In Parliament – Session 2021 - 2022

HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix EC-004-OR003

Ecology and biodiversity

Off-route works: Annandale depot

Document to inform a Habitats Regulations Appraisal Screening Report and Appropriate Assessment for the Solway Firth SPA, Upper Solway Flats and Marshes Ramsar Site and Solway Firth SAC

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Department for Transport

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1 Introduction

1.1 Background

1.1.1 There are certain ecological sites that are designated for their international importance and to which special considerations attach under the Conservation of Species and Habitats Regulations 2017 ('the Habitats Regulations')[1], either through operation of law or government policy.

1.1.2 These sites include Special Areas of Conservation (SAC) that have been designated to protect certain species and habitats; Special Protection Areas (SPA), designated to protect certain species of wild birds; and Ramsar sites designated to protect internationally important wetland areas.

1.1.3 These sites are subject to special legal protection that imposes restrictions on a 'competent authority' from granting consent permission or authorisations for any plan or project that may affect the conservation status and integrity of these designations. In the case of the hybrid Bill, the responsible competent authority is Parliament as it is the enactment of the Bill as legislation that grants consent for the hybrid Bill scheme to be undertaken.

1.1.4 The Habitats Regulations require the competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which is likely to have a significant effect on these designated sites (either alone or in combination with other plans or projects) to make an appropriate assessment of the implications of the plan or project for potentially affected sites in view of those sites' Conservation Objectives.

1.1.5 There are normally two stages in the process of discharging the duties imposed by the Habitats Regulations. The first is to undertake a 'screening' exercise to determine whether there is no reasonable scientific doubt that the plan or project will be likely to have a significant effect on the site's Conservation Objectives. If no such likelihood is identified, the competent authority may proceed to grant consent for the plan or project in question. If, on the other hand, there remains a reasonable scientific doubt as to its effects on the integrity of the site at this stage, the competent authority must move to a second stage and undertake a more detailed assessment, commonly referred to as an 'appropriate assessment' to determine whether, having regard to any mitigation measures that are proposed to be adopted in the delivery of the scheme, there will be an adverse effect on the integrity of the site.

[1] The Conservation of Habitats and Species Regulations 2017 (2017/1012), as amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (2019/579). London, Her Majesty's Stationery Office.

1.1.6 If the appropriate assessment does not identify an adverse effect on the integrity of the site, the competent authority may proceed to grant the consent. If an adverse effect cannot be ruled out, consent can only be granted on the basis that there are: no alternative solutions; there are imperative reasons of overriding public importance for the plan or project to proceed; and appropriate compensatory measures have been secured.

1.1.7 As noted above, it is Parliament as legislator (and not HS2 Ltd as the prospective developer) that is the competent authority and the body which is required to comply with the requirements of the Habitats Regulations. The purpose of this Habitats Regulation Appraisal (HRA) report is, however, to provide information to Parliament, based on HS2 Ltd's assessment of the hybrid Bill scheme, in order to inform and assist Parliament in complying with its obligations under the Habitats Regulations.

1.2 Description of the proposed scheme

1.2.1 The Proposed Scheme comprises the route from Crewe to Manchester with a connection onto the West Coast Mainline (WCML). HS2 Ltd trains serving the north of England and Scotland will need overnight stabling and depot facilities for cleaning and maintenance works, in cases where it is operationally impractical for them to be returned to the on-route Rolling Stock Depots.

1.2.2 The Proposed Scheme at Annandale depot includes provision of a Stabling Facility with the capacity to stable up to 28 HS2 units (200m long trains) at a site north of Gretna Green, approximately 19km north of Carlisle Station.

1.2.3 Land required for the construction of the Proposed Scheme is north of the A74(M) and the B7076 Roman Road, adjacent to the south of the WCML, and is, in part, allocated for development in the emerging Dumfries and Galloway Local Development Plan 2 (LDP2)[2].

1.2.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 4, Off-route effects Map Book. Maps showing designated sites (Map Series EC-01) can be found in the Volume 5, Ecology Map Book and maps showing Phase 1 habitat (Map Series EC-02) can be found in the Background Information and Data, Ecology Map Book[3].

[2] Dumfries and Galloway Council (2019), *Local Development Plan 2*. Available online at: www.dumgal.gov.uk/article/16130/ldp2.

[3] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data, Ecology Map Book*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewemanchester-environmental-statement.

1.2.5 Key features of the functional design, layout and construction of the Proposed Scheme relevant to this assessment include:

- various works to track, including new turnouts, signal works and crossover replacement between Cove Junction and Quintinshill;
- diversion of a 132kv overhead electricity pylon, which will be undergrounded;
- installation of 14 new HS2 stabling sidings, each capable of holding a full-length HS2 train (comprising two 200m units);
- reprovision of Cranberry Farm overbridge;
- provision of a carriage washing plant;
- realignment of Ewes Burn;
- installation of a wastewater treatment plant;
- installation of lighting, including localised task and security lighting assumed to operate continuously at the compounds and elsewhere during the hours of darkness only;
- construction of a new road, linked to the B7076 Roman Road, to provide main depot access;
- construction of a 120-space car park and depot building (approximately 250m long and 70m wide and up to 15m high), within the south of the depot;
- habitat restoration works, including planting a total of 8.1ha of woodland, at locations east of Grahamshill Railway Cottages and north of the existing railway line, locations between Grahamshill Railway Cottages and Cranberry Cottage and south of the WCML and locations around Cranberry Cottage; 4.6km of new hedgerow; 1.3ha of wetland along the alignment of the Ewes Burn; and 9.1ha of species-rich grassland predominantly at locations to the south of Railway Cottages and south of Cranberry Farm; and
- the facility will gain entry to the conventional railway network via a bi-directional reception track arrangement, with a 'North Reception' track (under the control of the Network Rail Signaller) and links to the main reception track arrangement that enable reversal for trains entering/leaving the stabling facility from/to Scotland.

1.2.6 Land required for the construction of the Proposed Scheme lies 2.6km to the north of the Upper Solway Flats and Marshes Ramsar site/Solway Firth SPA and SAC, including the approved marine extension to the SPA[4] (Figure 1). Collectively, these sites are classified/listed for wintering and passage bird populations, extensive estuarine habitats and a population of natterjack toad *Epidelea calamita*.

1.2.7 This report assesses the potential impact of the construction and operation of the Proposed Scheme at Annandale depot on these internationally important sites to inform a HRA. It has

[4] The Upper Solway Flats and Marshes SPA was extended formally in December 2020 to incorporate a 1,050.43km^2 marine component and renamed as the Solway Firth proposed SPA.

been prepared to provide all the necessary information for the competent authority to carry out a HRA under Regulation 63 of the Conservation of Habitats and Species Regulations 2017, as amended by the Conservation of Habitats and Species (amendment) (EU Exit) Regulations 2019.[5]

[5] The amending regulations generally seek to retain the requirements of the 2017 Regulations but with adjustments for the UK's exit from the European Union. See Regulation 4, which also confirms that the interpretation of these Regulations as they had effect, or any guidance as it applied, before exit day, shall continue to do so.

2 Context

2.1.1 In accordance with guidelines produced by Scottish Natural Heritage (SNH[6], and now NatureScot), this assessment considers whether the effects of the Proposed Scheme, either alone or in combination with other plans or proposals, are likely[7] to be significant in terms of the Conservation Objectives for which the following sites were classified/designated/listed:

- Solway Firth SPA, including the Solway Firth marine extension;
- Solway Firth SAC; and
- Upper Solway Flats and Marshes Ramsar site.

2.1.2 The HRA adopts the process as set out by SNH to address the following requirements:

- follow The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019;
- have regard to the potential for the plan to affect European protected sites[8] at all stages of plan-making;
- take such measures as can be identified to ensure adverse effects do not occur, based on the best available information; and
- put in place plans which effectively achieve their intended purpose, whilst protecting Scotland's most important wildlife sites.

2.1.3 Access has not been obtained to survey land required for the construction of the Proposed Scheme; as such, baseline information to inform the assessment is limited to publicly

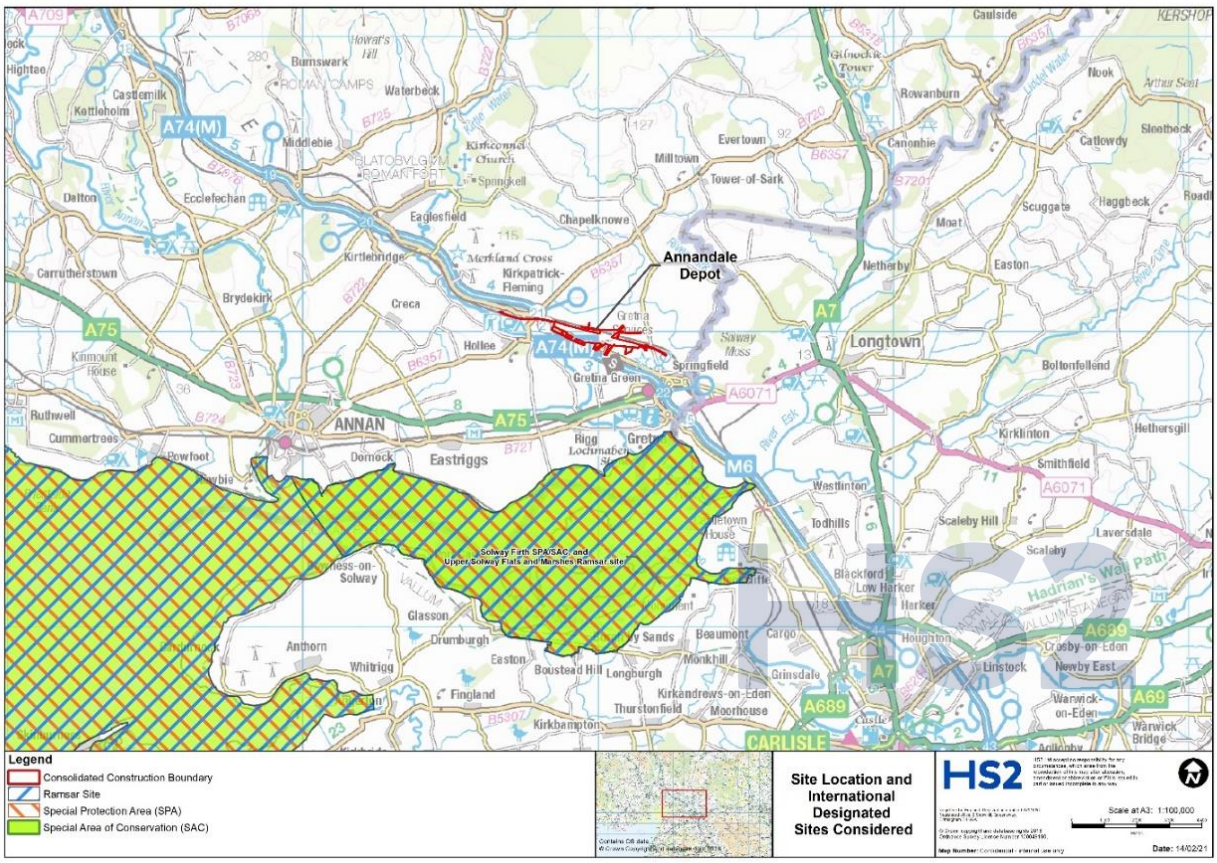
[6] Tyldesley and Associates (2015), *Habitats Regulations Appraisal of Plans. Guidance for plan-making bodies in Scotland*. Version 3. Available online at: www.nature.scot/sites/default/files/2019-07/Habitats%20Regulations%20Appraisal%20of%20Plans%20-%20plan-making%20bodies%20in%20Scotland%20-%20Jan%202015.pdf.

[7] A *likely* effect is one that cannot be ruled out on the basis of objective information. The test is a 'likelihood' of effects, rather than a 'certainty' of effects. In the Waddenzee case, the European Court of Justice ruled that a project should be subject to appropriate assessment 'if it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site, either individually or in combination with other plans and projects.' Therefore, '*likely*', in this context, should not simply be interpreted as 'probable' or 'more likely than not', but rather whether a significant effect can objectively be ruled out (Tyldesley and Associates, 2015). The test of significance is where a plan or project could undermine the site's Conservation Objectives.

[8] In Scotland, European sites considered in the assessment process are SPAs, SACs and 'candidate' SACs (cSACs). Those parts of SPAs, SACs and cSACs that are also referred to as European Marine Sites (EMS), and those in the offshore marine area referred to as European Offshore Marine Sites (EOMS), are also included. Scottish Government policy affords the same level of protection to proposed SACs and SPAs, where they have been approved by Scottish Ministers for formal consultation. Therefore, effects on these sites should also be appraised. Finally, Scottish Planning Policy refers to the fact that all Ramsar sites are also European sites and / or Sites of Special Scientific Interest. Where the interest features of Ramsar sites overlap with those of European sites, it is Scottish Government policy to afford them the same protection.

available data and observations made from publicly accessible nearby land. Therefore, in accordance with best practice and the Environmental Impact Assessment Scope and Methodology Report (SMR), Volume 5, Appendix CT-001-00001, a precautionary approach has been applied, whereby the assessment has been undertaken using appropriate sources of information and professional judgement.

Figure 1: Proposed Annandale depot in relation to the sites considered in this report



2.1.4 This report has been compiled following guidance published by SNH (2014)[9] and Tyldesley and Associates (2015)[4], NatureScot (2021)[10] and Natural England (2016)[11]. Advice provided by NatureScot (formerly Scottish Natural Heritage), in relation to assessing connectivity with

[9] Scottish Natural Heritage (2014), *Natura Casework Guidance. How to consider plans and projects affecting Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).* Version 9.0. NatureScot.

[10] NatureScot (2021), *Habitats Regulations Appraisal (HRA).* Available online at: https://www.nature.scot/professional-advice/planning-and-development/environmental-assessment/habitats-regulations-appraisal-hra.

[11] Natural England (2016), *Functional linkage: How areas that are functionally linked to European sites have been considered when they may be affected by plans and projects – a review of authoritative decisions.* Natural England Commissioned Report NECR207.

SPA (2016)[12], and survey methods and assessment pertaining to wind farm developments (SNH, 2017)[13], have also been adopted where relevant.

2.1.5 In line with recent case law[14] and guidance produced by NatureScot[15,16], the Screening Assessment (Stages 2-5)[17] has been compiled in the absence of all mitigation measures intended to avoid or reduce harmful effects on the sites listed above.

2.2 Solway Firth SPA

2.2.1 The former Upper Solway Flats and Marshes SPA comprises an area of 1,375km^2 of the Solway Firth Estuary on the west coast of Britain, with extensive areas of intertidal mudflats, fringing saltmarshes and grazing marshes. The boundaries of the Solway Firth SPA incorporate the Upper Solway Flats and Marshes Site of Special Scientific Interest (SSSI) (the full citation is provided in Annex A) and include further marine habitats to the west.

