11 Ecology

11.1 Introduction

11.1.1 This chapter considers the potential impacts of the Beaw Field Wind Farm on the ecology of the Site and surrounding Study Area, during construction and operation. The assessment is based on the Guidelines for Ecological Impact Assessment (EcIA) in the United Kingdom[1,2]; A Handbook on Environmental Impact Assessment[3]; and Assessing the Cumulative Impact of Onshore Wind Energy Developments[4]. The baseline ecological conditions were assessed through targeted field surveys of important and legally protected ecological receptors identified from a desk-study. The scope of the ecological assessment includes habitats, flora and fauna but excludes potential effects on birds, which are considered separately in Chapter 10: Ornithology.

11.1.2 Alba Ecology Ltd. is a Scottish-based multi-disciplinary ecological consultancy that has worked in the north of Scotland, and Shetland specifically, for many years. Alba Ecology staff have led on and contributed to all aspects of Ecological Impact Assessment on many large-scale Scottish wind farm development projects, including the management of Ecological Clerks of Work teams, principal ornithological/ecological surveyors, and advisors on planning applications, including expert witness at Public Local Inquiry and production of Environmental Statements and Habitat Management Plans.

11.1.3 The ecological surveyors that worked at the Site and surrounding Study Area between 2010 and 2012 and in 2015 were Peter Cosgrove, Dr Kate Massey, Robert Potter, Donald Shields, and Ryan Wilson-Parr. Dr Kate Massey worked on the Site again in 2020 and 2022 and therefore has a detailed understanding of habitats and communities.

11.1.4 The surveyors have extensive ecological field experience of upland areas, and attended regular training events led by experts, covering areas such as species identification, recording data concisely and accurately, navigation techniques and health and safety. Surveyors were trained to carry out surveying and mapping work in a systematic manner, following recognised standardised survey methods.

11.1.5 The fish habitat and electric fishing survey was conducted by Waterside Ecology. Waterside Ecology specialising in survey and monitoring of freshwater species and habitats. The aquatic macro-invertebrate survey was conducted by Aquaterra Ecology. Aquaterra Ecology has established a strong track record in surveying aquatic macro-invertebrates for the renewable energy sector.

11.1.6 Full details of ecological survey methodologies and results can be found in Appendix 11.1: Desk Study, Appendix 11.2: Phase 1 Habitat, NVC and GWDTE Survey Report, Appendix 11.3 Otter Survey Report, Appendix 11.4 Freshwater Pearl Mussel Survey Report, Appendix 11.5 Fish Habitat and Electric Fishing Survey Report and Appendix 11.6 Aquatic Macro-invertebrate Survey Report. An updated Habitat and NVC Survey Report is included at Appendix 11.7.

11.1.7 An updated habitat and NVC survey was carried out in 2020 to inform production of the Site's Habitat Management Plan (HMP). A further update survey was then then undertaken in May 2022. The update survey has found that there have been no fundamental changes to the habitats and communities within the Study Area and therefore the baseline remains unchanged. As a result, the findings of the original assessment, which are reproduced below, remain valid.

11.2 Legislative framework

11.2.1 Relevant national planning policy guidelines, international commitments, legislation, and planning policies relevant to the protection, conservation and enhancement of nature conservation interests associated with the Consented Development are outlined in Chapter 4: Planning and Policy Background.

11.2.2 The approach used to assess the significance of potential effects of the Consented Development upon ecological receptors is set in the context of:

- The Wildlife and Countryside Act 1981 (as amended);
- European Commission (EC) (2011) European Biodiversity Strategy;
- EC Directive 1992/43/EEC on the conservation of natural habitats and of wild fauna and flora. The so-called Habitats Directive;
- The Nature Conservation (Scotland) Act 2004 (as amended);
- Scottish Government (2014) Scottish Planning Policy[5];
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 as amended;
- Guidelines for Ecological Impact Assessment in the United Kingdom[1];
- Guidelines for Ecological Impact Assessment in the UK and Ireland, 2nd Edition[2];
- Guidelines for Ecological Evaluation and Impact Assessment[6]
- A Handbook on Environmental Impact Assessment[3];
- Land-use planning system SEPA guidance note 4: planning guidance on windfarm developments. LUPG-GU4 Version 7;
- Land-use planning system SEPA guidance note 31: Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. LUPG-GU31 Version 2;
- The UK Biodiversity Action Plan (BAP) 2004;
- Strategic Plan for Biodiversity 2011–2020' Convention on Biological Diversity, 2010[7]; and
- The Shetland Local Development Plan[8].

11.3 Methodology

Study area definitions

11.3.1 The following geographic definitions are used in this chapter and associated technical appendices (Table 11.1). The Study Area is illustrated in Figure 11.1.

Table 11.1: Study Area Definitions

Term	*Definition*
The Site	This refers to all the land within the Application Boundary for the Beaw Field Wind Farm.
Development Footprint	This refers to the footprint of the Consented Development infrastructure within the Site. It includes the turbines, access tracks, substation, temporary construction compound and borrow pit.
Study Area	The main Study Area is dependent on the ecological receptor. It takes into account best practice guidelines and the greatest distance by which a potential impact might likely occur. For example, the Study Area for the Phase 1 and NVC survey included the Application Boundary plus a 300m buffer, the Study Area for otters included the Development Footprint plus a 250m buffer around all infrastructure, except the access track which had a 100m buffer.

Surveys undertaken

11.3.2 The ecological surveys were conducted in two phases. The first was a desk study of historical information sources. The second was a series of targeted field surveys of potentially important and/or legally protected ecological receptors. All the ecology field surveys were undertaken by experienced ecological surveyors using recognised survey methods, during suitable times of year and under suitable weather conditions for the habitats and species concerned. The Study Area for each survey was determined according to the greatest distance by which a potential impact might likely occur for the potential receptors concerned, along with standard survey guidance for the relevant receptor.

Desk study

11.3.3 The desk study was conducted using the NatureScot (previously SNH)'s SiteLink website[9] and the NBN Gateway[10] (Appendix 11.1: Desk Study). All records of ecological receptors within a 2km radius of the desk Study Area were identified. All designated sites with ecological qualifying features within a 10km radius of the Site on Yell were identified.

Field surveys

Phase 1 habitat survey

11.3.4 A Phase 1 habitat survey was conducted in May 2012 and updated in September 2015. The vegetation was described and mapped following the methods described in Joint Nature Conservation Committee (JNCC) Handbook for Phase 1 Habitat surveys[11] and IEEM best practice guidelines[12]. Details of the survey methodology and results are provided in Appendix 11.2: Phase 1 Habitat, NVC and GWDTE Survey Report.

11.3.5 An update survey was carried out by Alba Ecology in 2020 to inform preparation of an HMP. A further update survey was then carried out in May 2022.

National vegetation classification (NVC) survey

11.3.6 An NVC field survey was carried out in May 2012 and updated in September 2015. The vegetation was described and mapped in accordance with published standard NVC methodology[13]. NVC survey

methods were not employed where the Phase 1 habitat survey had identified dry or wet modified bog. This was because modified bog is a highly modified habitat type. Details of the survey methodology and results are provided in Appendix 11.2: Phase 1 Habitat, NVC and GWDTE Survey Report. The May 2022 walkover survey provided an update on communities within the Site (see Appendix 11.7).

Groundwater dependant terrestrial ecosystems

11.3.7 Wetland habitats were identified using the Functional Wetland Typology[14, 15] cross-mapped the wetland typology with Phase 1 habitats and NVC vegetation types to allow comparison with existing survey data. Therefore, the Phase 1 habitats and NVC communities that were already assigned were used to determine wetlands. An assessment was conducted by surveyors in May 2012 and September 2015 to assess the landscape settings of the communities and whether they conformed to the wetland habitat categories and to the groundwater dependency as described in the SNIFFER field survey manual[15]. Details of the survey methodology and results are provided in Appendix 11.2: Phase 1 Habitat, NVC and GWDTE Survey Report.

11.3.8 Where wetlands were identified, an assessment was made as to whether they were likely to be GWDTEs as defined by Table 2 in SEPA Guidance Note LUPS-GU4 Version 7[16]

11.3.9 Further assessment of GWDTE can be found in Annex 11.2.1 GWDTE Risk Assessment.

Protected mammals

11.3.10 Given the geographical location and habitats present, and in consultation with NatureScot (previously SNH), the protected mammal survey focussed on determining the potential presence of otter (*Lutra lutra*). All terrestrial mammal species in Shetland are non-native having been introduced by humans over time[17]. Neither NatureScot nor CIEEM provide guidance on determining the value of non-native species, so professional judgement and general guidance from the Invasive Non-native Species Framework Strategy for Great Britain has been used[18]. This suggests that non-native species should not be considered as valuable or important ecological receptors. NatureScot and SIC agreed with the intention to scope out non-native mammal species in a Shetland context, with the exception of otter (For more details refer to Original Scoping Document Section 7.5 Ecology).

Otter survey

11.3.11 The otter survey was conducted using established standard methods[19, 20] within the otter Study Area. These methods involved a systematic spatial survey within 250m of the Development Footprint except the route of the access track which had a 100m buffer (Figure 11.1) Incidental records of otters were also recorded across the Application Boundary whilst other ecological surveys were conducted. The systematic otter survey involved looking for places otters use for shelter, resting and protection (such as couches, lying-up sites and holts), or for signs of activity (such as spraints, feeding remains or footprints)[19,20, 21]as per NatureScot Scoping comments.

11.3.12 The otter survey took place during suitable weather conditions (i.e. after a prolonged dry period), so that otter signs (e.g. spraints) would have time to build up, be relatively visible and would not have been washed away. Details of the survey methodology and results are provided in Appendix 11.3: Otter Survey Report.

Freshwater pearl mussel surveys

11.3.13 Freshwater pearl mussel (*Margaritifera margaritifera*) surveys were conducted by licensed surveyors following standard NatureScot guidance. On the basis that there are no known historical records of freshwater pearl mussels within the Site, site survey selection was directed towards establishing the status (presence or absence) of freshwater pearl mussels and habitat suitability in all potentially suitable watercourses within the Site. Details of the survey methodology and results are provided in Appendix 11.4: Freshwater Pearl Mussel Survey Report.

