during winter periods as well. Direct observations of foraging by guillemot and presumed return flights by razorbill towards Fowlsheugh SPA suggest that the area has some importance for these species. The limited temporal and spatial extent of the ECR corridor construction period suggests that impacts by disturbance will be of a negligible magnitude. On this basis the impact is considered to be of minor significance for guillemot and puffin and negligible significance for razorbill.

Indirect effects

Habitat loss associated with export cable installation is not considered likely to be permanent or significant, since sediments moved in trenching will be used to refill the cable trench. Habitat disturbance is estimated to extend to the 1km width of the ECR corridor, and it is not considered likely that this disturbance will have a significant effect on prey availability for bird species.

The potential noise effects of export cable installation on birds or their prey fish species are not as well quantified as those related to offshore foundation and substructure installation. However, cable installation by ploughing, trenching or cutting does not produce the same level of noise as is associated with pile driving or drilling. Therefore, potential noise effects on bird prey species from cable installation are not considered likely to be significant, and are not likely to require further assessment.

Suspended sediment concentrations resulting from cable installation activity will depend on the substrate type along the route. Any increases are likely to be limited, short term and temporary – although increases would be higher in finer sediment regions. The small area of seabed disturbance due to cable installation activity, combined with the short term nature of installation activity (i.e. potentially within 9 months), make the likelihood of significant suspended sediment effects on bird prey species low. Further assessment of these effects is not likely to be required.

Cable installation involves some limited disturbance of seabed sediments along the ECR corridor, and therefore there may be some small scale changes in abundance and distribution of bird prey species. Considering the small areal extent of seabed disturbance, and the short term duration of installation activity, changes in prey abundance and distribution are not likely to be significant, or to require further assessment.

7.2. Summary of effects of the construction phase

Table 22 provides a summary of the significance of all effects during the construction phase of the Transmission Asset Project.

Table 72: Summary of the significance of all effects in the construction phase of the Transmission Asset Project

Species	Sensitivity	OSPs		ECR corridor	
		Disturbance	Indirect effects	Disturbance	Indirect effects
Gannet	High	Minor	Negligible	Minor	Negligible
Kittiwake	High	Negligible	Negligible	Negligible	Negligible
Great black-backed gull	Low	Negligible	Negligible	Negligible	Negligible
Guillemot	High	Minor	Negligible	Minor	Negligible
Razorbill	Medium	Negligible	Negligible	Negligible	Negligible
Puffin	High	Minor	Negligible	Minor	Negligible

7.3. Operational Phase

7.3.1. Offshore Substation Platforms (collector and converter stations)

Disturbance due to maintenance activity

Disturbance of birds resulting from maintenance vessel activity around the OSPs is likely to be similar in scope to that discussed in relation to the construction phase, with no species subject to potentially significant impacts (Table 22). Whilst associated maintenance and vessel activity will be permanent (for the lifetime of the wind farm), it will be at significantly lower in intensity than during construction, and as such impacts are not likely to be significant and do not require further assessment.

Avoidance and displacement from the wind farm site

Avoidance and displacement due to OSPs in the operational wind farm is expected to be negligible when compared to potential effects from operational turbines. The OSPs will be subsumed within the wind farm layout and are of a smaller scale than individual turbines. Impacts are therefore considered unlikely to be significant and no further assessment is required.

Indirect effects

It is concluded that no indirect effects on habitat or prey species will results from operational OSPs and as such, impacts are considered to be negligible (Table 22) and no further assessment is required.

7.3.2. ECR corridor: intertidal area and offshore region

No sensitive ornithological receptors for the intertidal region of the ECR were identified, while a limited number of seabird species utilised nearshore areas. Operation of the export cable is considered benign in terms of impacts on these species. Maintenance of the export cable is likely to be infrequent, localised and temporary. Surface vessels will be used for any operation and maintenance activity, and therefore there will be no habitat disturbance associated with jack-up vessels. Potential impacts on ornithological receptors associated with operation and maintenance of the export cable are not considered likely to be prolonged or significant, and no further assessment is likely to be required.

Table 83: Summary of the significance of all effects in the operational phase of the Transmission Asset Project

Species	Sensitivity	OSPs			ECR corridor
		Disturbance (maintenance)	Disturbance /displacement	Indirect effects	
Gannet	Very High	Negligible	Negligible	Negligible	Negligible
Kittiwake	Very High	Negligible	Negligible	Negligible	Negligible
Great black-backed gull	Medium	Negligible	Negligible	Negligible	Negligible
Guillemot	Very High	Negligible	Negligible	Negligible	Negligible

Species	Sensitivity	OSPs			ECR corridor
Razorbill	High	Negligible	Negligible	Negligible	Negligible
Puffin	Very high	Negligible	Negligible	Negligible	Negligible

7.4. Cumulative Impacts

Potential cumulative impacts may arise with nearby offshore wind farms, and as in-combination impacts with other non-wind farm developments (in addition to cumulative effects with other aspects of Project Alpha and Project Bravo, i.e. construction and operation of turbines). These potential cumulative impacts will be further assessed in the forthcoming EIA. Activities (planned, consented, under construction and operational) to be considered as part of the cumulative ornithological impact assessment include other wind farms (e.g. STW sites Inch Cape and Neart na Gaoithe) as well as oil and gas activities and aggregate dredging projects.

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9. Appendix A: Distribution of seabird species along the Export Cable Route corridor

Appendix A1: Auk species

Appendix A2: Fulmar

Appendix A3: Gannet

Appendix A4: Kittiwake

Appendix A5: Large gull species

Appendix A6: Manx shearwater

Appendix A7: Overall bird distribution along the ECR corridor (seaward section)