2.2.2 The Solway Firth SPA qualifies under Article 4.1 of the EU Habitats Directive by supporting internationally or nationally important wintering populations of five Annex I species: red-throated diver (*Gavia* stellate), whooper swan (*Cygnus cygnus)*, barnacle goose (*Branta leucopsis)*, golden plover (*Pluvialis apricaria) and* bar-tailed godwit (*Limosa lappinica)*.

[12] Scottish Natural Heritage (2016), *Assessing connectivity with Special Protection Areas (SPAs), Guidance,* Version 3, NatureScot.

[13] Scottish Natural Heritage (2017), *Recommended bird survey methods to inform impact assessment on onshore wind farms,* Version 2, NatureScot.

[14] People Over Wind and Sweetman v Coillte Teoranta [C-323/17] was a reference by the Irish High Court for a preliminary ruling on the interpretation of Article 6(3) of the Habitats Directive. The Court of Justice of the European Union (CJEU) ruled that Article 6(3) must be interpreted as meaning that it is not appropriate, at the screening stage, to take account of the measures to avoid or reduce harmful effects of the project on the European site. In short, to take account of mitigation effects at the screening stage presupposes that there will be likely significant effects on the European site and therefore, based on the clear terms of the first sentence of Article 6(3), the requirement for appropriate assessment has been made out (see paragraph 38 of People Over Wind). To fail to undertake appropriate assessment would circumvent the procedural safeguards provided by the Habitats Directive and pre-empting the outcome of the appropriate assessment by taking account of mitigation measures at the screening stage is illegitimate. It is now necessary to follow the approach set out in People Over Wind and to disregard any mitigation measures at the screening stage. This judgement was upheld in August 2019 where the High Court dismissed a Claimant's appeal on the grounds that the CJEU's judgement in People over Wind and Sweetman v Coillte Teoranta is good law (Gladman Developments Limited v Secretary of State for Housing Communities and Local Government and Medway Council (2019).

[15] Scottish Natural Heritage (2018), *Guidance Note – The handling of mitigation in Habitats Regulations Appraisal – the People Over Wind CJEU judgement,* NatureScot.

[16] Mudge, G., Hill, C., Kerr, J. and Uttley, J. (2019), *SNH Guidance Note: The Handling of mitigation in Habitats Regulations Appraisal – the People over Wind CJEU judgement,* NatureScot.

[17] In accordance with Tyldesley and Associates (2015), Habitats Regulations Appraisal is separated into 13 stages. Of these, Stages 2-5 refer to Screening for Likely Significant Effects. In light of the People Over Wind judgement, it is considered that Stages 6 and 7 are no longer applicable.

2.2.3 The Solway Firth SPA qualifies under Article 4.2, as a Wetland of International Importance, by regularly supporting:

- over 20,000 water birds;
- internationally important wintering populations of the following migratory waterfowl species: pink-footed goose *Anser brachyrhynchus*; pintail *Anas acuta*; scaup *Aythya marila*; oystercatcher *Haematopus ostralegus*; knot *Calidris canutus*; curlew *Numenius arguata*; and redshank *Tringa tetanus;* and
- populations of European importance of ringed plover *Charadrius hiaticula* during the non-breeding (passage) period.

2.2.4 In addition to the species named in the paragraphs above, the SPA supports nationally important wintering populations of the following species: shelduck *Tadorna tadorna*; teal *Anas crecca*; shoveler *A. clypeata*; goldeneye *Bucaphala clangula*; grey plover *Pluvialis sguatorola*; sanderling *Calidris alba*; dunlin *Calidris alpine;* turnstone *Arenaria interpress*; common scoter *Melanitta nigra;* goosander *M. merganser*; lapwing *Vanellus vanellus;* cormorant *Phalacrocorax carbo;* black-headed gull; common gull; and herring gull *L. argentatus*. The full citation is provided in Annex A[18].

2.3 Solway Firth SAC

2.3.1 The Solway is a large, complex estuary on the west coast of Britain. It is one of the least industrialised and most natural large estuaries in Europe. There is a greater proportion of sand in the substrate than is found in more southern saltmarshes (the full citation is provided in Annex B).

2.3.2 The 43,676ha site is designated under Article 4(4) of the Directive, as it hosts the following habitats listed in Annex I:

- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);
- estuaries;
- fixed dunes with herbaceous vegetation (grey dunes) (dune grassland);
- mudflats and sandflats not covered by seawater at low tide (intertidal mudflats and sandflats);
- perennial vegetation of stony banks (coastal shingle vegetation outside the reach of waves);
- reefs;

[18] Whilst the Upper Solway Flats and Marshes SPA and the marine extension are part of the newly classified Solway Firth SPA, the original citations have been provided in Annex A.

- *Salicornia* and other annuals colonising mud and sand (glasswort and other annuals colonising mud and sand); and
- sandbanks which are slightly covered by sea water all the time (subtidal sandbanks).

2.3.3 The site is designated under Article 4(4) of the Directive, as it hosts the following species listed in Annex II:

- river lamprey *Lampetra fluviatilis*; and
- sea lamprey *Petromyzon marinus*.

2.4 Upper Solway Flats and Marshes Ramsar site

2.4.1 Coincident with the 43,676ha SAC, the flats and marshes of the Upper Solway Firth form one of the largest continuous areas of intertidal habitat in Britain. The whole estuarine complex is a site of national and international importance for wintering wildfowl and wading birds and is a vital link in a chain of west coast estuaries used by migrating birds. The Ramsar site is noted for its populations of breeding birds, natterjack toad and invertebrates. The geomorphology and vegetation of the estuarine saltmarshes is of international importance, with broad transitions to mature 'upper-marsh' being particularly well represented. A number of rare plant species and geological exposures occur within the site (the full citation is provided in Annex B). The site qualifies under Ramsar criteria 2, 5 and 6 in that it supports:

- over 10% of the British population of natterjack toad;
- assemblages of international importance in winter; and
- species/populations occurring at levels of international importance, including oystercatcher (spring/summer); and wintering whooper swan, pink-footed goose, barnacle goose, pintail, scaup, knot, bar-tailed godwit, curlew and redshank.

2.4.2 A number of species are also proposed for designation under criterion 6: lesser black-backed gull (breeding), herring gull (breeding); ringed plover (spring/autumn); and dunlin (winter).

3 Screening for likely significant effects

3.1.1 An appraisal of the potential effects on the integrity of the designated areas (Solway Firth SPA, Upper Solway Flats and Marshes Ramsar site and the Solway Firth SAC) resulting from construction and operation of the Proposed Scheme, and their likely significant effects on qualifying species, is provided below. In this regard, European guidance[19] suggests that plans or projects must be considered in all cases where they have the potential to have a likely significant effect, regardless of where they are located in relation to European protected sites. It goes on to state, that there is no geographical limit beyond which proposals are exempt from consideration.

3.1.2 NatureScot guidance[6] states that the following scenarios should be considered as part of an initial screening assessment:

- likely impacts are such that there is clear potential for the Conservation Objectives to be undermined, resulting in a conclusion of likely significant effect;
- likely impacts are so minimal (either because the affected areas are beyond the boundary of the European protected site and not of sufficient value for the species concerned, or because the risk to them is so small) that it can be confidently concluded that the Conservation Objectives will not be undermined; or
- there is doubt in relation to the scale of likely impacts, in terms of the Conservation Objectives, resulting in a precautionary conclusion of likely significant effects.

3.1.3 The assessment is based on consultation with NatureScot in 2020 and 2021, along with interpretation of available aerial imagery, observations from adjacent publicly accessible land and desk study data. The data sources used to inform this assessment are listed below:

- field observations of the land required for the construction of the Proposed Scheme, from adjacent publicly accessible land, on two occasions in December 2020 and one in January 2021;
- the 2016 and 2017 Dumfries and Galloway Bird reports[20,21];
- the British Trust for Ornithology (BTO) Atlas data for the periods 1981-1984 and 2007-2011; Birdtrack data for the period 2007-2019; Wetland Bird Survey data; non-estuarine water bird counts (NEWS); and winter gull surveys (WINGS)[22];

[19] European Commission (2000), *Managing Natura 2000 Sites: The provisions of Article 6 of the Habitats Directive 92/43EEC.*Office for Official Publications of the European Communities, Luxembourg.

[20] Henderson, B.D. (2016), *Dumfries and Galloway Bird Report No. 27.* Scottish Ornithologists' Club Dumfries and Galloway Branches, Solway Print, Dumfries.

[21] Henderson, B.D. (2017), *Dumfries and Galloway Bird Report No. 28.* Scottish Ornithologists' Club Dumfries and Galloway Branches, Solway Print, Dumfries.

[22] Data received from the British Trust for Ornithology from tetrads NY26Z and NY36E.

- Joint Nature Conservancy Council (JNCC) Seabird Colony Data[23];
- WWT Monitoring Data[24];
- the South West Scotland Environmental Information Centre (SWSEIC);
- Habitat Map of Scotland[25]; and
- the NBN Atlas[26].

3.1.4 Very limited field surveys have been possible, to date. As a consequence, the screening exercise has adopted a precautionary approach. It has been assumed that 114ha of habitat will be lost, of which 45ha will be restored following completion of the construction phase.

3.1.5 In line with the precautionary principle, it has been assumed that any bird species present will be displaced up to 300m[27,28] from the land required for the construction of the Proposed Scheme. Although there is evidence to suggest that goose species, in particular, exhibit a reduction in avoidance distances with time since construction for wind farms[29], a precautionary approach has been taken; in this instance, as a consequence of the lack of field survey data, it is assumed there will be no change in disturbance effects through time (i.e. no habituation to disturbance).

[23] Seabird Colony Data. Available online at: www.jncc.defra.gov.uk.

[24] WWT Monitoring Data. Available online at: Greeland white-fronted goose monitoring | WWT.

[25] Scottish Natural Heritage (2018), Habitat Map of Scotland (HabMoS), version dated 24/04/2018. Available online at: https://www.environment.gov.scot/our-environment/habitats-and-species/habitat-map-of-scotland/.

[26] National Biodiversity Network (2019), *National Biodiversity Network Atlas*. Available online at: nbnatlas.org. NBN Atlas data are reported only where these do not correspond with BTO Atlas data to avoid any double counting of records.

[27] Research into the displacement effects of windfarms suggest a range of between 100-600m (Rees, 2012). The likely significant effects of the proposed depot relate not to collision but to construction and operational noise, lighting and direct land required and are, consequently expected to fall within the lower end of this range. A precautionary distance of 300m has been considered appropriate based on the published literature and species considered as part of this assessment. Rees, E. (2012), *Impact of windfarms on swans and geese. A review*. Wildfowl, 62, P37-72.

[28] Cutts, N., Hemingway, K. and Spencer, J. (2013), *Waterbird disturbance mitigation toolkit. Informing estuarine planning and construction projects.* Institute of Estuarine & Coastal Studies, University of Hull. Version 3.2. The toolkit was developed to assist developers in relation to predicting the effects of disturbance impacts arising from construction works within or adjacent to SPAs and Ramsar sites. The toolkit aims to characterise construction sourced disturbance effects on estuarine waterbirds to provide both works management with a clear route to determine high level disturbance issues, and consenting authorities with sufficient information to reduce the level of precaution applied to the planning process.

[29] Harrison., A., Petkov, N., Mitev, D., Popgeorgiev, G., Gove, R. and Hilton, G. M. (2017), *Scale-dependent habitat selection by wintering geese: implications for landscape management*, Biodiversity and Conservation 1-22. 10.1007/s10531-017-1427-4.

3.2 Conservation Objectives

Solway Firth SPA

3.2.1 The Conservation Objectives of the former Upper Solway Flats and Marshes SPA aim to:

- avoid deterioration of the habitats of the qualifying species (listed in Section 2) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
- ensure for the qualifying species that the following are maintained in the long-term:
  - population of the species as a viable component of the site;
  - distribution of the species within the site;
  - distribution and extent of habitats supporting the species;
  - structure, function and supporting processes of habitats supporting the species; and
  - no significant disturbance of the species.

Solway Firth SAC

3.2.2 The Conservation Objectives of the SAC aim to ensure that the integrity of the site is maintained or restored as appropriate and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- the extent and distribution of qualifying natural habitats and habitats of qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of qualifying species; and
- the distribution of qualifying species within the site.

Upper Solway Flats and Marshes Ramsar site

3.2.3 The Conservation Objectives of the Ramsar site are inferred from the Upper Solway Flats and Marshes SSSI, taken from the Site Management Statement[30]. Of the Conservation Objectives listed, one (the third listed) is relevant to the consideration of impacts on the

[30] Upper Solway Flats and Marshes SSSI Site Management Statement prepared by SNH. Available online at: https://sitelink.nature.scot/site/1583.

integrity of the Ramsar site. This specifies the requirement to maintain wintering, migratory and breeding populations of nationally and internationally important birds.

3.2.4 The Site Management Statement clarifies this in terms of winter shooting, fishing, and recreational and general access to the estuarine habitats themselves, rather than development activities. Nevertheless, it is considered appropriate to screen the Proposed Scheme at Gretna against this objective in the absence of defined Conservation Objectives for the Ramsar site.

3.3 Likely significant effects

Data

3.3.1 The following information was provided by data holders, of which that considered relevant has been used to assess potential likely significant effects:

- BTO Atlas data for recording tetrads NY36E and NY26Z covering the land required for the construction of the Proposed Scheme, comprising 73 records of 44 species between 2007 and 2011 (the most recent available);
- Birdtrack data as of November 2019 covering Atlas tetrads NY36E and NY26Z, comprising 149 records of 41 species from between 2007 and 2019;
- SWSEIC data within a 5km radius of the land required for the construction of the Proposed Scheme, comprising 984 bird records of 118 species from between 1800 and 2017;
- NBN data search for a 10km radius of the land required for the construction of the Proposed Scheme, comprising 79,472 records of 241 species from between 1800 and 2019; and
- three visits to adjacent publicly accessible land to record observations of bird activity, where lines of sight allowed, from the land required for the Proposed Scheme, carried out on 2 and 16 December 2020 and 28 January 2021.

Features eliminated

3.3.2 In view of the distance between the land required for the construction of the Proposed Scheme and the estuary, no direct or indirect likely significant effects during construction or operation are considered for: the Solway Firth SAC; species associated with the approved Solway Firth SPA marine extension (red-throated diver, cormorant, goosander and common scoter); or, on natterjack toad (a qualifying feature of the Ramsar site), which is likely to range a very short distance beyond the boundary of the SPA/Ramsar site. It is considered that construction of the proposed Annandale depot would not therefore undermine the Conservation Objectives of these sites. These features have, consequently, been eliminated from further consideration in this Assessment.