Fish

11.3.14 Fish surveys were undertaken and included both quantitative and non-quantitative walkover surveys. Both were based on protocols described by Hendry and Cragg-Hine (1997)[22], Summers et al. (1996)[23] and SEPA (2010)[24]. These characterise in-stream habitats according to depth, substrate, flow and thus suitability for different age classes of salmonid fish. Quantitative habitat surveys were conducted where streams were judged largely suitable for production of salmonid fish. During these surveys data were collected on substrate composition, flow types and depths. Qualitative surveys were conducted in small first order streams. These streams were inspected, and target notes and photographs were taken. Obstacles to migration were recorded and photographed. Their likely passability for adult salmonids was assessed based on published guidance[24,25] . Details of the survey methodology and results are provided in Appendix 11.5: Fish Habitat and Electric Fishing Survey Report.

Aquatic macro-invertebrates

11.3.15 Aquatic macro-invertebrate communities were sampled using standard kick sampling methods[26 ,27] from 11 sites on five watercourses: Burn of Arisdale, Burn of Hamnavoe, Burn of Kettlester, Green Burn and Burn of Horsewater. Major groups (*Malacostraca, Ephemeroptera, Trichoptera, Plecoptera, Mollusca, Odonata* and adult *Coleoptera*) were identified to species level to establish presence of any rare species and to provide data for production of biological indices: BMWP (Biological Monitoring Working Party), ASPT (Average Score Per Taxon), WFD (Water Framework Directive) class, Water Chemistry Status and Index of Acidity. Physical environmental variables including bed width, depth, flow and substrate profile were recorded at each site. Details of the survey methodology and results are provided in Appendix 11.6: Aquatic Macro-invertebrate Survey Report.

Assessment

11.3.16 The ecological assessment involved the following key stages:

- Scoping and consultation;
- Identification of likely zone of influence of the Consented Development;
- Identification of potentially important ecological receptors likely to be affected by Consented Development;
- Evaluation of potentially important ecological receptors and features likely to be affected by Consented Development;
- Identification of likely impacts and magnitude of the Consented Development on potentially important ecological receptors; and
- Assessment of the likely significant ecological effects of the Consented Development, including any mitigation and enhancement measures and definition of any significant residual effects.

11.3.17 Whilst considering a range of potential outcomes that could arise from the Consented Development, the assessment reports the effects that are considered likely to be significant on the basis of evidence, standard guidance and professional judgement. It is these likely significant effects that the Applicant is obliged to report, and that the planning authority is obliged to consider.

11.4 Establishing the baseline conditions

Scoping opinion

11.4.1 Details of the scoping responses received are given in Chapter 5: Design Evolution and Alternatives. Table 11.2 summarises the ecological responses received from statutory and non-statutory consultees in relation to the Consented Development.

Table 11.2: Summary of Scoping Opinion Ecology Responses

Consultee	***Summary of response***	***Date of response***
NatureScot (previously Scottish Natural Heritage)	Natural heritage interests that are likely to be affected by the Consented Development include sensitive habitats and protected species. Welcome inclusion of a Habitat Management Plan. Agrees that no surveys for reptile, amphibian, or purely marine mammals are necessary. Likely that otters occur on the Site and recommend that surveys are carried out around the Consented Development to allow impacts on any holts within the Site to be mitigated for by micro-siting. An NVC survey is carried out in areas of botanical interest including any areas of blanket bog.	08/05/2015
Scottish Environmental Protection Agency (SEPA)	Concerned about the potential impact of the Consented Development on groundwater dependant terrestrial ecosystems (GWDTE). SEPA requests: • A Phase 1 habitat survey is conducted within a 250m radius of the Consented Development with evacuations deeper than 1m, and 100m radius of evacuations less than 1m; • An NVC survey of wetland habitats within these buffer distances; • A site specific qualitative or quantitative risk assessment following higher risk situations such as the proposed infrastructure being within 250m of GWDTE.	08/05/2015
Shetland Island Council (SIC)	SIC satisfied that the Scoping Report covered the potential issues. This issues being otters, blanket bog and the proximity to Otterswick and Graveland Special Protection Area. The Applicant should also take into account local information and knowledge imparted during the public consultation period.	07/05/2015

Designated sites

11.4.2 The desk study identified two designated sites with ecological qualifying feature on Yell within a 10km radius of the Study Area (Table 11.3 and Figure 11.2).

Table 11.3: Designated sites with ecological qualifying features within 10km of study area

Designated site	*Designation type*	*Qualifying features*	*Area (ha)*	*Distance (km) and direction from Study Area*
Yell Sound Coast	SSSI and SAC	Common Seal and Otters	1,540ha	1.3km south
East Mires Lumbister	SSSI and SAC	Blanket bog	620ha	9.9km north

11.4.3 The Yell Sound Coast SSSI and SAC supports a nationally and internationally important population of breeding otters. When designated, it was estimated that the site supported up to 25% of the Shetland population[28,9]. The areas within the SSSI contain some of the greatest concentrations of otters in Shetland and the UK, as measured by holt density. The habitat of these areas, which determines their suitability for otters, is mainly low rocky coastlines backed by areas of peaty moorland with numerous sources of fresh water.

11.4.4 9.9km to the north of the Site lies the East Mires and Lumbister SSSI and SAC. The designated site is nationally and internationally important for its blanket bog habitat which is one of the finest examples of intact blanket bog in Shetland.

Phase 1 habitat survey

11.4.5 Full details of the habitats present, as identified during Phase 1 habitat surveys, are provided in Appendix 11.2: Phase 1 Habitat, NVC and GWDTE Survey Report. A total of 17 Phase 1 habitats with 14 matrices were found and described using standard Phase 1 habitat survey methodology (Figure 11.3 and Table 11.4). These habitats were all typical of the Scottish uplands and Shetland. Of the habitats present, dry modified bog was the most common habitat making up 39% of the Study Area. The dry modified bog was overwhelmingly dominated by ling heather (*Calluna vulgaris*) with little or no bog-mosses (*Sphagnum* spp.). Wet modified bog made up 25% of the Study Area. It was characterised by extensive hagging with little bog-mosses present in its place woolly fringe moss (*Racomitrium lanuginosum*) dominated. Ling heather and cottongrasses (*Eriophorum* spp.) were abundant. Unmodified blanket bog made up 8% of the Study Area. The unmodified blanket bog was generally dominated by ling heather with abundant cottongrasses. Crowberry (*Empetrum nigra*) was a frequent dwarf shrub growing as a mat below the ling heather. There were small areas of unimproved acid grassland (7%), dry dwarf shrub heath (4%), improved grassland (2%) and wet dwarf shrub heath (1%) There were many mosaics of habitat types (12% in total) and several habitats which occurred occasionally (e.g. marshy grassland (<1%) and open water (1%)). The complete list of Phase 1 habitats and the percentage covers are in Table 11.4.

Table 11.4: The area and percentage cover of phase 1 habitats found in the study area

Phase 1 habitat	*Area (km^2)*	*Area (ha)*	*Percentage cover (%)*
Dry modified bog	6.321	632.1	38.9
Wet modified bog	4.006	400.6	24.6
Unmodified blanket bog	1.300	130.0	8.0
Unimproved acid grassland	1.162	116.2	7.1
Dry dwarf shrub heath	0.587	58.7	3.6
Unimproved acid grassland/bare peat	0.385	38.5	2.4
Dry modified bog/unimproved acid grassland	0.360	36.0	2.2
Improved grassland	0.342	34.2	2.1
Wet modified bog/dry modified bog	0.274	27.4	1.7
Semi-improved acid grassland	0.265	26.5	1.6
Dry modified bog/bare peat	0.226	22.6	1.4
Wet dwarf shrub heath	0.226	22.6	1.4
Open water	0.128	12.8	0.8
Dry modified bog/bare ground	0.126	12.6	0.8
Unmodified blanket bog/dry modified bog	0.111	11.1	0.7
Sea	0.071	7.1	0.4
Wet heath/unimproved acid grassland	0.065	6.5	0.4
Marshy grassland	0.043	4.3	0.3
Buildings and roads	0.034	3.4	0.2
Bare ground	0.033	3.3	0.2
Wet modified bog/acid grassland	0.033	3.3	0.2
Dry heath/unimproved acid grassland	0.027	2.7	0.2
Wet modified bog/wet heath	0.024	2.4	0.1
Improved grassland/unimproved acid grassland	0.024	2.4	0.1

Table 11.4: The area and percentage cover of phase 1 habitats found in the study area

Phase 1 habitat	*Area (km^2)*	*Area (ha)*	*Percentage cover (%)*
Bare peat/bare ground	0.021	2.1	0.1
Unimproved calcareous grassland	0.021	2.1	0.1
Intertidal	0.019	1.9	0.1
Acid flush/unimproved acid grassland	0.018	1.8	0.1
Acid flush	0.009	0.9	0.1
Unmodified blanket bog/wet modified bog	0.009	0.9	0.1
Semi-improved neutral grassland	0.001	0.1	0.0
Total	**16.269km^2**	**1,626.9ha**	**100%**

NVC survey

11.4.6 Full details of the habitats present, as identified during NVC surveys, are provided in Appendix 11.2: Phase 1 Habitat, NVC and GWDTE Survey Report. There were 17 different NVC communities and sub-communities found within the Study Area with a further 21 matrixes present (Figure 11.4). The most common vegetation community was dry modified bog and wet modified bog (which have no associated NVC community as they are highly modified) this was followed by the NVC community M19. M19 was dominated by ling heather and hare's-tail cottongrass (*Eriophorum vaginatum*) above a layer of red bog-moss (*Sphagnum capillifolium*). NVC grassland community U6 was the next most common community. Heath rush (*Juncus squarrosus*) was dominant with abundant mat grass (*Nardus stricta*).This community was found along the side of streams, in flushes and at transitions between grassland and heath/bog. It was also found on areas that had been affected by peatland management. Other NVC communities located within the Study Area included M15, M18, M20, U4, U5, H10 and H14.

GWDTE survey

11.4.7 Full details of the GWDTE are provided in Appendix 11.2: Phase 1 Habitat, NVC and GWDTE Survey Report and Annex 11.2.1: GWDTE Risk Assessment. Most of the habitats and communities within the Study Area are not considered likely to be wetlands or GWDTE (Figure 11.5). However, SEPAs Guidance Note[16]) recommends that the NVC communities U6, M6, M15, M28, M29, MG10 and CG10 should be treated as GWDTE unless information can be provided to demonstrate they are not dependent on groundwater. SEPA[29 ,16] recognises that some of these communities are common across Scotland (e.g. M6, M15 and MG10). SEPA[16] also recognise that these communities may be considered GWDTEs only in certain hydrogeological settings, or may have limited dependency on groundwater in certain hydrogeological settings. Evaluation of the hydrological setting of these habitat resulted in CG10 assessed as potentially highly GWDTE, although this habitat is more than 700m from the nearest infrastructure. The M6 and M29 NVC communities in the Study Area were evaluated as potentially moderately groundwater dependant. Further, hydrological assessment of the M6 and M29 communities established that these communities were predominantly maintained by water contained within the peat rather than the bedrock aquifer, and so are unlikely to be GWDTE (Annex 11.2.1 GWDTE Risk

Assessment).The other NVC communities were assessed as having either no groundwater dependency or potentially low groundwater dependency.

Otters

11.4.8 Full details of the otter field signs, as identified during otter survey work, are provided in Appendix 11.3: Otter Survey Report. There was only one spraint identified within the otter Study Area (Figure 11.6). An additional seven otter signs were recorded during other ecology surveys within the Application Boundary (Figure 11.6 and Table 11.5). Field signs included spraints, footprints, feeding signs and a possible slide and couch. Despite a thorough survey of the Study Area no other otter signs were recorded.

Table 11.5: The location of otter signs recorded within the study area in 2015

Location	***Record***
Migga Dale HU 468 812 – within Study Area	Spraint
Burn of Aris Dale HU 481 828 – outside Study Area	Spraint
Burn of Hamnavoe HU 498 824 – outside Study Area	Spraint
Mill Burn HU 53315 82489 – outside Study Area	Footprints
Mill Burn HU 53298 82453 – outside Study Area	Spraint and footprints
Mill Burn HU 53291 82439 – outside Study Area	Footprints
Burn of Horsewater HU 53016 81808 – outside Study Area	Possible slide and couch
Burn of Hummelton HU 52930 82407– outside Study Area	Fish remains. Possible otter sign

11.4.9 Although there was one otter field sign within the Study Area, no additional otter field signs, holts or resting areas were recorded, suggesting that the Study Area is used only occasionally by otters but it is not important for otters. However, on the basis of the spraint located within the Study Area, which indicates occasional use, otters are considered further within this assessment.

Freshwater pearl mussels

11.4.10 Full details of the freshwater pearl mussel surveys are provided in Appendix 11.4: Freshwater Pearl Mussel Survey Report. No freshwater pearl mussels were located within the Site. Therefore, freshwater pearl mussels are not considered further within this assessment.

Fish

11.4.11 Full details of the fish surveys are provided in Appendix 11.5: Fish Habitat and Electric Fishing Survey Report.

11.4.12 The main findings for these surveys were:

- Most of the streams in the Study Area were found to provide suitable habitats for trout.

- Productive trout habitats were most abundant in the Burn of Hamnavoe and the Burn of Arisdale. Suitable habitats were also identified in Green Burn and in the Loch of Kettlester outflow streams. Many of these habitats are accessible to sea trout and trout populations are likely to include a migratory component.
- Electric fishing found juvenile trout in varying densities in Burn of Arisdale, Burn of Hamnavoe, the Loch of Kettlester outflow and Green Burn. No trout were found at survey sites in Burn of Horsewater or Burn of Evrawater, but they may be present in the lower reaches of these watercourses, outside the Study Area.
- No salmon were found in the Study Area.
- Eels were widespread and were found in all streams where electric fishing took place.
- Three-spined sticklebacks were found only in the Loch of Kettlester outflow stream.
- Larval lamprey habitats were found only in Burn of Arisdale, but spot checks found no larvae, consistent with a previous survey of this stream during 2004.

11.4.13 Based on this data, fish are considered further within this assessment.

Aquatic macro-invertebrates

11.4.14 Full details of the aquatic macro-invertebrate surveys are provided in Appendix 11.6: Aquatic Macro-invertebrate Survey Report. The aquatic macro-invertebrate communities within the Study Area consisted of common and widespread species typical of Scottish upland or rural watercourses and no rarities were identified. Therefore, aquatic macro-invertebrates are not considered further within this assessment.

11.5 Assessment of impacts

Impacts assessed

11.5.1 The main elements of the Consented Development which have the potential to impact on ecological receptors both during construction and operation are described in Chapter 3: Project Description and include:

- 17 wind turbine generators with a maximum tip height of up to 145m with a total generating capacity greater than 50MW;
- Turbine foundations and transformers (if external);
- Access tracks;
- Hardstanding and cleared areas for wind turbine construction and maintenance;
- Underground electrical and communication cabling;
- Substation and control building;
- Compound during construction;
- Permanent Met mast;
- Radio communications tower
- Four borrow pits for aggregates; and

- Watercourse crossings.

11.5.2 The following potential impacts have been assessed in full in relation to the construction of the Consented Development:

- Direct loss of habitat;
- Direct loss of foraging habitat and/or breeding habitat for protected species;
- Indirect loss of foraging habitat and/or breeding habitat for species, through displacement; and
- Disturbance to protected species due to track and turbine base construction as well as turbine erection, heavy machinery, noise and human activity on the Site.

11.5.3 The following potential impacts have been assessed in full in relation to the operation of the Consented Development:

- Direct and indirect loss of foraging or breeding habitat due to displacement or avoidance; and
- Cumulative impacts of the Consented Development in the context of other nearby wind farms (operational and consented).

Impacts scoped out

11.5.4 Ecological impacts arising from the process of decommissioning have been scoped out of this assessment. An assessment of the ecological impacts of decommissioning the Consented Development has not been undertaken as part of the EIA because: (i) the future baseline conditions (environmental and other developments) cannot be predicted accurately at this stage; (ii) the proposals for decommissioning are not known at this stage, and (iii) the best practice decommissioning guidance methods will likely change during the lifetime of the Consented Development and so cannot be predicted at this stage. Nevertheless, the Applicant commits to an additional consultation one year in advance of the year of decommissioning and to implement best practice decommissioning methods at the time of decommissioning. General decommissioning plans are considered within Chapter 3: Project Description.

11.5.5 The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 as amended (hereafter known as the 'EIA Regulations') require all "*likely significant effects*" (beneficial and adverse) to be considered. This is usually taken to mean site specific related effects, although this is not as straightforward as it first appears to be. For example, the benefits to ecological receptors within the Study Area stemming from the contribution made by the wind farm towards countering climate change through renewable energy generation cannot yet be quantified at a local scale. Nevertheless, it is clear that a wind farm of this size will potentially make a beneficial contribution to meeting national CO_2 emission targets as well as reducing actual CO_2 emissions, helping to combat climate change, a significant threat to habitats and species globally. Uncertainties regarding climate change predictions mean that it is not possible at present to carry out a quantitative assessment of the beneficial impacts of wind farms to habitats and species. Therefore, these have been scoped out of further consideration within this chapter.

Evaluating conservation importance and sensitivity

11.5.6 The ecological receptors identified in the baseline studies were evaluated following best practice guidelines[1].The Site's ecological receptors determine its nature conservation interest or value. Guidance on Ecological Impact Assessment sets out categories of ecological or nature conservation

importance that relate to a geographical framework (e.g. international through to local) together with criteria and examples of how to place a site (defined by its ecological attributes) into these categories. It is generally straightforward to evaluate sites or species populations designated for their international or national importance (as criteria for defining these exist), but for sites or populations of regional or local importance, criteria may not be easily defined. Where possible, the potential importance of an ecological receptor in the Site is determined within a defined geographical context using categories outlined in Table 11.6.

Table 11.6: Summary of geographic importance of species or habitat

Importance term	***Definition***
International	>1% of European Community (EC) population/area of habitat
National	>1% of United Kingdom (UK) population/area of habitat
Regional	>1% of Shetland population/area of habitat
Local	Within local area

11.5.7 The importance attached to a species or habitat can also be determined according to legislative status. Some ecological receptors are subject to a general level of legal protection through the *Wildlife and Countryside Act 1981* (as amended) and others under *Council Directive 1992/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora* (Habitats Directive). There is no clear guidance for conservation importance of ecological receptors other than those of European protected species and designated site species. The importance of other species is based on professional judgement. The status of potentially important species, such as UK BAP priority species, LBAP species and species with proportionally large geographic populations within the Study Area, is taken in to consideration.

11.5.8 Another factor when assessing potential impacts is the behavioural sensitivity of the ecological receptor under consideration (e.g. high, medium or low), which can vary in space and time. Different receptors respond differently to stimuli, making some particularly sensitive to development activities and others less so. Professional judgement is used when assigning a sensitivity term to an ecological receptor and this is recorded here in a clear and transparent way. Sensitivity criteria vary across the wide range of taxonomic groups considered in an ecological impact assessment and are, therefore, provided in the receptor accounts of this chapter. It should be noted that to avoid confusion, legal protection requirements need to be considered separately from sensitivity and importance[1].

11.5.9 By way of example, sensitivity is determined according to species' behaviour, using broad criteria set out in Table 11.7. Behavioural sensitivity can differ between species and between individuals of the same species. Therefore, sensitivity is likely to vary with both the nature and context of the disturbance activity as well as the experience and even 'personality' of the species, in the case of mammals. Sensitivity also depends on the activity the species is undertaking. For example, a species is likely to be less tolerant of disturbance during the breeding season than at other times of year. Thus, sensitivity changes with both space and time.