Potential likely significant effects

3.3.3 In line with the precautionary principle, it has been assumed that all land required for the construction of the Proposed Scheme will be lost. In addition, it is assumed that up to 300m beyond this land will be subject to noise and lighting disturbance during construction and operation. In consequence, possible likely significant effects include the loss of potentially suitable habitat functionally linked to that of the SPA/Ramsar site; or the redistribution of birds away from land within 300m of land required for the construction of the Proposed Scheme. In terms of the Conservation Objectives of the SPA/Ramsar site, these effects must be assessed in relation to potential deterioration of the habitats of the qualifying species and/or significant disturbance, and therefore, the maintenance of viable populations over the long-term.

Functionally linked land

3.3.4 Estuary birds are known to range over considerable distances from the Upper Solway to locate secure high-tide roosts and/or to search for food. Typically, these comprise farmland pasture that provides security, minimal disturbance and, if wet, a food source for waders. In consequence, areas of land outside of the boundary of a site may be important, ecologically, in supporting the populations for which the site has been classified/listed[31]. Such land is considered to be linked because it provides an important role in the supporting populations of associated species for some part of their lifecycle.

3.3.5 It follows, therefore, that impacts to such habitats can have a significant effect upon the favourable conservation status of individual species, and therefore, upon the Conservation Objectives for which the site was designated/classified, where these habitats are considered to be functionally linked to the site.

3.3.6 In relation to the Proposed Scheme, a number of species for which the SPA/Ramsar site has been classified/listed utilise functionally linked land or water beyond the site boundary, be it seasonally, diurnally or even intermittently. Consequently, they are vulnerable to a range of both localised and strategic effects away from protected areas. Ecology guidance on the implementation of the Habitats Directive states clearly that evaluating the conservation status of habitats and species within the boundaries of protected sites is insufficient, where these features are only partially covered by the sites themselves. The relevance of functionally linked land to the HRA process is encapsulated in the following quote from

[31] Chapman, C. and Tyldesley, D. (2016), *Functional linkage: How areas that are functionally linked to European sites have been considered when they may be affected by plans and projects - a review of authoritative decisions*. Natural England Commissioned Reports, Number 207.

paragraph 27 of the High Court judgement in RSPB and others v Secretary of State and London Ashford Airport Ltd[32]:

'There is no statutory authority on the significance of the non-statutory status of the FLL[33]. However the fact that the FLL was not within a protected site does not mean that the effect which a deterioration in its quality or function could have on a protected site is to be ignored.....I am satisfied...that whilst no particular legal status attaches to FLL, the fact that land is functionally linked to protected land means that the indirectly adverse effects on a protected site, produced by effects on FLL, are scrutinised in the same legal framework just as are the direct effects of acts carried out on the protected site itself. That is the only sensible and purposive approach where a species or effect is not confined by a line on a map or a boundary fence. This is particularly important where the boundaries of designated sites are drawn tightly as may be the UK practice.'

3.3.7 Very limited field surveys have been carried out to inform this HRA due to access restrictions; therefore, in the absence of such information, aerial photography, observations from publicly accessible adjacent land (in December 2020 – January 2021) and desk study data have been used to determine the likely suitability of land required for the construction of the Proposed Scheme for qualifying bird species of the SPA/Ramsar site.

3.3.8 The loss of suitable habitat as a consequence of the Proposed Scheme is considered in relation to the resource present in the wider landscape (see Table 1), and to the availability of alternative habitats for those individuals likely displaced. Specifically, the basis for this assessment assumes that the qualifying bird species of the SPA/Ramsar site affected by the Proposed Scheme will preferentially relocate to higher quality habitats within their core feeding range (SNH, 2016), in line with the concept of a buffer effect[34]. The extent of available habitat within the wider landscape, and within the core feeding range of each interest feature, will determine whether effects are likely at the level of the whole population, through: a reduction in the average fitness of all individuals arising from decreased resource availability; or, disproportionately at the level of the individual, through antagonistic encounters with dominant conspecifics[35,36]. Where negative effects to individual

[32] RSPB and others v Secretary of State and London Ashford Airport Ltd (2014 EWHC 1523 Admin).

[33] FLL refers to functionally linked land.

[34] Gill, J.L., Norris, K., Potts, P.M., Gunnarsson, T.G., Atkinson, P.W. and Sutherland, W.J. (2001), *The buffer effect and large-scale population regulation in migratory birds,* Nature 412, 436-438. An extension of carrying capacity is the buffer effect. Conditional on there being demographic costs of inhabiting poor-quality sites, this predicts that where reproductive success and survivorship vary between potential habitats, sites will be sequentially filled according to a preference hierarchy with populations on preferred sites buffered over time by those on less-suitable habitats.

[35] Halama, K.J. and Duesser, R.D. (1994), *Of mice and habitats: tests for density-dependent habitat selection,* Oikos 69, P107-114.

birds cannot be discounted, it is considered that it will not be possible to rule out the risk of likely significant effects either alone or in-combination.

Habitat suitability

3.3.9 From aerial photography, limited observations from publicly accessible adjacent land and data available through the Habitat Map of Scotland[18], habitats within the land required for the construction of the Proposed Scheme appear to include parcels of improved grassland, interspersed by rough, cattle and sheep-grazed pasture between the WCML and the B7076. The Ewes Burn flows through the land required for the construction of the Proposed Scheme and extends to the south, crossing below the B7076. Field boundaries are separated by hedgerows and tree lines. Woodland, including ancient woodland of plantation origin, is present in small parcels near to the junction between the A74(M) and the B7076 Roman Road, to the north of the existing railway, and to the south of the Ewes Burn adjacent to the B7076.

3.3.10 Towards the west of the land required for the construction of the Proposed Scheme and associated with the land adjacent to the Ewes Burn, the habitat appears to include patchy scrub and rough grassland, with small, isolated patches of marshy/wet grassland. The majority of land falls within the Flow Plateau Landscape Character Area[37]. Land to the south falls within the Coastal Flats Landscape Character Area[38], characterised as flat and low-lying, with large to medium sized fields of improved pasture, with some arable cultivation. It is generally cattle-grazed, nearer the coast, with a mix of sheep and cattle further inland. The land required for the construction of the Proposed Scheme does not fall within any of the NatureScot integrated Habitat Network areas (woodland, neutral grassland, wetland, heathland or acid grassland).

3.3.11 Spatial data sourced from the Scottish Environment Protection Agency (SEPA)[39] indicate no areas of river or groundwater flooding from within or adjacent to the land required for the construction of the Proposed Scheme. The closest areas of river flooding are associated with Kirtle Water, more than 600m to the south beyond the A74(M). Whilst there are areas of surface water flooding from within the land required for the construction of the Proposed

[36] Ferrer, M. and Donazar, J.A. (1996), *Density-dependent fecundity by habitat heterogeneity in an increasing population of Spanish Imperial Eagles,* Ecology 77, P69-74.

[37] Scottish Natural Heritage (2019a), *SNH National Landscape Character Assessment. LCT 171 Flow Plateau – Dumfries and Galloway*. Available online at: https://www.nature.scot/professional-advice/landscape/landscape-character-assessment.

[38] Scottish Natural Heritage (2019b), *SNH National Landscape Character Assessment. LCT 158 Coastal Flats – Dumfries and Galloway.*

[39] Scottish Environment Protection Agency (2019), Flood Extent Map. Available online at: https://map.sepa.org.uk/floodmap/map.htm.

Scheme, these are restricted to small, isolated patches along the Ewes Burn and comprise less than 5% of the total habitat area.

3.3.12 Data collected during the three observation visits to adjacent publicly accessible land confirmed the nature of the habitats and no wildfowl or wader species were recorded. Instead, the assemblage was characterised by locally common and widespread species typical of farmland habitats in lowland Scotland, including robin *Erithacus rubecula*; blackbird *Turdus merula*; blue tit *Cyanistes caeruleus*; great tit *Parus major*; jackdaw *Corvus monedula*; rook *C. frugilegus*; carrion crow *C. corone*; starling *Sturnus vulgaris*; house sparrow *Passer domesticus*; chaffinch *Fringilla coelebs* and goldfinch *Carduelis carduelis*.

Screening for likely significant effects

3.3.13 Each of the qualifying bird species associated with the Solway Firth SPA/Upper Solway Flats and Marshes Ramsar site is considered in Table 1, on the basis of the following criteria: habitat preference; suitability of land required for the construction of the Proposed Scheme; known local distribution; and desk study data. This information has been used to assess the potential for the following likely significant effects:

- loss of habitat functionally connected to the SPA/Ramsar site; and
- disturbance to species occurring in numbers considered to be significant in terms of the maintenance of the Conservation Objectives of the species for which the SPA/Ramsar site has been classified/listed.

3.3.14 High level noise are characterised by sudden events over 60dB (at the receptor not the source) or a more prolonged noise of over 72dB[40]. Similarly, moderate noise level effects are those occasional noise events above 55dB, regular noise of 60-72dB and long-term regular noise above 72dB, where birds have become habituated. There is cross-over between the moderate and high categories. The higher category is assumed for those species considered to be particularly sensitive (i.e. brent goose, curlew and redshank) or of greater than average sensitivity (i.e. shelduck and bar-tailed godwit). Finally, low noise level effects are those considered unlikely to elicit a response in birds and include noises of less than 55dB at the receptor. These effects are likely to be masked by background inputs in all but the least disturbed areas. A noise-decay function can be applied to any given scenario to predict the likely noise levels experienced by birds. Using the information provided, it is possible to calculate likely disturbance effects for a given noise level and distance of the receptor (bird) from source. For instance, generation of 100dB(A) at source will provide a likely acceptable receptor dose[39] of 70dB(A) at approximately 20m distance. Similarly, a source generating 90dB(A) would be below the impact threshold at 10m distance.

[40] Cutts, N., Phelps, A. and Burdon, D. (2009), *Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance,* Report to Humber INCA, Institute of Estuarine and Coastal Studies University of Hull.

3.3.15 Noise effects are also considered alongside visual disturbance effects. Taking a precautionary approach, the construction and operational phases are considered to generate high level[41] disturbance responses for all species in the absence of habituation.

[41] High level disturbance results in birds moving away from the source to areas less affected. Birds than remain will experience a reduction in foraging efficiency which may affect survival. Visual stimuli reach high levels easily including the presence of workers, fast movement, large plant and proximity to the birds.

Table 1: Screening assessment for key bird species associated with the Solway Firth SPA/Upper Solway Flats and Marshes Ramsar site

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
Whooper swan	Yes – inland farmland on and within 300m of the land required for the construction of the Proposed Scheme; although the suitability is reduced due to the presence of hedgerows, woodland blocks and an overhead power line. These habitat features reduce lines of sight for foraging flocks and collectively decrease the likelihood of usage where alternative, higher quality, open habitats are available.	Favourable, Recovered (2007)	In 2017, 59% wintering population at Caerlaverock National Nature Reserve (NNR)/Wildfowl and Wetlands Trust (WWT) site. Concentrated around the Solway Estuary. Research into disturbance effects on this species at Black Cart SPA[44] noted responses up to 1.6km from source, although responses decreased both with increasing flock size and disturbance	No BTO Atlas or Birdtrack data were returned for this species associated with NY26Z and NY36E. SWSEIC data confirm the wintering distribution of birds in primarily coastal locations, with contemporary records[45] from Redkirk (maximum 110 birds in 2009), south of Rigg (maximum 4 birds), Sarkmouth (maximum 16 birds in 2009), Gretna foreshore (20+ in 2017) and west of Gretna (maximum of 6 in 2011). Given the accuracy of these records[46], the closest of these was at least 1.2km south-west of the land required for	Yes – possible loss of functionally linked land within 5km of night roost (core winter feeding zone); and possible demographic costs to the SPA/Ramsar site population, due to the localised redistribution of birds. Possible high level visual and noise disturbance resulting in localised redistribution, where noise levels exceed 70dB, resulting in possible loss of feeding efficiency and demographic costs to the population. Whilst suitable habitat is present, and birds could access the land required for, and within 300m of, the construction of the Proposed Scheme,

[42] Scottish Natural Heritage, Protected Nature Sites, 2021. Available online at: https://informatics.sepa.org.uk/ProtectedNatureSites/.

[43] Information from the Waterbird Disturbance & Mitigation Toolkit (Cutts, Hemingway and Spencer, 2013) is presented where available as a simple RAG rating where green is least and red most sensitive. For the purpose of this assessment, this has been converted to low, medium and high sensitivity.

[44] Rees, E.C., Bruce, J.H. and White, G.T. (2005), *Factors affecting the behavioural responses of whooper swans (Cygnus c. Cygnus) to various human activities,* Biological Conservation 121, P369-382.

[45] From between 2009 and 2019.

[46] Most are provided to 1000m resolution only.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
			frequency.	the construction of the Proposed Scheme north of Gretna. NBN data records were concentrated from the estuarine areas of the Solway, with 501 data records from within 10km, of which 190 are considered contemporary; 5 from within 5km; 4 within 2km; closest records 1.5km south-west adjacent to Kirtle Water. Records concentrated to the south and east of Gretna and the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020-January 2021.	there are no wintering data for the site from any of the data sources and extensive suitable habitat is present within the wider landscape. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site. Nevertheless, although the scope for whooper swan to be present on and within 300m of the land required for the construction of the Proposed Scheme is limited by the habitat quality, likely significant effects associated with the loss of functionally linked land, displacement and noise-related disturbance cannot be ruled out without further assessment.
Barnacle goose	Yes – inland farmland on and within 300m of the land required for the construction of the Proposed Scheme.; although the suitability is reduced due to the presence of hedgerows, woodland blocks and an overhead power line. These habitat	Favourable, Maintained (2007)	Common winter visitor to the coast. Scarce winter visitor to inland waters and farmland. In 2017, 58.5% of birds occurred at Caerlaverock NNR-WWT, 15.2% at RSPB Mersehead, 8.2% at Wigtown Bay Local	No BTO Atlas data were returned for this species associated with NY26Z and NY36E. A count of 60 individuals were returned by Birdtrack in 2016 at Gretna Services south of the A74(M). SWSEIC records show large	Yes – loss of possibly functionally linked land within 15km of night roost (core winter feeding zone); and possible demographic costs to the SPA/Ramsar site population due to the localised redistribution of birds. Whilst suitable habitat is present, and birds could access the land required for, and within 300m of, the

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	features reduce lines of sight for foraging flocks and collectively decrease the likelihood of usage where alternative, higher quality, open habitats are available. Attractiveness of fields further reduced where stock is present.		Nature Reserve (LNR) and 3.7% Auchencairn Bay. Generally regarded as highly vulnerable to visual disturbance and are known to avoid fields where stock is present (Owen, 1973)[47].	numbers of birds from estuarine areas including Rockcliffe Marsh (maximum of 12,000 in 2009), with 2 at Redkirk Point in 2017). The closest of these are from the Gretna foreshore (maximum of 3,000 birds in 2017). The NBN returned 490 records from within 10km, of which 113 are considered contemporary; and 2 within 5km. All are from land to the south of the A75, the closest of which was near Rigg from 2014 approximately 2.8km south of land required for the construction of the Proposed Scheme. Records are concentrated to the south and west, associated with the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January	construction of the Proposed Scheme, there are no wintering data for the site from any of the data sources. It is, therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site. Nevertheless, although the scope for barnacle goose to be present on, and within 300m of, the land required for the construction of the Proposed Scheme is limited by the habitat quality, and extensive alternative habitat is present within the wider landscape, likely significant effects associated with the loss of functionally linked land, displacement and noise-related disturbance cannot be ruled out without further assessment.