Table 11.7: Summary of sensitivity criteria

Sensitivity term	*Definition*
High	Species occupying remote areas away from human activities, or exhibiting strong and long-lasting reactions to disturbance events. Habitats that are considered highly groundwater dependant.
Medium	Species that appear to be warily tolerant of human activities, or exhibiting short-term reactions to disturbance events. Habitats that are considered moderately groundwater dependant.
Low	Species occupying areas subject to frequent human activity and exhibiting mild and brief reaction to disturbance events. Habitats that are considered to have low groundwater dependency or are not groundwater dependant.

Magnitude

11.5.10 Effects on ecological receptors may be beneficial, neutral or adverse. The characteristics and significance of an effect is a function of several factors such as the scale or importance (e.g. number of individuals killed or displaced by an activity, or hectares of habitat lost), extent (the area over which an impact occurs), duration (the time over which an impact occurs), reversibility (whether an impact is temporary or permanent) and its timing or frequency.

11.5.11 A reversible (temporary) effect is one from which spontaneous recovery is possible or for which effective mitigation is possible and a commitment to undertake this mitigation has been made. An irreversible (permanent) effect is one from which recovery is not possible within a reasonable timescale, or for which there is no reasonable chance of action being taken to reverse it.

11.5.12 The duration of a predicted impact can be important, with three time frames used in the assessment: short term (up to two years), medium term (two to five years) and long term (life of the wind farm). The timing of an impact can also have a large influence on its ecological effect. Finally, a level of confidence (whether the predicted effect is certain, probable, possible or unlikely) is attached to the predicted effect.

11.5.13 Magnitude refers to the ‘size’ or ‘amount’ of a predicted impact on a defined ecological receptor. Changes on ecological receptors are therefore judged in terms of their magnitude in space and time. There are many different ways in which these can be defined and it is important that whatever method is used clear definitions are provided[1]. In this assessment there are considered to be four levels of magnitude as shown in Table 11.8 and it is assumed these are adverse, unless otherwise stated.

Table 11.8: Levels of Magnitude of Change

Term	*Definition*
Major (high)	Total/near total loss of a population/habitat due to mortality or displacement. Total/near total loss of breeding productivity in a population due to disturbance. Guide: ≥50% of population/habitat affected.
Moderate (medium)	Moderate reduction in the status or productivity of a population/habitat due to mortality or displacement or disturbance. Guide: 10-49% of population/habitat affected.
Minor (low)	Small but discernible reduction in the status or productivity of a population/habitat due to mortality or displacement or disturbance. Guide: 1-9% of population/habitat affected.
None (negligible)	Very slight reduction in the status or productivity of a population/habitat due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the 'no change' situation. Guide: <1% population/habitat affected.

Significance

11.5.14 Consideration of the importance and sensitivity of receptors and magnitude of impacts or changes helps to determine the likely significance of a potential effect. In the context of the EIA Regulations, each likely effect is evaluated and classified as either significant or not significant, using professional judgement, evidence and best practice guidance. In this assessment, an ecologically significant effect is defined following IEEM (2006), as "*an impact on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a defined geographical area*". Thus, the geographical terms of reference at which a predicted effect may be considered significant must also be defined (e.g. an effect on a species or habitat evaluated to be of regional importance is either significant or not at the regional level). Using the four levels of magnitude as shown in Table 11.8 and the four levels of importance shown in Table 11.6, a matrix comparing the level effect can be seen in Table 11.9. The effects that are considered major or moderate are defined as significant in terms of the EIA Regulations. Those effects that are considered minor or negligible are defined as not significant.

Table 11.9: Matrix showing level of effect, related to importance of feature and magnitude of change

Importance of feature	*Magnitude of change*			
	Major (High)	*Moderate (Medium)*	*Minor (Low)*	*None (Negligible)*
International	Major	Major	Moderate	Negligible
National	Major	Moderate	Minor	Negligible
Regional	Moderate	Moderate	Minor	Negligible
Local	Minor	Minor	Negligible	Negligible

Limitations to the assessment

11.5.15 Where assumptions within the assessment are made, these are explicitly identified and explained. Similarly, limitations in methods and uncertainty over parameter values and species' ecology are also identified and discussed, particularly where this is likely to affect the outcome of the assessment. As with any environmental assessment there will be elements of uncertainty. Where there is uncertainty, this is identified and reported, along with the measures taken to reduce it, assumptions made, and an explanation as to the likely extent that any uncertainties are likely to affect the conclusions. In circumstances where there is uncertainty; evidence, expert opinion, best practice guidance and professional judgement have been used to evaluate what is biologically likely to occur if the Consented Development is constructed.

11.5.16 The level of certainty of impact prediction varies depending upon a range of parameters discussed already. For some elements (e.g. land-take) it is relatively straightforward to assess and quantify the area of habitat that is likely to be lost to development infrastructure and therefore quantify potential impacts of land-take on the habitats present. However, other impacts are less certain because there can be a range of possible scenarios. The main limitations in this assessment are common to most ecological assessments because:

- Baseline surveys undertaken are based on sampling techniques, not absolute censuses. Results give an indication of the numbers of ecological receptors recorded at the particular times that surveys were carried out. Species occurrence changes over time and therefore the results presented in this EIAR are snapshots in time. Importantly, no information gaps were identified in the baseline survey data that would prevent assessments in line with the requirements of the EIA Regulations to be undertaken.
- Putting ecology survey results into a wider geographical context is sometimes challenging because most species and habitats have not been systematically surveyed beyond the Study Area. Thus, defining a population as locally or regionally important is potentially difficult because local or regional population estimates do not exist for most taxa and habitats. Whenever such uncertainty exists, professional judgement and published evidence is used and populations in the Study Area or Site have been assumed to be at their highest potential level of geographical/ecological importance.

Evaluating the importance of species in the site

11.5.17 There was a single otter sign located in the Study Area and a limited number of otter signs recorded across the Site which indicates that otters use the Study Area only occasionally. However, the otters using the Site may be from the nearby Yell Sound Coast SSSI and SAC designated site which includes otters as a qualifying feature. Therefore, the few otters using the Site are evaluated as being of potentially national importance (coming from the SAC for otters) with low sensitivity. No salmon were recorded in the Study Area, but there were records of eels and trout. In accordance with Table 11.6 the fish are evaluated as being of local importance. Most of the plant species recorded in the Study Area were common and widespread across the UK and Shetland. Alpine bearberry was found in the dry dwarf shrub heath which is listed as being nationally scarce. The plant population was evaluated as being of local importance. A summary of the sensitivities and importance of the Study Area for important ecological receptors is provided in Table 11.10.

Table 11.10: Summary of important ecological species receptors sensitivity and importance

Ecological receptor	*Sensitivity*	*Importance*
Otter	Low	National
Fish	Low	Local
Plants (all species)	Low	Local

Evaluating the importance and sensitivity of habitats on the site

11.5.18 Active, peat forming blanket bog is listed by European legislation, under Annex 1 of the Habitats Directive (Directive on the Conservation of Natural Habitats and Wild Fauna and Flora EC/92/43). Some of the unmodified blanket bog habitat in the Study Area could be described as 'active' using Annex 1 definitions. However, a vegetation survey provides only limited information on which to assess whether blanket bog is actively peat forming or not. Where there was a deep continuous layer of bog-moss species and an abundance of hare's-tail cottongrass the blanket bog was likely to be active. At higher altitudes blanket bog with extensive erosion features may still be classified as 'active' if it otherwise supports extensive areas of typical bog vegetation, especially if the erosion gullies show signs of re-colonisation[30]. Therefore, on balance, the blanket bog habitats described as NVC community M18, M19 and M20 (not including areas matrixed with M3, M15, U5, U6 or modified bog) in the Study Area should be treated as possibly approaching Annex 1 European habitat descriptions.

11.5.19 There is 2,200,000ha (22,000km^2) of blanket bog in the UK[31,32] and 1,759,000ha (17,590km^2) of this is located in Scotland[31]. There appears to be no data published showing the amount of blanket bog on a regional scale (i.e. in Shetland). The Study Area had 130ha (1.30km$^{2;}$ Table 11.4) of unmodified blanket bog habitat. Although some of the unmodified blanket bog is possibly approaching both UK BAP and Annex 1 habitat definitions, there is much less than 1% of the national total (0.006%), and therefore the quantity/size present is not considered to be of national, European or international importance. Blanket bog (or peatland) is a ubiquitous habitat across Shetland as a region[33]. Therefore, the area of blanket bog within the Study Area was considered to be of local importance in the context of the blanket bog resource on Yell. The sensitivity of blanket bog is considered to be low/medium as bogs can recover, given the chance, over a short-medium time scale after disturbance, as evidence by rapid recovery on adjacent West Yell blanket bog with reduction in grazing and trampling pressure (Appendix 10.4 Outline Habitat Management Plan).

11.5.20 The dry dwarf shrub heath in the Study Area included NVC communities H10 and H14. H14 is included in the UK BAP priority habitat mountain heaths and willow scrub and H10 is included in the UK BAP priority habitat upland heath. Both are included in the Annex 1 habitat alpine and boreal heath. The UK BAP mountain heaths and willow scrub description includes heaths dominated by ling heath and bilberry (*Vaccinium myrtillus*) with abundant woolly fringe moss and/or lichens with stiff sedge (*Carex bigelowii*) (Maddock, 2008). Annex 1 alpine and boreal heath is defined as dwarf shrub heaths of ling heather, bilberry or juniper (*Juniperus communis*) which are low growing or prostrate[31]. The H14 community on the top of the hills within the Study Area was equivalent to these definitions.

11.5.21 There is estimated to be 60,000ha of mountain heaths and willow scrub in Scotland[30] and 42,100ha of alpine and boreal heath in the UK[31]. There appears to be no data published showing the amount of heath in Shetland. There was 37ha of H14 within the NVC Study Area; this is 0.06% and 0.09% of the

mountain heath and willow scrub and alpine and boreal heath respectively. Heathlands are also known to be common habitats in Shetland[33]. Therefore, the quantity and condition of the H14 community suggests it should be evaluated as of local importance. The sensitivity of dry heath is considered to be low-medium as heaths can recover over a short-medium time scale after disturbance.

11.5.22 Annex 1 European dry heath includes dwarf shrub dominated vegetation with ling heather, bilberry and bell heather[31]. Some of the H10 dry dwarf shrub heath may have been approaching these definitions, but it was found in small patches, within a matrix of acid grassland. There is 608,000ha (6,080km^2) of dry dwarf shrub heath in the UK[31]. There was 24ha of H10 the within the Study Area which is much less than 1% (0.0004%) of the total. Therefore, the H10 was not considered to be of sufficient quantity or quality to be regionally, nationally or internationally important and was evaluated as being of local importance. The sensitivity of dry heath is considered to be low-medium as heaths are known to recover over a short-medium time scale after disturbance.

11.5.23 UK BAP wet dwarf shrub heath (within the upland heath BAP habitat) in favourable condition is defined as 'dominated by a mixture of cross-leaved heath, deergrass, ling heather and purple moor-grass over an understorey of bog-moss'[30]. Annex 1 Northern Atlantic wet heath includes M15 including wet heath[31]. There is 462,000ha (4,620km^2) of wet dwarf shrub heath in the UK[31]. There appears to be no data published showing the amount of wet heath in Shetland. There was 22ha of wet dwarf shrub heath within the Study Area, which is much less than 1% (0.004%) of the total. Wet heaths are common habitats on Shetland[33]. Therefore, the wet dwarf shrub heath was evaluated as being of local importance. The sensitivity of wet heath is considered to be low-medium. Heaths can recover over a relatively short timescale.

11.5.24 Other NVC communities identified during the survey work are listed in the UK BAP Priority Habitat Descriptions[30], e.g. M6, M28, M29 and CG10. However, as with the heath communities, the very small size of the areas of each of these communities in the Study Area renders them of little importance on a regional, national, European or international scale. Therefore, they are evaluated as being of local importance.

11.5.25 Most of the habitats and communities within the Study Area are not considered likely to be wetlands or GWDTE. However, NVC communities CG10 was considered to be potentially highly groundwater dependant and NVC community M6 and M29 were considered moderately groundwater dependant. In accordance with Table 11.7 these NVC communities have been evaluated as high and moderately sensitive habitats respectively and of local importance (Table 11.6).

11.5.26 A summary of the sensitivities and importance of the Study Area for important ecological habitat receptors taking into account ecological value and groundwater dependency is provided in Table 11.11.

Table 11.11: Summary of important ecological habitat receptors sensitivity/importance

Phase 1 habitat	*Sensitivity*	*Importance*
Dry modified bog	Low	Local
Wet modified bog	Low	Local
Unmodified blanket bog	Low/medium	Local
Unimproved acid grassland	Low	Local
Dry dwarf shrub heath	Low/medium	Local
Improved grassland	Low	Local
Semi-improved acid grassland	Low	Local
Wet dwarf shrub heath	Low/medium	Local
Marshy grassland	Low	Local
Bare ground	Low	Local
Unimproved calcareous grassland (NVC community CG10)	High	Local
Acid flush (NVC communities M6 and M29)	Medium	Local
Semi-improved neutral grassland	Low	Local

Evaluation of construction and operation effects

Impacts to be assessed

11.5.27 The main construction and operational elements of the Consented Development which have the potential to impact on ecological receptors both during construction and operation are assessed within this section. For full details of the proposed scheme refer to Chapter 3: Project Description. A summary of the potential construction and operational impacts on ecology are outlined in Tables 11.12 and 11.13. Potential impacts in these tables do not imply that they will occur, or that any resultant effects will be significant.

Table 11.12: Summary of potential construction impacts on ecology

Activity	*Potential Ecological Impact*
Mobile plant operations and traffic	Direct habitat loss. Temporary noise. Vibration, movement, vegetation disturbance and habitat fragmentation. Pollution and sediment release into watercourses. Mortality.
Borrow pit operations	Direct habitat loss. Temporary noise. Vibration, movement, vegetation disturbance, habitat loss and fragmentation. Pollution and sediment release into watercourses. Mortality.
Tracks and watercourse crossings including cut/fill works	Direct habitat loss. Temporary noise. Vibration, movement, vegetation disturbance and habitat fragmentation. Pollution and sediment release into watercourses. Changes in hydrology and chemistry leading to vegetation changes. Mortality.
Cable laying including cut/fill works	Direct habitat loss. Temporary noise. Vibration, movement, vegetation disturbance and habitat fragmentation. Pollution and sediment release into watercourses. Introduction of drainage lines leading to habitat change.
Construction compounds and laydown areas including cut/fill works	Direct habitat loss. Temporary habitat loss, disturbance and fragmentation caused by overlaying vegetation. Pollution and sediment release into watercourses. Mortality.

Table 11.13: Summary of potential operational impacts on ecology

Activity	*Potential Ecological Impact*
Turbines in operation	Noise and movement resulting in potential disturbance.
Foundations	Small residual loss of habitat from construction throughout operation. Impacts on hydrology resulting in changes to vegetation.
Tracks	Residual loss of habitat from construction throughout operation, severance and fragmentation of habitats. Impacts on hydrology and chemistry along track edges resulting in changes to vegetation. Sediment release into watercourses. Mortality from service vehicles.
Recreation i.e. recreational use of tracks	Increased disturbance and associated effects through noise and trampling etc. e.g. motorbikes, walking, dogs and litter etc.
Substation	Loss of habitat from construction continues throughout operation.
Borrow pits	Changes to habitats (loss of one habitat and creation of another).
Cleared areas around turbines	Loss of habitat from construction continues throughout operation.

Impacts evaluated on designated sites

11.5.28 There are two designated ecological sites within 10km of the Consented Development, as identified in Table 11.3 (Figure 11.2). The closest designated ecology site is Yell Sound Coast SSSI and SAC supporting a nationally and internationally important population of breeding otters. However, it is 1.3km away from the Application Boundary. Therefore, no land-take or changes to hydrology will take place within this designated site, so no direct or indirect habitat loss will occur.

11.5.29 The East Mires and Lumbister SSSI and SAC is nationally and internationally important for blanket bog and holds one of the finest examples of intact blanket bog in Shetland. This vegetation provides a nationally and internationally important breed ground for waders. The East Mires and Lumbister is 9.9km away from the Application Boundary. Therefore, no land-take or changes to hydrology will take place within this designated site, so no direct or indirect habitat loss will occur. No other route to impact on designated sites or their features are predicted. Consequently, no significant effects on designated sites are predicted.

Impacts evaluated on species and habitat

11.5.30 This section describes the potential effects on otters, fish and habitats that could arise, in the absence of mitigation, from the construction and operation of the Consented Development. Mitigation measures to reduce potential effects are described in the **Section 11.7** Mitigation measures, with an assessment of the residual effects (i.e. after mitigation has been implemented) described in the Residual effects section. Potential impacts include:

- Direct habitat loss due to land-take by turbine bases, access tracks and ancillary structures, and temporary habitat loss due to the construction compound;
- Indirect habitat loss due to the displacement of species as a result of construction, operation and maintenance activities due to the presence of the operating turbines close to important habitat, including foraging areas or commuting routes;
- Habitat modification e.g. due to changes in hydrology;
- Direct habitat loss and/or mortality and injury due to pollution of habitat from construction methods;
- Mortality or injury e.g. due to road traffic accidents or construction methods; and
- Disturbance caused by noise of construction or operation maintenance.

11.5.31 Following the baseline study, the assessments on freshwater pearl mussel and aquatic macro-invertebrates have been scoped out. Consequently, the following receptors are assessed:

- Otters;
- Fish; and
- Habitats.

Otter

11.5.32 The construction and operation of the Consented Development has the potential to negatively affect otter directly or indirectly in a number of ways (Table 11.12 and 11.13):

- Physical damage or loss of holts, feeding and resting site;

- Damage to routes used by otters while crossing the Study Area;
- Damage to water courses by runoff, pollution and blocking of streams; and
- Disturbance caused by noise of construction or operational maintenance.

11.5.33 However, there was only one sign of otters recorded within the otter Study Area (Figure 11.6). Although occasionally otter spraints and feeding signs were found in suitable habitat within the Application Boundary (outwith the otter Study Area), the otter survey failed to find any otter resting sites, natal holts or important foraging areas, so the magnitude of change arising from the negligible loss of habitat (land-take) from the Consented Development on otters is assessed as 'none' negligible. It is likely that any otters using the Site are a component of Yell Sound Coast SSSI and SAC therefore the small number of otters using the Site are assessed as being of national importance (from adjacent SSSI/SAC) but minor (low) sensitivity, resulting in a negligible effect level as shown in Table 11.9. Therefore, no significant effects are predicted.

11.5.34 Severance describes the loss of continuity between habitats which ultimately results in the isolation or fragmentation of discrete populations of species. The Consented Development includes five major watercourse crossings and one minor watercourse crossing plus frequent culverts (for details see Chapter 3: Project Description). These crossings and culverts have the potential to disrupt otter movements, when they occasionally use the watercourses. In essence, the watercourse crossing, or culvert could act as a barrier to movement between habitats. As part of the design process, 'otter friendly' designs (with appropriate mammal ledges to provide routes for otters to pass through) have been used in the design of large culverts/crossing points and so the magnitude of change in otter habitat as a consequence of severance is assessed as 'none' negligible. Given that the importance of the receptor is national, the effect level is assessed as negligible in accordance with Table 11.9. Therefore, non-significant effects are predicted.