[47] Owen, M. (1973), *The management of grassland areas for wintering geese,* Wildfowl 24, P123-130.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
				2021.	
Golden plover	Yes – inland farmland is present on and within 300m of the land required for the construction of the Proposed Scheme.	Favourable, Maintained (2007)	Common winter visitor to coasts and uncommon winter visitor to inland farmland. In 2017, most records were from Caerlaverock NNR-WWT (45.9%), Wigtown Bay LNR (6.1%), RSPB Crook of Baldoon (4.9%), Auchencair Bay and Corsewall Point (3.7% each) and Southerness Point (3.3%). Sensitivity to disturbance – medium. Golden plover is moderately sensitive to disturbance, with effects noted within 200m. A precautionary approach assumes tolerance of noise up to 72dB considered acceptable at the bird, but with caution above 55dB (60dB in highly disturbed areas).	No BTO Atlas or Birdtrack data were returned for this species associated with NY26Z and NY36E. SWSEIC returned 8 records between 1910 and 2017. Of these, three were provided from west of Gretna and south of the A74(M), with a maximum count of 2000 in 2010. Given the accuracy of these records, the closest of these was at least 1.2km south-west of the land required for the construction of the Proposed Scheme. NBN returned 495 records from within 10km, of which 70 records are considered contemporary. The closest of these is to the west of Rigg, approximately 6.9km to the south-west of land required for the construction of the Proposed Scheme. Records concentrated to the south-east and south-west of Gretna, associated with the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed	Yes – loss of possibly functionally linked land within core winter feeding zone; and possible demographic costs to the SPA/Ramsar site population due to the localised redistribution of birds. Whilst suitable habitat is present, and birds could access the land required for, and within 300m of, the construction of the Proposed Scheme, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site. However, given the location within the core foraging zone, likely significant effects associated with displacement and noise-related disturbance cannot be ruled out.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
				Scheme from adjacent land carried out in December 2020 – January 2021.	
Bar-tailed godwit	No – exclusively present on estuarine areas absent on and from within 300m of the land required for the construction of the Proposed Scheme.	Unfavourable, No Change (2016)	Common winter visitor and passage migrant to coastal areas. All records were from coastal locations. Sensitivity to disturbance – medium. Bar-tailed godwit are considered relatively disturbance tolerant[40] and a distance of 200m is considered relevant during construction.	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. No records were returned by SWSEIC. The NBN returned 138 records within 10km, of which 19 records are contemporary. All were concentrated around the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	No – eliminated from further consideration due to the lack of suitable habitat.
Pink-footed goose	Yes – inland farmland is present within and within 300m of the land required for the construction of the Proposed Scheme; although the suitability is reduced due to the presence of hedgerows, woodland blocks	Favourable, Maintained (2007)	Common winter visitor on coasts, uncommon winter visitor to farmland and inland waters. In 2017, records fluctuated over the winter period across individual sites within the Region. Numbers were	The BTO Atlas data returned a single record of 1 bird recorded from NY36E and none from NY26Z. BirdTrack data also returned a flock of 100 birds from 2011 within Atlas tetrad NY26Z in fields to the south of the A74(M). SWSEIC returned 30 records, with	Yes – loss of possibly functionally linked land within 15km (core winter feeding zone) of night roosts; and possible demographic costs to the SPA/Ramsar site population due to the localised redistribution of birds. Possible high level visual and noise disturbance resulting in localised

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	and an overhead power line. These habitat features reduce lines of sight for foraging flocks and collectively decrease the likelihood of usage where alternative, higher quality, open habitats are available.		concentrated at Caerlaverock, Threave National Trust Site, Auchencairn, Wigtown Bay LNR, West Freugh and Loch Connell. Generally regarded as highly vulnerable to human disturbance (RSPB, 2021)[48].	the majority of birds recorded from Rockcliffe Marsh (78% of the total birds recorded). Eight records between 2008 and 2017, were returned from Gretna foreshore (20 in 2017), north of Rigg (maximum of *c.*1,000 in 2010), north of the River Sark east of Gretna (400), Gretna (maximum of *c.*30 in 2015), Gretna Green (*c.*130 in 2008), south of A74(M) near Kirtle Water (100 in 2011). The NBN returned 388 records from within 10km, of which 121 records were considered contemporary; 11 within 5km. The closest records are to the north of Gretna Services in 2008 and 2010, approximately 300m south of the land required for the Proposed Scheme and south of the wind turbine. Records concentrated to the south-east and south-west of Gretna. Not	redistribution where noise levels exceed 70dB up to 300m from receptor resulting in possible loss of feeding efficiency and demographic costs to the population. Whilst suitable habitat occurs and birds could access the land required for, and within 300m of, the construction of the Proposed Scheme, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site. Nevertheless, although the scope for pink-footed goose to be present on, and within 300m of, the land required for the construction of the Proposed Scheme is limited by the habitat quality, and extensive alternative habitat is present within the wider landscape, likely significant effects

[48] Royal Society for the Protection of Birds (2021), *Pink-footed goose*. Available online at: https://www.rspb.org.uk/our-work/conservation/conservation-and-sustainability/farming/advice/helping-species/pink-footed-goose/.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
				recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021. The NatureScot Rural Surveyor stating with confidence that this species has not been recorded on these fields in the past 12 years[49].	associated with the loss of functionally linked land, displacement and noise-related disturbance cannot be ruled out without further assessment.
Pintail	No – associated with coastal and inland waters not present on, or within 300m of, the land required for the construction of the Proposed Scheme. Some potential for	Favourable, Maintained (2015)	Common winter visitor on coasts and inland waters. In 2017, most records were from Caerlaverock NNR-WWT (49.5%), RSPB Mersehead (14.6%),	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned a single record from 1891 at Rockcliffe Marsh. The NBN returned 162 records from	No – eliminated from further consideration due to the lack of suitable habitat on, and within 300m of, the land required for the construction of the Proposed Scheme. Closest records are 1.5km south of the land

[49] Statement provided by email on 24th November 2020 from the NatureScot Rural Surveyor (Dylan deSilva pers. comm.): 'I have travelled through the area, year round for the past 12 years, and whilst pink footed geese are seen moving through and within the area, I am not aware of any particular fields or areas within the zone identified on their map, which would cause a concern if it were to change from cereal/grassland to a railway depot. Any loss of fields which are occasionally used are likely to be compensated for by birds moving to other fields within the area and/or across the wider area. In terms of connectivity with the Solway, the pink footed geese using the wider area will roost on the Solway some of the time, and potentially in larger fields inland (potentially around where they feed), but I am not aware of any particular roost in the area in question (or locations which could be potential roosts). Changes in land management are unlikely to cause any material effect on their distribution, unless it involved a wholescale shift form cereal/grass to a crop which did not offer goose grazing. Knowing the land quality/drainage in this area, such a change is most unlikely. Obviously, there are a range of other birds using the Solway which could potentially use the subject area, but again, I am not aware of any particular concentrations of any species within the subject area. As such, I cannot reasonably foresee any particular issues from a bird point of view.'

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	presence on inundated grassland habitats present on and within 300m of the land required for the construction of the Proposed Scheme during prolonged wet periods. Data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.		Wigtown Bay LNR (9.6%) and Carskuith (6.5%). Pintail have been shown to be least sensitive to disturbance[50].	within 10km of the land required for the construction of the Proposed Scheme, of which 63 are contemporary. 14 were from within 5km. The closest records were from fields adjacent to Kirtle Water, 1.5km south of the land required for the construction of the Proposed Scheme. Records concentrated around the Solway Estuary. None from within 200m of the land required for the construction of the Proposed Scheme. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	required for the construction of the Proposed Scheme. Closest inland water body is Gavins Loch, 374m south of land required for the construction of the Proposed Scheme. At this distance, this is unlikely to result in significant disturbance effects at the population level due to the low sensitivity reported for this species. Whilst suitable habitat occurs and birds could access the land required for, and within 300m of, the construction of the Proposed Scheme during prolonged wet periods when the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the

[50] Cutts, N., Phelps, A. and Burdon, D. (2009), *Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance,* Report to Humber INCA, Institute of Estuarine and Coastal Studies University of Hull.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
					SPA/Ramsar site.
Scaup	No – coastal and inland waters not present on, or within 300m of, the land required for the construction of the Proposed Scheme. Some potential for presence on inundated grassland habitats on and within 300m of the land required for the construction of the Proposed Scheme during prolonged wet periods. Data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for	Favourable, Maintained (2015)	Winter visitor, especially to Loch Ryan and the Inner Solway. Occasionally to inland waters. In 2017, numbers were concentrated at Loch Ryan (93% in January). Scaup are considered highly sensitive to disturbance effects (Borgmann, 2012)[51].	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned two records, 'several adults' from Sarkfoot in 1986 and 15 birds in 2017 from the Gretna foreshore. The NBN returned 201 records from within a 10km radius, of which 25 are contemporary. Five records were from within 5km, all associated with estuarine habitats. Closest records associated with the Solway Estuary foreshore. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	No – eliminated from further consideration due to the lack of suitable habitat on, and within 300m of, the land required for the construction of the Proposed Scheme. Closest inland water body is Gavins Loch, 374m south of land required for the construction of the Proposed Scheme. Whilst suitable habitat occurs and birds could access the land required for the construction of, and within 300m of, the Proposed Scheme during prolonged wet periods when the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the

[51] Borgmann, K.L. (2012), *A review of human disturbance impacts on waterbirds, Produced in relation to the proposed Palm Paper CCGT Order, Saddlebow Industrial estate, Kings Lynn,* PINS Reference: EN010039. Available online at: https://hogisland.audubon.org/sites/default/files/documents/humandisturbanceimpactsreportfinal.pdf.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	the construction of the Proposed Scheme.				SPA/Ramsar site.
Oystercatcher	Yes – inland farmland adjacent to estuarine areas during harsh winters where birds are unable to obtain their food requirements from the estuarine areas. Estuarine areas are not present on or within 300m of the land required for the construction of the Proposed Scheme.	Favourable, Declining (2016)	Common resident on coasts and summer visitor to farmland and inland waters. In 2017, most records were from Caerlaverock NNR-WWT (18.4%), Loch Ryan (8.3%), Wigtown Bay LNR (5.7%), Carskuith (5.4%), Kircudbright Bay (2.3%) and Isle of Whithorn (2%). Sensitivity to disturbance – medium; however, oystercatcher are relatively tolerant of disturbance stimuli and are considered likely to habituate rapidly to ongoing activity[40]. The species is relatively tolerant of moderate and	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned 19 records, the closest of which was from the Gretna foreshore and Gretna south of the A74(M) in 2017. The NBN returned 839 records from within a 10km radius, of which 234 are contemporary. Twenty-two records were returned from within 5km and 2 within 1km. The closest records were from adjacent to Kirtle water in 2010, 770m south of land required for the construction of the Proposed Scheme. Records concentrated around the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed	No – whilst suitable habitat occurs on, and within 300m of, the land required for the construction of the Proposed Scheme and birds could access this land during harsh winters, birds tend to move inland via linear waterways. Desk study data appear to accord with this behaviour, with the closest records located 700m to the south of land required for the construction of the Proposed Scheme associated with Kirtle Water. Although the Ewes Burn could provide a corridor for movement for this species during harsh winters when birds are forced inland where cockle *Cardiidae spp*. and mussel *Mytilus spp*. availability is insufficient, individual oystercatchers are shown to exhibit high levels of site fidelity in winter and are consequently less mobile than

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
			high levels of visual disturbance within a radius of 200m of construction works.	Scheme from adjacent land carried out in December 2020 – January 2021.	other species such as knot (Atkinson et al., 2000[52]). Whilst Atkinson et al. (2000) also state that inland feeding in winter is more common on the south and west coasts, there are no wintering data from with the land required for the construction of the Proposed Scheme from any of the data sources. Further, in contrast with coastal areas, inland birds tend to be in pairs rather than larger aggregations. In addition, there are extensive areas of suitable grassland habitat adjacent to the favoured estuarine areas. The species is considered unlikely to be present away from these coastal fields. It is therefore, considered highly unlikely that, if present at all, this species would be present in numbers likely to undermine the Conservation Objectives of the site even during harsh winter periods where birds could come further inland.

[52] Atkinson, P.W., Clark, N.A., Clark, J.A., Bell, M.C., Dare, P.J. and Ireland, P.L. (2000), *The effects of changes in shellfish stocks and winter weather on shorebird populations: results of a 30-year study on the Wash, England,* BTO Research Report 238, Thetford.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
Knot	No - present on estuarine areas absent on and from within 300m of the land required for the construction of the Proposed Scheme. Whilst birds may come inland where there is regular flooding/standing water, data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with only minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.	Favourable, Declining (2015)	Common winter visitor to the inland Solway coast. All records were from coastal locations. Sensitivity to disturbance – high. Knot are considered sensitive to noise above 55dB or 60dB in highly disturbed areas[40].	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. No records were returned by SWSEIC. The NBN returned 152 records from within a 10km radius, of which 31 were considered contemporary. All which were concentrated around the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	No – eliminated from further consideration due to the lack of suitable habitat. Whilst suitable habitat occurs and birds could access the land required for, and within 300m of, the construction of the Proposed Scheme during prolonged wet periods when the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.
Curlew	No - present on estuarine areas absent on and from within 300m of the land required for the construction of the Proposed Scheme. Some potential for presence on inundated grassland habitats on and within 300m	Unfavourable, No Change (2016)	Common passage migrant and winter visitor. In 2017, most records were submitted from Caerlaverock NNT-WWT (25.5%), Wigtown Bay LNR (7.7%), Carsluith (7.2%), RSPB Mersehead	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. Two records were returned by SWSEIC from 2017, the closest of which was from fields to the south of the A74(M) to the west of Gretna. The NBN returned 1174 records	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on or within 300m of the land required for the construction of the Proposed Scheme. Whilst suitable habitat occurs and birds could access the land required for the

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	of the land required for the construction of the Proposed Scheme during prolonged wet periods. Data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.		(6.2%), Loch Ryan (5.1%) and Southerness (3.4%). Sensitivity to disturbance – medium. Curlew are considered to be moderately sensitive to disturbance within a 300m radius for construction works[40].	within 10km, of which 243 were contemporary. All records were located more than 2km from land required for the construction of the Proposed Scheme. Records were concentrated around the Solway Estuary. None from within 300m of the land required for the construction of the Proposed Scheme. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	construction of the Proposed Scheme and the adjacent 300m radius during prolonged wet periods where the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.
Redshank	No – present on estuarine areas and coastal lagoons absent on and from within 300m of the land required for the construction of the Proposed Scheme. Whilst birds may come inland where there is regular flooding/standing water, data from SEPA suggest that the land required for the construction of the Proposed	Favourable, Maintained (2015)	Common resident on coasts. In 2017, most records were from Caerlaverock (27.3%), Wigtown Bay LNR (7%), Loch Ryan (6.4%), Carsluith (6%) and Auchencairn Bay and Airds Point to Carsethorn (both 4%). Sensitivity to disturbance – high.	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. Two records were returned by SWSEIC from 2017, the closest of which was from fields to the south of the A74(M) to the west of Gretna. The NBN returned 1160 records from within 10km, of which 296 are contemporary. All records were from around the Solway Estuary; 61 were from within 5km and none	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on, or within 300m of, the land required for the construction of the Proposed Scheme. Whilst suitable habitat occurs and birds could access the land required for the construction of the Proposed Scheme and the adjacent 300m radius during prolonged wet periods where the habitats are likely inundated, given the

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	Scheme is not subject to groundwater flooding, with only minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.			from within 2km of the land required for the construction of the Proposed Scheme. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020/January 2021.	limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.
Ringed plover – passage	No – estuarine areas absent from and within the land required for the construction of the Proposed Scheme. Occasionally present on inland wetlands during periods of seasonal inundation where there is regular flooding/standing water, however data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with only minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of	Favourable, Maintained (2006)	Common resident on coasts. Scarce summer visitor to inland waters. In 2017, spring/autumn passage records were from estuarine locations only. Sensitivity to disturbance – low.	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned 3 records, 2 records totalling 67 birds from Rockcliffe Marsh (no month specified but assumed to be within the breeding season given the notes) and 1 from the Gretna foreshore in August 2017. None were from the passage period. The NBN returned 210 passage records from within 10km, of which 62 records are contemporary. All records were from around the Solway Estuary. Not recorded during observation surveys of the land required for the	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on, or within 300m of, the land required for the construction of the Proposed Scheme. Whilst suitable habitat is present, and birds could access the land required for, and within 300m of, the construction of the Proposed Scheme during prolonged wet periods when the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	the total area within the land required for the construction of the Proposed Scheme.			construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	SPA/Ramsar site.
Shelduck	No – coastal areas and inland waters absent on and from within 300m of the land required for the construction of the Proposed Scheme. Whilst birds may come inland where there is regular flooding/standing water, data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with only minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.	Favourable, Maintained (2015)	Common resident on coast, some inland during the breeding season. Most records were from Caerlaverock NNR-WWT (31.8%), Wigtown Bay LNR (9.2%), RSPB Mersehead (7.1%), Carsluith (6%) and RSPB Crook of Baldoon and Loch Ryan (both 5.4%). Sensitivity to disturbance – high. Typically, this species remains at least 300m distant from construction works and is affected by visual disturbance up to 500m[40].	A single record of shelduck was returned for NY26Z, with no records for NY36E. No Birdtrack data were returned. SWSEIC returned a single record of shelduck from 2017 from the Gretna foreshore. The NBN returned 788 records from within 10km, of which 134 are contemporary. Records were concentrated around the estuarine habitats, with just one elsewhere. The closest record was from fields adjacent to Kirtle Water, 770m south of the land required for the construction of the Proposed Scheme. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on, or within 300m of, the land required for the construction of the Proposed Scheme. Closest inland water body is Gavins Loch, 374m south of land required for the construction of the Proposed Scheme. Nevertheless, whilst suitable habitat occurs and birds could access the land required for, and within 300m of, the construction of the Proposed Scheme during prolonged wet periods when the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
Teal	No – coastal and inland wetlands absent from and within 300m of the land required for the construction of the Proposed Scheme. Whilst birds may come inland where there is regular flooding/standing water, data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with only minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.	N/A	Common winter visitor on coast and inland waters. In 2017 most records were from Caerlaverock NNR-WWT (51.1%), RSPB Mersehead (7.3%), Wigtown Bay LNR (5.3%), and RSPB Ken-Dee Marshes/Loch Ken (3.2%). Teal are considered more sensitive to anthropogenic sources of disturbance compared to those generated by natural disturbance such as predators (Bregnballe et al., 2017)[53].	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned no records. The NBN returned 1116 records from within 10km, of which 379 are contemporary. Records were concentrated around the estuarine habitats, with just one elsewhere. The closest record was from fields adjacent to Kirtle Water, 770m south of the land required for the construction of the Proposed Scheme. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on, or within 300m of, the land required for the construction of the Proposed Scheme. Closest inland water body is Gavins Loch, 374m south of land required for the construction of the Proposed Scheme. Whilst suitable habitat occurs and birds could access the land required for the construction of the Proposed Scheme and the adjacent 300m radius during prolonged wet periods where the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the

[53] Bregnballe, T., Speich, C., Horsten, A. and Fox, A.,D. (2017), *Differential flight responses of spring staging Teal Anas crecca and Wigeon A. Penelope to human versus natural disturbance,* Wildfowl 67, P130-140.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
					SPA/Ramsar site.
Shoveler	No – coastal and inland wetlands absent from and within 300m of the land required for the construction of the Proposed Scheme. Whilst birds may come inland where there is regular flooding/standing water, data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with only minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.	N/A	Common winter visitor on coast and inland waters. In 2017, most records were from Caerlaverock NNR-WWT (64.9%), Wigtown Bay LNR (5.1%) and Milton Loch, RSPB Ken-Dee Marshes and Loch Ryan (all 3.2%). Shoveler are considered moderately sensitive to disturbance, although data are limited to water-based recreational activities (Hockin et al., 1992[54]).	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned no records. The NB returned 350 records from within 10km, of these 97 are contemporary. Four records, all historical, were returned from land 2.9km south-west, likely associated with Kirtle Water. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on or within 300m of the land required for the construction of the Proposed Scheme. Whilst suitable habitat occurs and birds could access the land required for the construction of the Proposed Scheme and the adjacent 300m radius during prolonged wet periods where the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.
Goldeneye	No – coastal and inland	Unfavourable,	Common winter visitor to	The BTO Atlas data and Birdtrack	No – eliminated from further

[54] Hockin, D., Ounsted, M., Gorman, M., Hill, D., Keller, V. and Barker, M.A. (1992), *Examination of the effects of disturbance on birds with reference to its importance in ecological assessments*, Journal of Environmental Management 36, P253–286.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	wetlands absent from and within 300m of the land required for the construction of the Proposed Scheme. Whilst birds may come inland where there is regular flooding/standing water, data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with only minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.	Declining (2007)	coasts and inland waters. Six birds recorded at Redkirk Point, Gretna in January 2017. Records from coastal areas only. Goldeneye are considered to be moderately sensitive to disturbance but generally immediately re-settle, with safe working buffers for forestry workers suggested between 150-300m (Ruddock and Whitfield, 2007)[55].	returned no records from NY36E and none from NY26Z. SWSEIC returned 11 records between 1978 and 2017. Of these, 99% of individuals were reported from coastal areas. A single record of 2 birds was returned from NY3167 at Gretna, at least 1.3km from the land required for the construction of the Proposed Scheme. The NBN returned 1081 records from within 10km, of which 251 are contemporary. Seventy-three records are from within 5km (8 contemporary), the closest of which was from fields to the east of Kirtle Water 2.9km south-west of the land required for the construction of the Proposed Scheme. Records were concentrated around the Solway Estuary and to the east of Gretna. Not recorded during observation surveys of the land required for the	consideration due to the lack of suitable habitat and absence of desk study records on or within 300m of the land required for the construction of the Proposed Scheme. Whilst suitable habitat occurs and birds could access the land required for the construction of the Proposed Scheme and the adjacent 300m radius during prolonged wet periods where the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.

[55] Ruddock, M. and Whitfield, D.P. (2007), *A review of disturbance distances in selected bird species,* A report from Natural Research (projects) Ltd to NatureScot.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
				construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	
Grey Plover	No – present on estuarine areas absent from and within 300m of the land required for the construction of the Proposed Scheme.	Favourable, Declining (2016)	Common winter visitor to coast. All records from coastal areas in 2017. Sensitivity to disturbance – medium. Grey plover is considered to be relatively tolerant to disturbance[40]. However, despite this, birds have been known to abandon highly disturbed areas.	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned no records. The NBN returned 107 records within 10km, of which 28 are contemporary. Two records were from within 5km, the closest of which was from fields to the north of the estuary, neat Baurch, 4.3km south of land required for the construction of the Proposed Scheme. All records from around the Solway Estuary. Species not recorded during surveys in December 2020 – January 2021.	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on or within 300m of the land required for the construction of the Proposed Scheme.
Sanderling	No – present on estuarine areas absent from and within 300m of the land required for the construction of the Proposed Scheme. Whilst	N/A	Passage migrant and winter visitor to coasts. All records in 2017 from coastal sites. Sensitivity to disturbance	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned no records. 2 records from within 10km, none	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on or within 300m of the land required for the construction of

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	birds may come inland where there is regular flooding/standing water, data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with only minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.		– low. Sanderling is thought to be extremely tolerant to disturbance, with a radius of 50m suggested as likely to result in disturbance responses[40].	of which were within 5km. All records were from around the Solway Estuary. None from within 300m of the land required for the construction of the Proposed Scheme. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	the Proposed Scheme. Whilst suitable habitat occurs and birds could access the land required for the construction of the Proposed Scheme and the adjacent 300m radius during prolonged wet periods where the habitats are likely inundated, given the limited extent of surface water flooding likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.
Dunlin	No – present on estuarine areas absent from and within 300m of the land required for the construction of the Proposed Scheme. Whilst birds may come inland where there is regular flooding/standing water, data from SEPA suggest that the land required for the construction of the Proposed Scheme is not subject to groundwater flooding, with	Favourable, Declining (2016)	Common winter visitor to coasts. All records in 2017 from coastal sites, with most records from Caerlaverock NNR-WWT (20%), Southerness-Southwick (7.8%), Wigtown Bay LNR (6.8%), Carse Bay/Carsethorn (6.3%), Airds point-Carsethorn (5.4%) and Auchencairn Bay (4.9%). Sensitivity to disturbance	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned 2 records totalling 103 birds, both from 1997, from Rockcliffe Marsh. The NBN returned 544 records from within 10km, of which 137 are contemporary. Five records (none, contemporary) were from within 5km, associated with the River Esk and estuarine habitats. All records from around the Solway	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on or within 300m of the land required for the construction of the Proposed Scheme. Whilst suitable habitat occurs and birds could access the land required for the construction of the Proposed Scheme and the adjacent 300m radius during prolonged wet periods where the habitats are likely inundated, given the limited extent of surface water flooding

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
	only minor, isolated patches of surface water considered likely. These are estimated to account for less than 5% of the total area within the land required for the construction of the Proposed Scheme.		– low. Dunlin are considered very tolerant of moderate and high levels of visual disturbance, with a 75m radius considered likely to generate disturbance responses[40]. The species is not particularly sensitive to noise, with 72dB (at the bird) considered acceptable.	Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	likely, there are no wintering data for the site from any of the data sources. It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.
Turnstone	No – present on estuarine areas, rocky coasts/hard engineering structures absent from and within 300m of the land required for the construction of the Proposed Scheme.	N/A	Winter visitor to coast. In 2017, the majority of records were from the Inner Solway from Carsethorn to Southwick (29.7%) and Loch Ryan (29.7%). Sensitivity to disturbance – low. Turnstone is considered tolerant to noise and visual disturbance and habituate rapidly. Noise levels of up to 75dB appear acceptable at the bird and disturbance	The BTO Atlas data and Birdtrack returned no records from NY36E and none from NY26Z. SWSEIC returned no records. The NBN returned 65 records from within 10km, all of which were from around the Solway Estuary. None from within 300m of the land required for the construction of the Proposed Scheme. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January	No – eliminated from further consideration due to the lack of suitable habitat and absence of desk study records on or within 300m of the land required for the construction of the Proposed Scheme.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
			responses are usually not noted beyond 50m[40].	2021.	
Lapwing	Yes – inland farmland is present on and within 300m of the land required for the construction of the Proposed Scheme.	Favourable, Declining (2016)	Common winter visitor to coasts and inland farmland. In 2017, most records were from Caerlaverock NNR-WWT (44.1%), Mersehead (10%), RSPB Crook of Baldoon (4.2%), Wigtown Bay (3.7%), RSPN Ken-Dee Marshes (3.1%) and Auchencair Bay (2.6%). Sensitivity to disturbance – medium. Lapwing is moderately sensitive to disturbance, with effects noted within 200m. A precautionary approach assumes tolerance of noise up to 72dB considered acceptable at the bird, but with caution	No BTO Atlas data were returned for this species associated with NY26Z and NY36E. BirdTrack data returned a single record from 2017 (of 30+ individuals) in fields to the south of Gretna Services and the A74(M). SWSEIC returned 48 records from between 1889 and 2017. Of these, one was provided from fields to the south of Gretna services adjacent to the A74(M), with a count of 30+ individuals reported corresponding to the record from Bird Track. NBN returned 1,381 records from within 10km, of which 279 records are considered contemporary. Of these, 1 is from within 2km of the land required for the construction of the Proposed Scheme, located in fields over 1.5km to the north in	No – whilst suitable habitat occurs on and within 300m of the land required for the construction of the Proposed Scheme and birds could access this land, there are no wintering data for the site from any of the data sources. In addition, lapwing tend to aggregate in 'normal' winter conditions, dispersing during periods of cold weather. If colder conditions persist, mass movements south and south-east towards coastal locations are usually shown (Gillings and Fuller, 1999)[56]. Even if birds dispersed throughout the wider landscape during harsh winters, extensive suitable habitat is present It is therefore, considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.