11.5.35 In the event that a serious pollution incident occurred within the Study Area, such episodes can lead to a sudden pulse of pollutant, which, if not readily contained, might enter the aquatic environment and could affect otters directly, e.g. by coating fur with oil or indirectly through damage to their prey species. Taking into account the intended implementation of best practice pollution prevention measures outlined in Chapter 15: Hydrology and Hydrogeology and Appendix 3.6, it is however, considered very unlikely that a serious pollution incident would occur during construction. Furthermore, the otter activity suggests that otters only occasionally use the water courses within the Study Area for feeding – regular fresh spraints throughout the year would be expected if the Study Area was important for foraging or commuting and these were not found. Therefore, in the unlikely event that a pollution incident did occur, it is very doubtful that pollution would affect otter foraging or commuting. The magnitude of change occasioned by a pollution event for otter is assessed as minor (low) (Table 11.8), resulting in an effect level being assessed as minor in accordance with Table 11.9. Consequently, non-significant effects are predicted.

11.5.36 Since the construction work will be spread over a 24 month period and concentrated in areas not heavily used by otters (which are mobile and have large territories), the magnitude of change to otters as a consequence of disturbance from construction and operation of the Consented Development is assessed as negligible. Combined with the national importance of the feature, the resulting effect level is assessed as negligible. Consequently, non-significant effects are predicted.

11.5.37 Vehicular traffic on existing and new tracks will increase (from pre-construction baselines) during the construction and will mean that individual otters will have an increased possibility (albeit still small) of being injured or killed by vehicles on tracks across the Study Area. However, the existing in-built design

measures of otter friendly crossings and low vehicle speed limits (15mph) should greatly reduce the likelihood of this happening. Consequently, the magnitude of change that would be occasioned due to mortality from development traffic is assessed as 'none' (negligible) resulting in an effect level being assessed as negligible. Therefore, non-significant effects are predicted.

11.5.38 In summary, non-significant effects are predicted for otters in relation to the construction and operation of the Consented Development these are shown in Table 11.14.

Table 11.14: Summary of potential construction and operational effects on otters

Parameter	***Habitat loss***	***Severance***	***Pollution***	***Disturbance***	***Traffic related mortality***
Extent	Foraging habitat	Some watercourse crossings	Site wide in downstream areas of any event	Site wide	Site wide
Duration	Long-term	Long-term	Event = short-term Recovery = medium-term	Short-term	Short-term
Reversibility	Irreversible	Reversible	Reversible	Reversible	Reversible
Frequency	One off	One off	One off/never	Intermittent	Intermittent
Probability	Certain	Very unlikely	Very unlikely	Possible	Possible
Magnitude	Negligible	Negligible	Low	Negligible	Negligible

Fish

11.5.39 Construction and operation has the potential to negatively impact fish populations directly or indirectly damaging habitats and causing severance at crossing points (blocking migration routes) or pollution. Damage to watercourses/bodies by runoff/pollution may potentially kill fish and damage fish habitats. The Fish Habitat Survey (Appendix 11.5: Fish Habitat and Electric Fishing Survey Report) assessed that the streams largely had suitable habitats for salmon, trout and eels, but no salmon were recorded in the Study Area. Variable densities of trout were recorded, and eels were present. High densities of trout tended to reflect good general habitat quality and spawning habitat.

11.5.40 Two stream crossings in reaches potentially providing productive fish habitat are included in the proposed layout, one on Burn of Hamnavoe (HU 49720 81300) and one on Burn of Evrawater (HU 50330 81360). However, the Burn of Evrawater crossing location was found to be non-sensitive from a fisheries or fish ecology perspective, with little suitable habitat and an absence of trout. So long as standard mitigation is implemented to avoid significant downstream impacts on water quality no impact on fish habitats would be expected from works at this location. Habitat at the proposed Burn of Hamnavoe crossing was suitable for juvenile trout. No spawning habitat was recorded at this location, but spawning and productive juvenile habitats were present both up and downstream of the proposed crossing site. As part of the design process, fish friendly designs have been considered and built into the design process. Therefore, the magnitude of change arising from potential habitat loss is assessed as minor (low) and the magnitude of change anticipated as a consequence of severance is none

(negligible). Fish have been evaluated as low sensitivity and of local importance. Consequently, the effect level is evaluated as negligible and no significant effects are predicted.

11.5.41 Taking into account standard guidance and best practice pollution prevention measures (outlined in Chapter 15: Hydrology and Hydrogeology), it is considered very unlikely that a serious pollution incident would occur during construction. However, were a catastrophic pollution event to occur (highly unlikely) it could potentially impact up to half of a catchment. In such an instance, the magnitude of change to the receiving environment is assessed as moderate (medium). Therefore, the level of effect is evaluated as minor and no significant effects are predicted for fish in relation to pollution/runoff.

11.5.42 In summary, no significant effects are predicted for fish in relation to the construction and operation of the Consented Development (Table 11.15).

Table 11.15: Summary of potential construction and operational effects on fish

Parameter	***Habitat loss***	***Severance***	***Pollution/runoff***
Extent	Localised at crossing points	Localised at crossing points	Site wide in downstream areas of any event
Duration	Long-term	Long-term	Event = short-term Recovery = medium-term
Reversibility	Irreversible	Reversible	Reversible
Frequency	One off	One off	One off/never
Probability	Certain	Very unlikely	Very unlikely
Magnitude	Negligible	Negligible	Low - moderate

Habitats

11.5.43 The construction and operation of the Consented Development has the potential to negatively affect habitats directly or indirectly through temporary habitat loss at construction, through a smaller, but permanent habitat loss during operation, and through severance. Potential effects on habitats have been considered by overlaying the Consented Development layout on to the Phase 1 habitat map (Figure 11.3). It should be noted that a series of design, management and mitigation measures aimed at avoiding important and sensitive habitats (including GWDTE) have been incorporated into the design process (see Chapter 3: Project Description and Chapter 5: Design Evolution and Alternatives). Various assumptions have been made in relation to construction and operation land-take habitat loss calculations, i.e. those parameters that are 'permanent' for the lifetime of the Consented Development as shown in Table 11.16, and those that are temporary and relate to the construction phase of the Consented Development as shown in Table 11.17.

Table 11.16: Summary of operational habitat loss parameters

Activity	*Habitat loss metric*	*Total area (m^2) in Chapter 3: Project Description*	*Total area (m^2) from GIS[a]*
Proposed access track	Length of access track (11,100m) × width of access track (4.5m) plus 1m shoulder for drainage[b]	11,100m by 4.5m plus drainage sections (1m) = 61,050	60,723 (reduced amount due to overlap at bends)
Turning points	7 turning points	N/A	9,580
Turbine bases and hard standing	Q1 hard standing and cleared area at turbine base (refer to Figure 3.5)	Approximately 1,125m^2 for each turbine base (19,125m^2 in total). No metric for cleared areas.	45,838
Substation	One substation	N/A	1,518
Total of merged components			117,659

Table 11.17: Summary of construction habitat loss parameters

Activity	*Habitat loss metric*	*Total area (m^2) in Chapter 3: Project Description*	*Total area (m^2) from GIS[c]*
Proposed access track	Operation loss plus 5m buffer (2.5m each side of track), plus any additional areas identified requiring additional excavation	N/A	138,788
Turning points	Operation loss plus 2.5m buffer	N/A	13,973
Turbine bases, hard standings and cleared areas	Q1, Q2, Q3, Q4, Q5 and all cleared areas plus 2.5m buffer, (refer to Figure 3.5)	N/A	95,066
Substation	Operation loss plus 2.5m buffer	N/A	1,993

[a] Area calculated from ArcGIS shapefiles. Note that the area is not the same as stated in Chapter 3: Project Description, this is to be expected due to merging of overlapping buffers etc.

[b] Passing places were not included in the calculations as the locations of these will be determined during construction and will avoid the most sensitive habitats under instruction of the Ecological Clerk of Works.

[c] Area calculated from ArcGIS shapefiles. Note that the area is not the same as operational + buffers due to buffering of all sides of infrastructure unless otherwise specified. The construction habitat loss value is based on buffers applied in an ARC GIS model and includes additional areas e.g. at the end of tracks and area were overlapping buffers were merged.

Table 11.17: Summary of construction habitat loss parameters

Activity	*Habitat loss metric*	*Total area (m^2) in Chapter 3: Project Description*	*Total area (m^2) from GIS[c]*
Construction compounds including parking	Area for construction compound plus 2.5m buffer	Approximately 8,000	8,890
Met mast and radio tower track and turning area	1,059m of track plus 5.5m buffer (2.75m on each side of the track), plus the turning areas with a 2.5m buffer Footprint of the radio tower plus 2.5m buffer	Met mast footprint 4m x 2.5m = $10m^2$	4,655
Borrow pits	4 borrow pits	BP 1 14,787 BP 2 27,667 BP 3 23,413 BP 4 17,931 Total 83,798	BP 1 14,786 BP 2 27,669 BP 3 23,415 BP 4 17,929 Total 83,801
Total of merged components			310,904

11.5.44 The total areas calculated in Table 11.16 and 11.17 are not the same as all the separate metrics combined due to overlap between components which are merged in GIS. It should also be noted that the habitat boundaries on the Phase 1 habitat map are indicative only, because there is usually a gradation between different habitat types and rarely a distinct boundary. The approximate habitat loss as a consequence of land-take caused during construction and operation is provided in Table 11.18.