[56] Gillings, S. and Fuller, R.J. (1999), *Winter ecology of golden plovers and lapwings: A review and consideration of extensive survey methods,* BTO Research report 224, British Trust for Ornithology, Thetford.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
			above 55dB (60dB in highly disturbed areas).	2014. Records concentrated to the south-east and south-west of Gretna, associated with the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	
Black-headed gull	Yes – widely distributed in winter including inland wetlands, fields, urban areas and coastal areas.	N/A	Common resident/winter migrant. Sensitivity to disturbance – low.	The BTO Atlas data returned a single record of 7 birds within grid square NY36E from fields to the west of Gretna Services and south of the A74(M). Birdtrack returned 5 records, all of which were west of Gretna Services and south of the A74(M). SWSEIC returned 13 records from between 1800 and 2017 (excluding those reported as breeding pairs). Of these, 2 were from west of Gretna Services and south of the A74(M). NBN returned 620 records from within 10km, of which 412 are considered contemporary. Of these, 5 are from within 2km of the land	No – whilst suitable habitat occurs on and within 300m of the land required for the construction of the Proposed Scheme and birds could access this land, it is considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site. In addition, given their published low sensitivity to disturbance, it is considered highly unlikely that this species would be present in sufficient numbers during the winter period for the Proposed Scheme to undermine the Conservation Objectives of the site.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
				required for the construction of the Proposed Scheme, with none recorded from within 1km. Records largely concentrated within the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	
Common gull	Yes – widely distributed in winter including inland wetlands, fields and coastal areas.	N/A	Common resident/winter migrant. Sensitivity to disturbance – low.	The BTO Atlas data returned a single record of 15 birds from within grid square NY36E from fields to the west of Gretna Services and south of the A74(M). In addition, a single record of 15 birds was recorded from NY26E from fields between Gavin's Loch and Kirtle Water, south of land required for the construction of the Proposed Scheme. Birdtrack returned no records. SWSEIC returned 8 records from between 2009 and 2017 (excluding those reported as breeding pairs). Of these, 1 was from west of Gretna	No – whilst suitable habitat occurs on and within 300m of the land required for the construction of the Proposed Scheme and birds could access this land, it is considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site. In addition, given their published low sensitivity to disturbance, it is considered highly unlikely that this species would be present in sufficient numbers during the winter period for the Proposed Scheme to undermine the Conservation Objectives of the site.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
				Services and south of the A74(M). NBN returned 364 records from within 10km, of which 249 records are considered contemporary. Of these, 3 are from within 2km of the land required for the construction of the Proposed Scheme, located between Gavin's Loch and Kirtle Water, south of land required for the construction of the Proposed Scheme. Records largely concentrated within the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	
Herring gull	Yes – widely distributed in winter including inland wetlands, fields and urban areas.	N/A	Common resident. Sensitivity to disturbance – low.	The BTO Atlas data returned no records. Birdtrack returned 3 records, the closest of which were from fields to the west of Gretna Services and south of the A74(M). SWSEIC returned 5 records from between 2009 and 2017. A single	No – whilst suitable habitat occurs on and within 300m of the land required for the construction of the Proposed Scheme and birds could access this land, it is considered highly unlikely that this species would be present in numbers likely to undermine the Conservation Objectives of the SPA/Ramsar site.

Species	Suitable habitat present within the land required for the construction of the Proposed Scheme?	Condition of feature[42]	Known local distribution, sensitivity to disturbance[43]	Desk study data	Potential for likely significant effects?
				record was located from fields to the west of Gretna Services and south of the A74(M). The NBN returned 345 records from 10km, of which 245 are contemporary, with two records from within 2km and none from within 1km. The closest record is from fields to the west of Gretna Services and south of the A74(M of the land required for the construction of the Proposed Scheme. Records largely concentrated within the Solway Estuary. Not recorded during observation surveys of the land required for the construction of the Proposed Scheme from adjacent land carried out in December 2020 – January 2021.	In addition, given their published low sensitivity to disturbance, it is considered highly unlikely that this species would be present in sufficient numbers during the winter period for the Proposed Scheme to undermine the Conservation Objectives of the site.

3.3.16 On the basis of Table 1, it is considered that this land is not functionally linked and is therefore not necessary to achieve the Conservation Objectives of the following key species associated with the Solway Firth SPA/Upper Solway Flats and Marshes Ramsar site:

- pintail;
- scaup;
- oystercatcher;
- knot;
- bar-tailed godwit;
- curlew;
- redshank;
- shelduck;
- teal;
- shoveler;
- grey plover;
- sanderling;
- dunlin;
- turnstone;
- lapwing;
- black-headed gull;
- common gull;
- herring gull; and
- ringed plover (passage).

3.3.17 It is considered that impacts associated with the bird species discussed above are highly unlikely given the lack of suitable habitat, coupled with the lack of desk study records. In-combination, this suggests that these species will either not be present or potentially present in very low numbers within and adjacent to the land required for the construction of the Proposed Scheme.

3.3.18 Although unlikely, the presence of whooper swan, barnacle goose, golden plover and pink-footed goose within the land required for the construction of the Proposed Scheme cannot be discounted. Although the scope for these species to use the land required for the construction of the Proposed Scheme is limited by a cluttered landscape of habitat features (such as hedgerows, woodland blocks and power lines), and extensive suitable habitat is present within the wider landscape, in line with published guidelines on HRA in Scotland and the application of the precautionary principle, likely significant effects cannot be ruled out without further assessment. There is, therefore, the potential for the Conservation Objectives of the SPA/Ramsar site to be undermined. Appropriate assessment is, therefore, required.

4 Document to inform appropriate assessment

4.1 Habitat suitability

4.1.1 Aerial imagery suggests that the land required for the construction of the Proposed Scheme supports a balance of habitats with the potential to support wintering populations of whooper swan, golden plover, barnacle goose and pink-footed goose. The scope for these species to be present is, however, reduced due to the presence of hedgerows, woodland blocks and an overhead power line. These habitat features reduce lines of sight for foraging flocks and collectively decrease the likelihood of usage where alternative, higher quality, open habitats are available.

4.1.2 As a consequence, the potential for the Proposed Scheme to affect functionally linked land associated with high-tide roosts or alternative feeding sites cannot be discounted without further assessment and is considered in detail below.

4.1.3 The land required for the construction of the Proposed Scheme is in part (24.8%) allocated as industrial development (reference: A74(M). B&I3)[57]. SNH and RSPB were consulted on the proposed LDP2[1], with no comments made in relation to likely significant effects associated with this site. In addition, prior to allocation, sites proposed formed part of the Spatial Strategy subject to screening as part of the preparation of LDP2. The HRA reporting for LDP2 states that '*All sites proposed for inclusion in the spatial strategy were subject to assessment for likely significant effect and consultation with SNH and other key agencies took place prior to the Main Issues Report. No sites that could have a likely significant effect on any Natura site have been carried forward into the Proposed Plan…*'. Whilst Policy ED1a, which relates to this land allocation, could not be initially screened out, subsequent assessment and engagement concluded that the policy could not have a likely significant effect on any Natura 2000 site. It is, consequently, logical to assume that there would be no likely significant effects on the Solway Firth SPA/Upper Solway Flats and Marshes Ramsar site as a direct consequence of the land allocation at Gretna to which a proportion of the land required for the construction of the Proposed Scheme relates.

4.2 Disturbance

4.2.1 For the purpose of this assessment, whilst it is recognised that individual species respond differently to noise and visual disturbance, including the ability to habituate to predictable levels, in the absence of detailed information a precautionary approach has been adopted.

[57] Allocation A74(M). B&I3 Redhouse, Kirkpatrick Flemming comprises 28.19ha, 24.8% of the land required for the construction of the Proposed Scheme.

4.2.2 High levels of lighting and noise during construction and operation are assumed to result in a displacement of birds away from the affected areas. Ultimately, this habitat avoidance is interpreted as a form of habitat loss[58]. The land required for the construction of the Proposed Scheme is therefore assumed to be rendered inhospitable to all species assessed here.

Whooper swan

4.2.3 Research into habitat preferences of this species show that over 80% feed on improved or flooded pastures, or in permanent inland waters[59]. Habitats within the land required for the construction of the Proposed Scheme, therefore, appear to be suitable for this species during the wintering period. However, several factors are considered to limit suitability, including habitat characteristics (barriers to sight lines; absence of standing water; distance from the core winter feeding range), absence of desk study data and initial field survey results.

4.2.4 Considering the quality of the land required for the construction of the Proposed Scheme, the presence of hedgerows and woodland blocks has been shown to be an important factor in hierarchical habitat selection by geese and swans[60]. Specifically, migratory waterfowl are thought to make a series of selections in relation to their winter habitat. This comprises an initial selection of geographic regions, within which is the selection of wetland systems and their associated terrestrial landscapes within those regions. Birds then make local, site-specific selections within their seasonal home range, and finally, microhabitats where individuals may roost, forage etc. In Britain and Ireland, whooper swans traditionally winter on freshwater habitats and agricultural land[59], with site selection generally limited by flooding levels[61]. Further, in a study across Britain and Ireland[62], whooper swans were shown to preferentially aggregate on permanent inland waters (68% during the 1990-1991 winter). The same study demonstrates that less than 15% of the population were located on agricultural land, a statistic also reported by Cranswick et al. (2002)[61]. Whilst a study by

[58] Drewitt, A.L. and Langston, R.W.H. (2006), *Assessing the impacts of wind farms on birds,* Ibis, 148, P29-42.

[59] Robinson, J. A, Colhoun, K., McElwaine, J.G and Rees, E.C (2004), *Whooper Swan Cygnus cygnus (Iceland population) in Britain and Ireland 1960/61 – 1999/2000*, Waterbird Review Series, The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

[60] David, J.B., Guillemain, M., Kaminski, R., Arzel, C., Eadie, J.M. and Rees, E.C. (2014), *Habitat and resource use by waterfowl in the northern hemisphere in autumn and winter*, Wildfowl Special Issue 4, P17-69.

[61] Cranswick, P., Bowler, S.N., Delany, O., Gardarsson, A., McElwaine, J.G., Merne, O.J., Res, E.C. and Wells, J.H. (2002), *Numbers of whooper swans Cygnus cygnus in Iceland, Ireland in Britain in January 1995: results of the international whooper swan census*.

[62] Rees, E.C., Kirby, J.S. and Gilburn, A. (1997), *Site selection by swans wintering in Britain and Ireland; The importance of habitat and geographic location*, Ibis 139 (2), P337-352.

Chisholm and Spray (2002)[63] appeared contradictory, showing that although wintering whooper swan in the Tweed Valley preferentially selected agricultural crops, it was consistent in that the analysis of field choice showed that swans also chose larger fields and those closer to water.

4.2.5 In consequence, the land required for the construction of the Proposed Scheme does not present an attractive option for wintering whooper swan. This is due to the presence of hedgerows and woodland blocks (which reduce field sizes and create impediment to sight lines), coupled with the absence of areas of standing water. In addition, NatureScot guidance on core winter feeding ranges states that this species is only likely to be present within 5km of roost locations (Scottish Natural Heritage, 2016). The site itself is in excess of 17km from Caerlaverock NNR and over 5km from Mossband and is, therefore, considered beyond the core winter feeding zone, reducing the likelihood that aggregations of birds would be present.

4.2.6 In addition to the limited suitability of the habitats, absence of data from the desk study cannot be taken as definitive evidence that birds do not use the land required for the construction of the Proposed Scheme. However, early studies showed a high degree of site fidelity[64] reporting 78% of whooper swans marked in south-west Scotland during the early 1980s returned to the same site for at least one further winter. This would suggest that records would be present if birds were using these habitats. Further, the 2016 and 2017 Dumfries and Galloway Bird Reports state that wintering records are concentrated around Caerlaverock NNR, WWT reserve (over 17km to the west), with over 59% occurring in this area in 2017. The spatial and temporal distribution of the desk study records confirm this assessment; with records concentrated approximately 6km to the south-east of the land required for the construction of the Proposed Scheme adjacent to the estuary. Given the accuracy of these records, the closest of these was at least 1.2km south-west of the land required for the construction of the Proposed Scheme north of Gretna. Within a 10km radius, the highest concentration of records is from land to the east of the M6 at Mossband (60% of the total records), on fields to the north of the estuary. Similarly, records with the 10km radius of the land required for the construction of the Proposed Scheme represent 16.9% of the records returned for Dumfries and Galloway.

4.2.7 Land proposed for the construction of the Proposed Scheme is, therefore, considered likely to be unimportant for this species. Even if individuals are present within this area and a further 300m radius, it is considered highly unlikely that they would be present in sufficient numbers for their disturbance to undermine the Conservation Objectives of the site.

[63] Chisholm, H. and Spray, C. (2002), *Habitat Usage and Field Choice by Mute and Whooper Swans in the Tweed Valley, Scotland,* Waterbirds: The International Journal of Waterbird Biology, vol. 25, 2002, P177-182.

[64] Black, J. M., and Rees, E. C. (1984), *The structure and behaviour of the Whooper Swan population wintering at Caerlaverock, Dumfries and Galloway, Scotland: an introductory study,* Wildfowl 35, P21-36.

Additionally, from the information from observations of the site from adjacent land, coupled with the advice from the NatureScot Rural Surveyor, it is considered that there is sufficient suitable habitat within the wider landscape to accommodate any redistribution of individuals resulting from the construction of the Proposed Scheme.

Barnacle goose

4.2.8 Wintering geese, including barnacle goose, display strong site fidelity throughout the year[65] with coastal areas supporting the highest concentrations of birds. The 2002 study identified the winter movements of individual birds and concluded that those radio tracked from Caerlaverock NNR/WWT reserve were wide ranging spending 20-40% of their winter season at Rockcliffe Marsh and 46-80% at Caerlaverock. Only one bird visited Southerness and another to north-west Cumbria. By contrast, those birds from Southerness were largely sedentary, rarely or never moving from that area and staying within a core area of 180-340ha, dispersing to Rockcliffe Marsh at the end of the winter period. It was noted that birds did not forage outside the four main coastal areas despite the apparent suitability of alternative areas.

4.2.9 Habitats within the land required for the construction of the Proposed Scheme therefore appear to be suitable for this species during the wintering period. However, several factors are considered to limit suitability including habitat characteristics (barriers to sight lines; absence of standing water; distance from the core winter feeding range), known winter distributions, and the absence of desk study results.

4.2.10 It is considered that the quality of food resources within the land required for the construction of the Proposed Scheme is low compared with arable fields and saltmarsh habitats. This is reinforced by the data provided in the 2016 and 2017 Dumfries and Galloway Bird Reports. These state that this species is a scarce winter visitor to inland waters and farmland, with records concentrated around Caerlaverock NNR/WWT reserve (the traditional arrival site, Phillips et al., 2002). The use of the 2,000ha refuge area at Caerlaverock has been shown to increase since its establishment, with a high proportion of the wintering population supported throughout the winter period[66]. Desk study data from within a 10km radius of the land required for the construction of the Proposed Scheme represent less than 17% of the records returned for Dumfries and Galloway overall, with just 0.1% located within 2km and none from the site itself. The data search returned four records from the area south and west of Gretna and south of the A74(M), although none relate to

[65] Phillips, R.A., Cope, D.R., Rees, E.C. and Connell, M.J. (2002), *Site fidelity and range size of wintering Barnacle Geese Branta leucopsis,* Bird Study 50, P11-169.