Table 11.18: Habitat loss as a consequence of land-take

Phase 1 habitat	*Habitat loss in m^2 (ha) during construction*	*Habitat loss in m^2 (ha) during operation*
Wet modified bog	94,317 (9.43)	42,794 (4.27)
Dry modified bog	90,086 (9.01)	22,932 (2.29)
Unmodified blanket bog	41,612 (4.16)	18,142 (1.81)
Unimproved acid grassland/bare peat	37,866 (3.78)	7,054 (0.71)
Bare peat/bare ground	7,340 (0.73)	3,117 (0.31)
Dry modified bog/bare ground	5,931 (0.59)	1,173 (0.12)
Bare ground	5,792 (0.57)	1,801 (0.18)

Table 11.18: Habitat loss as a consequence of land-take

Phase 1 habitat	***Habitat loss in m^2 (ha) during construction***	***Habitat loss in m^2 (ha) during operation***
Wet modified bog/dry modified bog	5,218 (0.52)	580 (0.06)
Unimproved acid grassland	4,913 (0.49)	1,838 (0.18)
Dry dwarf shrub heath	4,349 (0.43)	2,487 (0.25)
Unmodified blanket bog/dry modified bog	3,355 (0.34)	2,021 (0.20)
Buildings and roads	3,012 (0.30)	1,588 (0.15)
Wet dwarf shrub heath	2,341 (0.23)	13 (0.001)
Dry modified bog/bare peat	2,240 (0.22)	882 (0.09)
Semi-improved acid grassland	2,059 (0.21)	958 (0.10)
Wet heath/unimproved acid grassland	793 (0.08)	0
Total	**311,223**	**107,380**

11.5.45 It is clear that the majority of the habitat lost underneath the Consented Development will be wet modified bog (Table 11.18), followed by dry modified bog. These two habitats are currently highly modified through a combination of grazing pressure and peatland management activities. Unmodified blanket bog would have the third greatest amount of loss. Micro-siting (within 50m, or 100m in exceptional circumstances) will be used to relocate tracks and infrastructure to further avoid the most sensitive habitats. This will necessarily be carried out on the ground and will be informed by the results of intrusive site investigations, building upon the theoretical desk-based exercise. The NVC survey of unmodified blanket bog provided guidance in many areas of how to avoid the most sensitive, intact and potentially active blanket bog areas through design (which has already been done) and micro-siting (yet to be done). However, it is recognised that in several areas there is little scope for moving off the higher quality areas of blanket bog. Small areas of unimproved acid grassland, dry dwarf shrub heath and semi-improved acid grassland will also be lost. Operational habitat loss is a subset of construction habitat loss (Table 11.18) and is not additional.

11.5.46 Table 11.19 provides this habitat loss (at construction, which is largest) as a proportion of the habitats at the Study Area and at the UK scale for the key (UK BAP, Annex 1) habitats in the Site. There appears to be no published equivalent Shetland wide metrics on which to base regional estimates.

Table 11.19: Proportional land-take habitat loss during construction

Phase 1 habitat	***Amount in Study Area (ha) (% loss, scale of magnitude)***	***Amount in UK (ha) (% loss, scale of magnitude)***
Wet modified bog	400 (2.35%, Low)	N/A
Dry modified bog	632 (1.4%, Low)	N/A
Unmodified blanket bog	130 (3.2%, Low)	2,200,000 (1.8×10^{-4}%, Negligible)
Unimproved acid grassland/bare peat	38.5 (9.6%, Medium (Ecological value very low as degraded habitat)	N/A
Bare peat/bare ground	2.1 (N/A)	N/A
Dry dwarf shrub heath	58.7 (1.1%, Low)	608,000 (7.1×10^{-5}%, Negligible)
Unmodified blanket bog/dry modified bog	11.1 (2.9%, Low)	N/A
Unimproved acid grassland	116.2 (0.4%, Negligible)	N/A
Bare ground	3.3 (N/A)	N/A
Buildings and roads	3.4 (N/A)	N/A
Dry modified bog/bare ground	12.6 (4.6%, Low, ecological value very low as degraded habitat)	N/A
Semi-improved acid grassland	26.5 (0.75%, Negligible)	N/A
Dry modified bog/bare peat	22.6 (0.9%, Negligible, ecological value very low as degraded habitat)	N/A
Wet modified bog/dry modified bog	27.4 (1.8%, Low)	N/A
Wet dwarf shrub heath	22.6 (1.0%, Low)	462,000 (4.97×10^{-5}%, Negligible)
Wet heath/unimproved acid grassland	6.5 (1.0%, Low)	N/A

11.5.47 The 4.2ha of unmodified blanket bog predicted to be lost or otherwise affected during construction constitut2 approximately 3.2% of the Study Area resource and 1.8×10^{-4}% of the UK resource. Unmodified blanket bog is assessed as being of local importance and the magnitude of change that would arise as a consequence of construction land-take is assessed as minor (low). Therefore, the level of effect is assessed as negligible and no significant land-take effects are predicted for unmodified blanket bog.

11.5.48 The geographic importance of all the other habitats present in the Study Area are all assessed as of being of local importance. The magnitude of change as a consequence of predicted land-take habitat losses is either minor (low) or none (negligible) in terms of overall area, in proportional loss of habitat in the Study Area and on a UK basis. The habitat with the largest percentage loss is unimproved acid grassland/bare peat matric (9.6%). However, this type of matrix habitat has low ecological value as it is a degraded habitat with exposed bare peat. Therefore, the magnitude of change in relation to predicted habitat loss (for all habitat types) is assessed as minor(low) or none (negligible) and therefore no significant effects are predicted.

11.5.49 No habitat assessed as potentially high or moderately groundwater dependant will be affected by land-take. A minimal amount of habitats that were assessed as potential low dependence on groundwater will be impacted by land-take. The habitat unimproved acid grasslands incudes the NVC community U6 which was assessed as potentially low groundwater dependency. A loss of 0.5ha of unimproved acid grassland predicted during construction. The resulting permanent loss of unimproved acid grassland is 0.18ha during operation of the Consented Development and its associated infrastructure (Table 11.18). The magnitude of change occasioned by habitat loss in this regard is assessed as none (negligible) and, when combined with the 'local' importance of this feature results in a negligible level of effect and so no significant effects in relation to GWDTE habitat loss are anticipated.

11.5.50 Severance has the potential to negatively affect habitat connectivity. Access tracks have the potential to separate terrestrial habitats and impede movements of associated species. The average width of all new proposed tracks is 5.5m. There is no evidence that any of the important ecological receptors associated with the Study Area habitats would find a 5.5m track, and associated cuttings and embankments, a physical barrier, causing severance and preventing movement between habitat patches. Therefore, the magnitude of change associated with potential severance is assessed as none (negligible) for the terrestrial habitats. Reference to Table 11.11 indicates that all ecological habitats are assessed as being a receptor of local importance, resulting in an effect level being assessed as 'negligible' (Table 11.20). Thus, no significant effects are predicted.

11.5.51 The construction and operation of the Consented Development has the potential to negatively affect GWDTE through disruption or change in groundwater flow. However, through careful design (Chapter 5: Design Evolution and Alternatives, it is unlikely that the Consented Development would substantially disrupt or block subsurface flow pathways to the potential GWDTE (for details refer to Annex 11.2.1: GWDTE Risk Assessment). The foundations of the proposed turbines may cause localised deviation in subsurface flow pathways within the peat, but the water would still supply any adjacent GWDTE. Access tracks would be designed to be permeable to allow both lateral and vertical water movement through them and thereby maintain the hydrologic connectivity of the peatland and the GWDTE. The drainage channels and sediment management measures associated with the turbines would be designed, post-treatment, to allow water to soakaway to ground within the Site resulting it being unlikely there would be any change to the volume of water feeding the potential GWDTE. Table 11.11 indicates that GWDTE are assessed as being receptors of high, medium or low sensitivity and of local Importance. The GWDTE that is of high sensitivity is well away from the Consented Development (>700m away). No change in groundwater flow is predicted for GWDTE with potentially low or medium groundwater dependency. Therefore, the magnitude of change associated with impacts on GWDTE is assessed as none (negligible). Therefore, the level of effect is assessed as negligible (Table 11.9) and no significant effects are predicted for GWDTE.

Table 11.20: Summary of potential construction and operational effects on habitats

Parameter	*Habitat loss*	*Severance*	*Change in Hydrological Flow*
Extent	Site wide	Site wide, but localised	Localised
Duration	Long-term	Long-term	Long-term
Reversibility	Irreversible	Reversible	Reversible
Frequency	One-off	One-off	Long-term
Probability	Certain	Possible	Possible
Magnitude	Low or negligible	All habitats negligible	Negligible

11.5.52 In summary, no significant adverse effects are predicted for habitats in relation to the construction and operation of the Consented Development.

11.6 Cumulative impacts

11.6.1 The above sections have considered the implications of the Consented Development in isolation from other developments. There is no published NatureScot (previously SNH) guidance for cumulative impact assessment on ecological receptors. *NatureScot Guidance on cumulative impact assessment of onshore wind farms*[4] is confined to landscape and birds. The key principle of NatureScot's cumulative impact assessment guidance for birds is to focus on any significant effects and in particular those that are likely to influence the outcome of the consenting process.

11.6.2 There are no likely significant effects for any ecological receptors at the Consented Development. Therefore, no effect is likely to influence the outcome on the consenting process, alone or in combination with other developments. Consequently, no significant cumulative effects are predicted.

11.7 Mitigation measures

11.7.1 PAN 58 identifies a hierarchy of mitigation for potential impacts that seeks to:

- Avoid negative ecological impacts, especially those that could be significant to important receptors;
- Reduce negative impacts that could not be avoided; and
- Compensate for any remaining significant impacts.

11.7.2 No significant effects on designated sites, otters, fish or habitats are predicted but this assumes important mitigation measures relating to the overall design of the planned works and those detailed in the OCEMP are implemented fully. For example, these would include ensuring that there are no insurmountable physical barriers to otter and fish movements in watercourse crossings within the Consented Development as well as detailed pollution prevention measures, including contingency plans (which are included as part of Appendix 3.6) the contractor would be required to implement.

11.7.3 Non-significant effects on unmodified blanket bog habitats are predicted to occur, with negative construction impacts on 4.2ha predicted during construction, ultimately resulting in a permanent loss of 1.8ha of unmodified blanket bog during operation of the Consented Development and its associated infrastructure.

11.7.4 There will be no land-take from GWDTE assessed as potentially highly or moderately groundwater dependency and non-significant effects are predicted to occur on some low GWDTE with a loss of 0.5ha of unimproved acid grassland (which includes the potentially low GWDTE U6) predicted during construction. The resulting permanent loss of unimproved acid grassland is 0.18ha during operation of the Consented Development and its associated infrastructure.