[66] Owen, M., Black, J.M., Agger, M.K. and Campbell, C.R.G. (1987), *The use of the Solway Firth, Britain, by barnacle geese Branta leucopsis Bechst, in relation to refuge establishment and increases in numbers,* Biological Conservation, 39, P63-81.

the land required for the construction of the Proposed Scheme. The closest of these was approximately 60 birds identified on a single occasion in 2016 at Gretna Services 350m to the south-east.

4.2.11 Whilst only limited field surveys have been carried out to inform this HRA, the suitability of the land required for the construction of the Proposed Scheme is likely reduced as a consequence of: the presence of the A74(M) motorway to the immediate south; the WCML to the north; and Scottish Power overhead lines running through the eastern part of the site itself. In this regard, those species that congregate in large flocks are considered more vulnerable to collision due to reduced visibility on an individual basis. In addition, field observations carried out in December 2020 and January 2021 recorded no goose species as present.

4.2.12 Studies have shown that wintering geese avoid areas close to roads for grazing. Madsen (1985)[67]; reviewed in Hockin et al. (1992) demonstrated that the flight distance of goose flocks increased with flock size and was longer in autumn than in spring. Roads with a traffic volume of more than 20 cars per day disturbed birds up to a distance of 500m in autumn, but less in spring. Lanes with 0–10 cars per day also reduced the use of adjacent fields by geese but less so than roads with heavier traffic.

4.2.13 Land proposed for the construction of the Proposed Scheme is, therefore, considered likely to be unimportant for this species. Additionally, from the information from observations of the site from adjacent land, coupled with the advice from the NatureScot Rural Surveyor, it is considered that there is sufficient suitable habitat within the wider landscape to accommodate any redistribution of individuals resulting from the construction and operation of the Proposed Scheme in the unlikely event that disturbance to individuals occurs. Even if individuals are present on or within 300m of the land required for the construction of the Proposed Scheme, this is unlikely to be in numbers sufficient to result in significant effects on the integrity of the SPA/Ramsar site during either the construction or the operational phase.

Golden plover

4.2.14 Habitats within the land required for the construction of the Proposed Scheme are suitable for feeding golden plover during the wintering period. However, several habitat factors are considered to limit suitability, including habitat characteristics and lines of sight/field sizes. Golden plover winter in large numbers with studies showing a pronounced preference for

[67] Madsen, J. (1985), *Impact of disturbance on field utilisation of pink-footed geese in west Jutland, Denmark,* Biological Conservation 33, P53-63.

lowland farmland and high site fidelity (Fuller and Youngman, 1979)[68], although habitat use varies through the season, with wider dispersal during periods of extreme cold weather (Gillings and Fuller, 1999). Milsom et al., (1998) also demonstrated that golden plover avoid unmown fields and heavily grazed areas as the latter can decrease the diversity and abundance of food sources. In addition, the work of Tucker (1992)[69] determined that this species avoided fields used by sheep, with Gillings et al., (2006)[70] reporting that a high percentage of the wintering population in Britain exist on or in close proximity to wetlands.

4.2.15 Many ground feeding birds, including golden plover, preferentially select relatively sparsely vegetated foraging areas[71] and as vegetation height increases, foraging efficiency is considered likely to decline, probably because prey-locating cues become less detectable and forager mobility is impeded. In relation to the land required for the construction of the Proposed Scheme, aerial imagery shows a number of dividing hedgerows, woodland blocks, and smaller field sizes as well as the presence of sheep in at least one of the fields. In addition, data sourced from SEPA indicate no areas of river or groundwater flooding and limited areas of surface water. It is therefore considered unlikely that golden plover would be present in large numbers.

4.2.16 Coupled with the limited habitat suitability, the 2016 and 2017 Dumfries and Galloway Bird Reports state that this species is an uncommon winter visitor to farmland, with records concentrated around Caerlaverock NNR/WWT reserve. This is supported by the desk study and initial walkover survey data. Excluding records from the estuary, SWSEIC returned eight records of golden plover between 1910 and 2017. Of these, three were provided from west of Gretna and south of the A74(M), with a maximum count of 2000 in 2010. Given the accuracy of these records, the closest of these was at least 1.2km south-west of the land required for the construction of the Proposed Scheme, beyond the distance where disturbance effects could occur. Within a 10km radius of the land required for the construction of the Proposed Scheme, the highest concentration of records is from land to the east of the M6 at Mossband and south of Eastriggs (collectively 71% of the total records), on fields immediately adjacent to the estuary. Similarly, records with the 10km radius of the land required for the construction of the Proposed Scheme represent 24% of the records returned for Dumfries and Galloway overall.

[68] Fuller, R.J. and Youngman, R.E. (1979), *The utilisation of farmland by golden plovers wintering in southern England*, Bird Study, 26:1, P37-46.

[69] Tucker, G.M. (1992), *Effects of agricultural practices on field use by invertebrate-feeding birds in winter*, Journal of Applied Ecology, 29, P779-790.

[70] Gillings, S., Austin, G.A., Fuller, R.J. and Sutherland, W.J. (2006), *Distribution shifts in wintering golden plover Pluvialis apricaria and lapwing Vanellus vanellus,* Bird Study, 53:3, P274-284.

[71] Butler, S.J. and Gillings, S. (2004), *Quantifying the effects of habitat structure on prey detectability and accessibility to farmland birds,* Ibis 146, P123-130.

4.2.17 Land proposed for the construction of the Proposed Scheme is, therefore, considered likely to be unimportant for this species. Additionally, from the information from observations of the site from adjacent land, coupled with the advice from the NatureScot Rural Surveyor, it is considered that there is sufficient suitable habitat within the wider landscape to accommodate any redistribution of individuals resulting from the construction of the Proposed Scheme in the unlikely event that disturbance to individuals occurs. Even if individuals are present on or within 300m of the land required for the construction of the Proposed Scheme, this is unlikely to be in numbers sufficient to result in significant effects on the integrity of the SPA/Ramsar site during either the construction or the operational phase.

Pink-footed goose

4.2.18 Habitats within the land required for the construction of the Proposed Scheme appear to be suitable for this species during the wintering period. However, several factors are considered to limit suitability including habitat characteristics (barriers to sight lines; absence of standing water; distance from the core winter feeding range, presence of roads) and absence of desk study results. In addition, the Rural Surveyor for NatureScot has stated that this species has not, to his knowledge, been recorded on the land required for the Proposed Scheme in the past 12 years.

Habitat characteristics

4.2.19 Animals select foraging sites based on a trade-off between energy gain and predation risk[72]. Everything else being equal, animals will feed in patches with lower predation risk, although they can be forced to feed at suboptimal sites as a result of density dependence and competition. In Britain and Ireland pink-footed geese traditionally feed on grassland (salt marsh, semi-natural grassland, barley stubbles and winter cereals). Further, geese flock, and when searching for foraging areas appear attracted to locations where they see other geese congregated. In general, geese prefer fields with an open view to avoid predation by natural predators and humans. Studies by Madsen (1982) concluded that the width of an area of habitat must exceed 500m with no hindrances in order to be acceptable to flocks of pink-footed geese in autumn. In both spring and autumn, larger flocks took off at a greater distance from a car than smaller flocks, presumably because larger flocks were capable of greater vigilance. In terms of providing suitable habitat for pink-footed geese the size of the area should depend on population size, shyness, proximity to other goose feeding or roosting areas. For example, the study concluded that 1000 pink-footed geese would need: (a) extensive feeding grounds at a distance of 500m away from roads with traffic volumes

[72] Lima, S.L. and Dill, L.M. (1990), *Behavioural decisions made under the risk of predation: a review and prospectus,* Canadian Journal of Zoology, 68, P619–640.

greater than 20 cars/day; (b) traffic lanes should be regulated as even less than 1 car per day has a depressing effect on goose utilisation, although generalisation of this finding to other situations is probably likely to depend on lane size, quality of food in the fields and season; and (c) the width of the area should exceed 1km and windbreaks, plantations and other structural features should not be established in the area. A number of studies provided evidence that birds avoided areas completely (Madsen, 1985, Gill et al., 1996[73], Larsen and Madsen, 2000[74] and Courtens et al., 2005[75]). Further, pink-footed goose has been shown to preferentially locate away from roads[76].

4.2.20 In consequence, the land required for the construction of the Proposed Scheme does not present an ideal option for wintering pink-footed goose due to the presence of hedgerows and woodland blocks reducing field sizes and creating impediment to sight lines. In addition, NatureScot guidance on core winter feeding ranges states that this species is likely to be present less than 5km from roost locations (Scottish Natural Heritage, 2016). The site itself is in excess of 17km from Caerlaverock NNR and over 5km from Mossband and is, therefore, considered beyond the core winter feeding zone reducing the likelihood that aggregations of birds would be present. A study carried out in 2012 confirmed this, with no wintering records for this species identified as part of a study caried out in 2012 by the WWT[77].

4.2.21 Pink-footed goose display high levels of site fidelity, with birds return to feeding areas where they have already fed safely[78]. For instance, Hearn and Mitchell (1995) showed that of 1,492 fields surveyed around Loch Leven, only 14% were ever used. Within a 10km radius, the highest concentration of records is from land to the east of the M6 at Mossband and south of Eastriggs (collectively 76.5% of the total records), on fields adjacent to the estuary. Similarly, records with the 10km radius of the land required for the construction of the Proposed Scheme represent 13.4% of the records returned for Dumfries and Galloway overall, and 0.4% of records located within 5km.

[73] Gill, J.A., Sutherland, W.J. and Watkinson, A.R. (1996), *A method to quantify the effects of human disturbance on animal populations,* Journal of Applied Ecology, 33, P786–792.

[74] Larsen, J.K. and Madsen, J. (2000), *Effects of wind turbines and other physical elements on field utilization by pink-footed geese (Anser brachyrhynchus): a landscape perspective,* Landscape Ecology, 15, P755–764.

[75] Courtens, W., Vantieghem, S. and Kuijken, E. (2005), *The East coast Polders, a table laid for wintering geese?* Natuur. Oriolus, 71, P122–130.

[76] Gill, J.L. (1996), *Habitat Choice in Pink-Footed Geese: Quantifying the Constraints Determining Winter Site Use,* The Journal of Applied Ecology, 33(4), P884.

[77] Taken from Figure 11 of Mitchell (2012) that shows no wintering records for pink-footed goose, Mitchell, C. (2012), *Mapping the distribution of feeding pink-footed goose and Iceland greylag geese in Scotland*, Wildfowl and Wetlands Trust/Scottish Natural Heritage Report, Slimbridge. 108pp.

[78] Mitchell, C.R. and Hearn, R.D. (2004), *Pink-footed goose Anser brachyrhynchus (Greenland/Iceland population) in Britain 1060/61 -199/2000.* Waterbird Review Series, The Wildfowl and Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

4.2.22 Excluding records from the estuary, the data search returned three records from the area north and west of Gretna. A single bird was recorded in 2014 possibly from within the land required for the construction of the Proposed Scheme. The closest aggregation was a flock of 100 birds located at approximately 600m[79] south-west of the land required for the construction of the Proposed Scheme (SY2969) in 2011.

4.2.23 The 2016 and 2017 Dumfries and Galloway Bird Reports state that this species is an uncommon winter visitor to inland waters and farmland, with records concentrated around Caerlaverock NNR/WWT reserve 17km to the east.

4.2.24 Whilst limited field surveys have been carried out to inform this HRA and no goose species were reported, the suitability of the land required for the construction and operation of the Proposed Scheme for wintering pink-footed goose is likely reduced as a consequence of the presence of the (A74M) motorway to the immediate south; the WCML to the north; and Scottish Power overhead lines running through the eastern part of the site itself. Published literature suggests that this species demonstrates a reduction in grazing intensity within fields at distances often greater than 250m from roads[80]. Further, pink-footed goose has been shown to preferentially locate away from roads[81].

4.2.25 Land proposed for the construction of the Proposed Scheme is, therefore, considered likely to be unimportant for this species. Additionally, from the information from observations of the site from adjacent land, it is considered that there is sufficient suitable habitat within the wider landscape to accommodate any redistribution of individuals resulting from the construction and operation of the Proposed Scheme in the unlikely event that disturbance to individuals occurs. Even if individuals are present on or within 300m of the land required for the construction of the Proposed Scheme, this is unlikely to be in numbers sufficient to result in significant effects on the integrity of the SPA/Ramsar site during either the construction or the operational phase.

4.3 Summary

4.3.1 Whilst only limited field surveys of the land required for the construction of the Proposed Scheme have been undertaken to inform this HRA, desk study data provide evidence that the land is unsuitable for 17 of the qualifying species of the SPA/Ramsar site, as listed below:

- pintail;
- scaup;

[79] SWSCEI data point is accurate to 1,000m and it is therefore not possible to determine their exact location.

[80] Madsen, J., (1985), *The impact of disturbance on field utilisation by pink-footed geese in West Jutland, Denmark*, Biological Conservation 33, P53-63.

[81] Gill, J.L. (1996), *Habitat Choice in Pink-Footed Geese: Quantifying the Constraints Determining Winter Site Use*, The Journal of Applied Ecology, 33(4), P884.

- oystercatcher;
- knot;
- bar-tailed godwit;
- curlew;
- redshank;
- shelduck;
- teal;
- shoveler;
- grey plover;
- sanderling;
- dunlin;
- turnstone;
- lapwing;
- black-headed gull;
- common gull;
- herring gull; and
- ringed plover.

4.3.2 It can, therefore, be concluded with a high level of confidence that the land required for the construction of the Proposed Scheme is not functionally linked to the SPA/Ramsar site and no likely significant effects are predicted for any of these species.

4.3.3 By contrast, taking a precautionary approach, whilst the initial observation surveys of the land required for the construction of the Proposed Scheme from adjacent publicly accessible land recorded none of the species associated with the SPA/Ramsar site, it must be assumed that individuals of the following species could be present over the winter period: whooper swan, golden plover, barnacle goose and pink-footed goose. Nevertheless, given the characteristics of the habitat, including disrupted lines of sight and lack of standing water, the land required for the construction of the Proposed Scheme is not likely to support these species (in the unlikely event that they are present at all) in numbers and frequency likely to affect the integrity of the SPA/Ramsar site. This conclusion is supported by a statement provided by the local Rural Surveyor for NatureScot that stated that they were not aware of any concentrations of any species within the land required for the construction of the Proposed Scheme (Dylan deSilva pers. comm, 2020).

5 In-combination effects

5.1.1 Appendix CT-004-OR000 lists unimplemented major committed development, i.e. approved consents, development allocations and minerals safeguarding areas (MSA) in adopted development plans, identified up to 31 July 2019 where there is potential for environmental effects to occur. Where development falls within the land required for construction of the Proposed Scheme and it has been assumed that it cannot be implemented as a result of the Proposed Scheme, it has not been included as a committed development and does not form part of the assessment. The location of the committed developments listed in Table 1 of Appendix CT-004-OR000 are shown in the Volume 5 Map Book, Map Series CT-13.

5.1.2 None of these committed developments are located on habitats likely to displace species associated with the SPA/Ramsar site. In view of the above, it is considered that there will be no likely significant effects in-combination.

5.1.3 To support this conclusion, the local plan for Dumfries and Galloway overlaps with the land required for the construction of the Proposed Scheme. The local authority has formed a conclusion that 'all aspects of the Proposed Dumfries and Galloway Local Development Plan, alone or in combination, have been screened out of further appraisal. Appropriate assessment of the Proposed Plan is therefore not required.' It then goes on to conclude 'Dumfries and Galloway Council, as the plan-making body concludes that it can be ascertained by means of this Habitat Regulations Appraisal that adoption of the Dumfries and Galloway Local Development Plan (and the Supplementary Guidance issued at the same time as the proposed Local Development Plan) would have no adverse effect on the integrity of any Natura sites.' In relation to the proposed allocation, this statement applies to 24.8% (28.19ha) of the land required for the construction of the Proposed Scheme for industrial purposes.

6 Conclusions

6.1.1 Based on the best available information (including desk study data and the observations of birds from adjacent, publicly accessible land), it is considered that the land is not critical to the maintenance of the integrity of the SPA/Ramsar site. It can therefore be concluded that the construction and operation of the Proposed Scheme would result in no adverse effects on the Conservation Objectives of the qualifying species for which likely significant effects were identified (whooper swan, barnacle goose, golden plover and pink-footed goose). Specifically, there would be no adverse effect on the integrity of the SPA through habitat deterioration or disturbance, and that the Proposed Scheme would have no adverse effect on the long-term maintenance of the following, alone or in combination with other projects and plans:

- population of the species as a viable component of the site;
- distribution of the species within the site;
- distribution and extent of habitats supporting the species;
- structure, function and supporting processes of habitats supporting the species; and
- no significant disturbance of the species.

6.1.2 In relation to the Upper Solway Flats and Marshes Ramsar site, there would be no adverse effect on the maintenance of wintering populations of wintering, migratory and breeding populations of nationally and internationally important birds.

Annex A: European site characteristics

1 Solway Firth SPA (including the Upper Solway Flats and Marshes SPA and marine extension) citation

1.1 Site description

The Solway Firth Special Protection Area (SPA) is a large estuarine/marine site on west coast of Great Britain. The SPA includes the classified Upper Solway Flats and Marshes SPA with extensive areas of intertidal mudflats, fringing saltmarshes and grazing marshes. The offshore sediments of the marine extension are substantially sand, associated with mud and gravel towards the edges of the firth, especially in the smaller tributary estuaries. The series of sandbanks north-east of the Isle of Man is the result of strong currents and an abundant supply of sand. The inner firth is shallow, as is Wigtown Bay, but further west towards the north-eastern Irish Sea the water deepens steadily to over 40m.

1.2 Qualifying interest

The Solway Firth Special Protection Area (SPA) qualifies under Article 4.1 by regularly supporting a non-breeding population of European importance of the following Annex 1 species: red-throated diver (a mean peak estimate of 521 individuals; 3.1% of the Great Britain population) for the years 2001/02 to 2005/06), whooper swans (an average of 250 individuals; 1.5% of the north-west European population; 4% of the British non-breeding population) for the years 1986/87 to 1990/91), barnacle geese (an average of 12,300 individuals; 100% of the Svalbard population, all of which winter in Britain) for the years 1986/87 to 1990/91), golden plover (an average of 3,380 individuals; 2% of the Great Britain population) for the years 1986/87 to 1990/91) and bar-tailed godwit (an average of 4,800 individuals; 4% of east Atlantic flyway, 8% of the Great Britain population) for the years 1986/87 to 1990/91. The site also qualifies under Article 4.2 by regularly supporting populations of European importance of the following migratory species (average peak counts recorded during the five year period 1986/87 to 1990/91): pink-footed geese (an average of 14,900 individuals; 14% of the Icelandic population, all of which winter in Britain), pintail (an average of 1,400 individuals; 2% of north-west European, 6% of the Great Britain population), scaup (an average of 2,300 individuals; 2% of north-west European, 57% of the Great Britain population), oystercatcher (an average of 33,850 individuals; 4% of east Atlantic flyway population, 12% of the Great Britain population), knot (an average of 15,300 individuals; 4% of the east Atlantic flyway, 7% of the Great Britain population), curlew

Numenius arquata (an average of 6,700 individuals; 2% of east Atlantic flyway, 7% of the Great Britain population) and redshank (an average of 2,100 individuals; 2% of east Atlantic flyway, 3% of the Great Britain population). The site also qualifies under Article 4.2 by regularly supporting populations of European importance of ringed plover during the non-breeding (passage) period (a mean peak population estimate of 981 individuals; 1.3% of the biogeographic population) for the years 2007/08 to 2011/12. The site further qualifies under Article 4.2 by regularly supporting in excess of 20,000 water birds. In the five non-breeding period 1986/87 to 1990/91 an average peak count of 122,200 waterfowl was recorded, comprising 43,100 wildfowl and 79,100 waders. During the period 2001/02-2010/11 the marine extension in the outer Solway Firth added approximately a further 5,000 waterbirds to the non-breeding assemblage. In addition to the species named above this includes nationally important populations of the following species: shelduck (an average of 1,600 individuals; 2% of the Great Britain population), teal (an average of 1,400; 1% of the Great Britain population), shoveler (an average of 120 individuals; 1% of the Great Britain population)), goldeneye (an average of 300 birds; 2% of the Great Britain population), grey plover (an average of 720 individuals; 3% of the Great Britain population), sanderling (an average of 260 individuals; 2% of the Great Britain population), dunlin (an average of 11,900 individuals; (3% of the Great Britain population) and turnstone (an average of 600 individuals; 1% of the Great Britain population). It also includes nationally important populations of the following species: common scoter (a mean peak population estimate of over 1,588 individuals; 1.6% of the Great Britain population) for the years 2001/02 to 2005/06, goosander (a minimum mean peak population estimate of 146 individuals; 1.6% of the Great Britain population) for the years 2007/08 to 2011/12, lapwing (a mean peak population estimate of 5037 individuals; 0.8% of the Great Britain population and more than 2,000 individuals) for the years 2007/08 to 2011/12), cormorant (a mean peak population estimate of 581 individuals; 1.6% of the Great Britain population) for the years 2007/08 to 2011/12, blackheaded gull (a peak population estimate of 13,732 individuals; 0.6% of the Great Britain population) for the years 2003/04 to 2005/06, common gull (12,486 individuals; 1.8% of the Great Britain population) for the years 2003/04 to 2005/06 and herring gull (a peak population estimate of 3034 individuals; 0.4% of the Great Britain population) for the years 2003/04 to 2005/06.

The above figures are minimal estimates due to gaps in count coverage of this large and complex site.

Area: 1,357.49 km^2 (135,749.35 ha)

Location: 54° 43.543’ N, 003° 47.798’ W (coordinates are supplied in WGS 1984)

OS Sheet: 1:50,000 - 83, 84, 85 & 89

03/12/2020 NatureScot

Rockcliffe Marsh SPA classified on the 1 October 1986, Upper Solway Flats and Marshes

SPA (including Rockcliffe Marsh SPA) classified on the 30 November 1992.

2 Solway Firth SAC citation

2.1 EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora

The Solway is a large, complex estuary on the west coast of Britain. It is one of the least industrialised and most natural large estuaries in Europe. Tidal streams in the estuary are moderately strong and levels of wave energy can be high. There is considerable seasonal fluctuation in water temperature, owing to the shallow nature of the estuary. The sediment habitats present, mainly dynamic sandflats and subtidal reefs and sediment banks, are separated by six main river channels, which are continually changing their patterns of erosion and accretion. The estuary has been little affected by enclosure, with the result that it demonstrates unusually large areas of upper marsh and transitions to freshwater grassland communities. There is a greater proportion of sand in the substrate than is found in more southern saltmarshes.

The mid-upper marsh is heavily dominated by saltmarsh rush *Juncus gerardii* community with smaller areas of the saltmarsh-grass/fescue *Puccinellia/Festuca* communities. The glasswort *Salicornia* spp. saltmarsh is part of a complete sequence of saltmarsh types, from pioneer communities through extensive mid to high-saltmarsh and transition to tidal grazing marsh. The pioneer marshes within this site develop in response to changing river channels and erosion of existing marsh and form part of a dynamic suite of maritime habitats. Some of the species present, for example sea-purslane *Atriplex portulacoides*, common sea-lavender *Limonium vulgare* and lax-flowered sea-lavender *Limonium humile*, are at their northern limit in the UK.

The shingle and sand dune areas of Grune Point and Preston Merse support a typical range of plant species including burnet rose *Rosa pimpinellifolia*, sea-holly *Eryngium maritimum*, bloody crane's-bill *Geranium sanguineum* and the uncommon Isle of Man cabbage *Rhynchosinapis monensis*. Dyer's greenweed *Genista tinctoria* occurs in the small areas of dune heath and grassland.

The sublittoral sediment communities are typically sparse in the inner estuary, owing to the mobility of the sediment coupled with low and variable salinity. Salinity ranges from fully marine to estuarine in character, and these gradients in physical conditions add to the ecological diversity within the site. The presence of intertidal sediment flats of fine sands, rather than muds, in conditions of estuarine salinity is a notable feature. Communities become richer towards the outer estuary, where there are less extreme environmental conditions and more varied substrates.

The dominant species of the infaunal communities comprise different annelid worms, crustaceans, molluscs and echinoderms, depending on the nature of the substrate. For

example, the bivalve molluscs *Fabulina fabula* and *Spisula subtruncata* occur at the edge of sandbanks in fine and medium sand respectively. These communities are richer in the less extreme conditions of the outer estuary. The estuary also provides a migratory passage for sea lampreys *Petromyzon marinus* and river lampreys *Lampetra fluviatili*s to and from their spawning and nursery grounds.

Qualifying habitats: The site is designated under article 4(4) of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);
- estuaries;
- fixed dunes with herbaceous vegetation (grey dunes) (dune grassland);
- mudflats and sandflats not covered by seawater at low tide (intertidal mudflats and sandflats);
- perennial vegetation of stony banks (coastal shingle vegetation outside the reach of waves);
- reefs;
- *Salicornia* and other annuals colonising mud and sand (glasswort and other annuals colonising mud and sand); and
- sandbanks which are slightly covered by sea water all the time (subtidal sandbanks).

Qualifying species: The site is designated under article 4(4) of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- river lamprey *Lampetra fluviatilis*; and
- sea lamprey *Petromyzon marinus.*

3 Upper Solway Flats and Marshes Ramsar site citation

3.1 General overview

The flats and marshes of the Upper Solway Firth form one of the largest continuous areas of intertidal habitat in Britain. The whole estuarine complex is a site of national and international importance for wintering wildfowl and wading birds and is a vital link in a chain of west coast estuaries used by migrating birds. The site is also noted for its populations of breeding birds, natterjack toad and invertebrates. The geomorphology and vegetation of the estuarine saltmarshes or merses is also of international importance with broad transitions to mature 'upper-marsh' being particularly well represented. A number of rare plant species and geological exposures also occur within the site.

Ramsar criterion 2

Supports over 10% of the British population of natterjack toad (Habitats Directive Annex IV species (S1202)).

Ramsar criterion 5

Assemblages of international importance:

Species with peak counts in winter: 13,5720 waterfowl (5 year peak mean 1998/99 – 2002/2003).

Ramsar criterion 6 – species/populations occurring at levels of international importance.

Qualifying Species/populations (as identified at designation):

Table A1: Ramsar criterion 6 – species/populations occurring at levels of international importance qualifying species/populations

Species with peak counts in spring/autumn	
Oystercatcher, Europe and NW Africa-wintering	56,831 individuals, representing an average of 5.5% of the population (5 year peak mean 1998/9 – 2002/3)
Species with peak counts in winter	
Whooper swan, Iceland/UK/Ireland	154 individuals, representing an average of 2.6% of the GB population (5 year peak mean 1998/9 – 2002/3)
Pink-footed goose, Greenland, Iceland/UK	4,321 individuals, representing an average of 1.8% of the population (5 year peak mean 1998/9 – 2002/3).

Species with peak counts in spring/autumn	
Barnacle goose, Svalbard/Denmark, UK	13,515 individuals, representing an average of 58.7% of the population (5 year peak mean 1998/9 – 2002/3).
Northern pintail, north-west Europe	4,264 individuals, representing an average of 7.1% of the population (5 year peak mean 1998/9 – 2002/3).
Greater scaup, western Europe	1,612 individuals, representing an average of 21.3% of the GB population (5 year peak mean 1998/9 – 2002/3).
Red knot, western and southern Africa (wintering)	9,370 individuals, representing an average of 2% of the population (5 year peak mean 1998/9 – 2002/3).
Bar-tailed godwit, Western Palearctic	1,758 individuals, representing an average of 1.4% of the population (5 year peak mean 1998/9 – 2002/3).
Curlew, northern Europe (breeding)	6,179 individuals, representing an average of 1.4% of the population (5 year peak mean 1998/9 – 2002/3)
Redshank	3,459 individuals, representing an average of 1.3% of the population (5 year peak mean 1998/9 – 2002/3).

Species/populations identified subsequent to designation for possible future consideration under criterion 6.

Table A2: Species/populations identified subsequent to designation for possible future consideration under criterion 6

Species regularly supported during the breeding season	
Lesser black-backed gull, western Europe/Mediterranean/west Africa	2,402 apparently occupied nests, representing an average of 1.6% of the breeding population (Seabird 2000 Census)
Herring gull, north-west Europe and Iceland/W Europe	7,211 apparently occupied nests, representing an average of 1.9% of the breeding population (Seabird 2000 Census)
Species with peak counts in spring/autumn	
Ringed plover, Europe/north-west Africa	1405 individuals, representing an average of 1.9% of the population (5 year peak mean 1998/9 – 2002/3 - spring peak)
Species with peak counts in winter	
Dunlin, west Siberia/west Europe	14807 individuals, representing an average of1.1% of the population (5 year peak mean 1998/9 – 2002/3)
Produced by JNCC: Version 3.0, 13/06/2008[82]	

[82] JNCC (2008), *Ramsar Information Sheet: UK11079, Upper Solway Flats and Marshes*. Available online at: https://jncc.gov.uk/jncc-assets/RIS/UK11079.pdf.

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