11.7.5 The OHMP (Appendix 10.4) details a series of habitat enhancement schemes which, if implemented, would result in many positive outcomes for the ecology in the Study Area, including peatland restoration. Peatland restoration will take place primarily through reductions in grazing pressure over the entire Application Boundary (Appendix 10.4: Outline Habitat Management Plan).

11.7.6 The mitigation measures outlined in this section would not only reduce the small, non-significant impacts of construction and operation identified but, with full implementation of the OHMP could result in positive effects on the ecology in the Site. A full and detailed mitigation plan would be prepared with input from a suitably qualified and experienced Ecological Clerk of Works (ECoW) prior to the start of construction work. Monitoring the implementation of mitigation as outlined in this EIAR and compliance in line with the requirements in the CEMP (OCEMP contained in Appendix 3.6), would be important components of the ECoW's remit during construction.

Pre-construction surveys

11.7.7 Pre-construction surveys would be carried out and the results used to assist in mitigating the potential destruction of, or disturbance to, otter breeding holts and resting places (offences under the Habitat Regulations 1994 (as amended) and the Wildlife and Countryside Act 1981 (as amended)). Otters use a large number of holts and resting places within their ranges and may use new breeding and resting holts between the time of the current survey and planned construction. A targeted otter survey should therefore be carried out prior to commencement of construction works within a 250m buffer zone around proposed watercourse crossing locations and all infrastructure.

11.7.8 Should any active *'structure or place used for shelter or protection*' used by otters be discovered during the pre-construction survey, then works in the vicinity (within 30m) of the structure or place would be suspended and NatureScot would be consulted immediately. If an otter structure was discovered beyond 30m of the construction work then a 30m exclusion zone, inaccessible to any person, would be created in line with NatureScot best practice[20].If it is suspected from pre-construction otter surveys that there were breeding otters then; work would be suspended until it was discovered they were not breeding, or the cubs were sufficiently old, or a larger exclusion zone (at least 100m) would be erected around the structure.

11.7.9 If the otter structure is located within 30m of the construction work or otter breeding is suspected then a European Protected Species (EPS) licence is likely to be required for any construction work to continue, along with suitable mitigation or compensation works to be agreed with NatureScot.

Work programming and awareness raising

11.7.10 Construction work programmes can take into account periods of high sensitivity for protected species and where practical, some work tasks may be scheduled to avoid specific periods in consultation with the ECoW and statutory consultees. Additional pre-construction surveys will be undertaken as required (specifically for otters).

11.7.11 As part of the OCEMP requirements, the ECoW will provide ecological training and raise construction staff awareness of site-specific ecological issues through induction procedures and toolbox talks. All new staff will undergo an ecological induction and be made aware of the ecological sensitivities on the Site and (legal) implications of not complying with agreed working practices. To avoid and/or reduce the likelihood of otter mortality and injury during construction and operation, provision will be made for on-site speed limits for construction and maintenance traffic (15mph), protection from entrapment in open excavations, pipes etc when not operational.

Micro-siting of infrastructure and demarcation of exclusion zones

11.7.12 To comply with relevant legislation and best practice guidance, the potential for temporary disturbance to protected species during construction would be minimised as far as possible, even though no significant impacts are predicted. As a matter of course, a 50m marked exclusion zone would follow all at-risk watercourses and water bodies, whenever possible. Where exclusion is not possible, such as at crossing points, access to the watercourses by personnel and machinery would be kept to an absolute minimum and would follow agreed plans and methods.

11.7.13 Infrastructure would be micro-sited along the preferred route to avoid the most sensitive habitats wherever possible. Typically, micro-siting is allowed up to 50m without any further permissions but with notification to the relevant bodies as would be specified in any development consent. Micro-siting over 50m would require written permission of the relevant body. Any micro-siting would, however, require to be agreed with the specialist advisors, e.g., the ECoW as appropriate, and ensure it is away from sensitive habitats such as GWDTE and not towards them. NVC surveys undertaken provide a large, surveyed area (a minimum of 300m) around the proposed infrastructure potentially allowing the relocation of infrastructure to less sensitive habitats where available. The presence of a fully qualified independent ECoW when laying down working routes would help to ensure that opportunities to avoid sensitive habitats during construction are identified and taken.

Control of pollution and sedimentation

11.7.14 Mitigation including best practice techniques outlined in Chapter 15: Hydrology and Hydrogeology would be adopted for all construction and operational works to ensure that water quality within the Study Area is maintained, and to control and reduce pollution and sedimentation risk as far as possible. For example, surface water can be directed across vegetated zones, or through mesh fencing, to capture sediment, sediment traps or settlement lagoons, may also be considered if the quantity of sediment laden water is anticipated to be large. Additionally, pollution incident response plans would be prepared, identifying the type and location of onsite resources (spill kits, absorbent materials, oil booms etc.) available for the control of accidental releases of pollution and other environmental incidents. These resources would be available to contractors at all times of operation.

11.7.15 Implementation of a detailed OCEMP, agreed with SEPA, should ensure that direct pollution and sedimentation impacts on watercourses and their associated species are avoided.

Watercourse crossings

11.7.16 In order to mitigate against the potential destruction of, or disturbance to, otter foraging areas, to facilitate otter movements across the Site, to reduce the risk of otter road traffic injury or mortality and, to protect trout spawning and nursery areas and to facilitate fish movements within catchments, the number of watercourse crossings has been kept to an absolute minimum through careful design (Chapter 3: Project Description). This has effectively reduced the proportion of (potentially suitable otter) riparian habitats that would have been affected at the design stage, substantially mitigating the potential impact of watercourse crossings on these protected species.

11.7.17 Where a water-crossing is unavoidable, best practice would be followed for any construction works, combined with appropriate hydrological mitigation (Chapter 15: Hydrology and Hydrogeology). Best practice design for otters is being taken forward at all moderate and large water-crossings. Where necessary, the otter friendly engineering works described in the Design Manual for Roads and Bridges[34] would be adopted. This includes allowing for the easy and safe passage of otters under rather than over bridges and culverts by leaving spaces for ledges and providing ramps at either end of bridges and culverts.

11.7.18 Where bridge crossings are impractical, and culverts are considered necessary, their design should allow for plenty of air space above water during times of flood, or if this is not possible, alternative and parallel tunnels to provide an alternative route for otters to move without being forced to cross roads.

11.7.19 The site-based construction and maintenance vehicle speed limit would be 15mph (Chapter 18: Highways and Transportation) to reduce any potential impact for otter road traffic injuries and mortalities. Watercourse crossings would be designed to allow free passage of all fish species. Trout undergo spawning migrations annually and require access to spawning areas. Therefore, fish access to these areas would not be restricted.

Potential hydrological changes due to infrastructure

11.7.20 In order to mitigate against potential impacts on habitats and particularly GWDTE, due to hydrological changes a number of measures will be taken. These include:

- Micro-siting of infrastructure away from GWDTE;
- Excavations will be kept closed as much as possible and reinstated as soon as practicable once construction works are complete and will ensure that natural hydrological conditions are restored as far as possible;
- Runoff and any water pumped from excavations in proximity to potential GWDTE will be discharged near to the excavation thereby retaining natural flow patterns; and
- All new and upgraded access tracks will be constructed from material of a benign chemistry, have a suitable camber and will have a permeable, granular surface.

11.7.21 Further details of road and track design, peat and drainage and mitigation are provided in Chapter 3: Project Description, Chapter 15: Hydrology and Hydrogeology and Annex 11.2.1 GWDTE Risk Assessment. Careful management would mitigate potential changes to hydrology and consequent changes to habitats and species distribution.

Habitat reinstatement

11.7.22 Best practice techniques of vegetation and habitat reinstatement would be adopted and implemented in areas of disturbed vegetation, such as track sides, borrow pits. Early restoration of all disturbed areas would be undertaken to minimise the effects of peat exposure erosion. Any plant material used in restoration techniques would be of local provenance and be appropriate for locations being reinstated. Re-instatement techniques, appropriate to the Consented Development, would be agreed in consultation with NatureScot before construction operations begin.

Borrow pit working

11.7.23 Best practice techniques will be adopted and used in the design and subsequent restoration of borrow pits. Detailed reinstatement plans for each borrow pit would be produced separately and agreed in consultation with the LPA and NatureScot before borrow pits are opened.

Enhancement work

11.7.24 Although no significant effects are predicted from the Consented Development, habitat enhancement measures could achieve biodiversity benefits and compensate for the small loss of habitats and otter foraging habitats could be implemented. Committed enhancement work proposed at the Site is described in the Appendix 10.4: Outline Habitat Management Plan (OHMP). This includes measures of peatland restoration and riparian woodland expansion.

11.8 Residual effects

11.8.1 There were no significant effects predicted across any ecological receptors. The residual effects of the consented development are classed as non-significant.

11.9 Monitoring

11.9.1 Monitoring will be required to take place on a range of ecological receptors during construction, and throughout operation including vegetation monitoring of the effectiveness of habitat restoration and enhancement measures. To ensure the full implementation of appropriate mitigation measures, an independent and fully qualified ECoW is proposed for the construction phase of Consented Development. Continued monitoring during the course of the operational phase by an independent and experienced ecologist is proposed, to monitor the effectiveness of the habitat restoration and enhancement measures. A monitoring schedule is outlined in the OHMP (Appendix 10.4). Where any monitoring surveys reveal that the objectives of the mitigation or compensation are not being met, contingency measures would be put in place through the OHMP (Appendix 10.4).

11.10 Summary and conclusions

11.10.1 This EIAR chapter has:

- Established the baseline ecological conditions of the Site using a desk-study and targeted ecological surveys (Phase 1 habitat survey, NVC survey, GWDTE survey, otter survey, freshwater pearl mussel survey, fish survey and macro-invertebrate survey);
- Identified the important ecological receptors likely to be affected by the Consented Development namely otters, fish and habitats;

- Assessed the ecocal importance and sensitivity of otters, fish and habitats;
- Evaluated the likely magnitude of change on these ecological receptors from the construction and operation of the Consented Development.

11.10.2 This assessment does not predict any significant ecological residual effects associated with the Beaw Field Wind Farm.

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