

20. SUMMARY OF MITIGATION AND RESIDUAL EFFECTS

20.1 EFFECTS ON LANDSCAPE CHARACTER (ES CHAPTER 8)

Identified impacts	Mitigation	Residual effect
<p>Changes to landscape character caused by:</p> <ul style="list-style-type: none"> • Turbines, anemometry masts and control buildings • Construction activities • Tracks and borrow pits • Grid connection apparatus • Cable laying. 	<p>Extensive input to layout design.</p> <p>Landscape management and habitat creation.</p>	<p>No significant impact will be experienced at designated sites such as the National Scenic Areas or Historic Gardens and Designed Landscapes.</p> <p>Significant impacts will occur on a number of local landscape character areas within 15km of the proposed development. In the East and West Kame landscape area moderate to substantial adverse landscape impacts would be experienced. Where impacts are indirect, impacts in this character area would be reduced to moderate, but still significant. Significant impacts would also be experienced by the part of the Peatland and Moorland Inland Valleys landscape character area at Pettadale and Kergord.</p> <p>Elsewhere in the detailed study area: moderate direct and indirect adverse landscape impacts would be experienced by Coastal Crofting and Grazing Lands and the Scattered Settlements / Crofting and Grazing Land landscape character areas; and indirect adverse landscape impacts ranging from moderate to moderate-substantial would be experienced in a number of other local character areas. There would also be a small number of localised areas of moderate (and therefore significant) impact upon other character areas.</p> <p>Just under two-thirds of the local landscape character areas within the detailed study area would experience no significant impact.</p>

20.2 VISUAL IMPACTS (ES CHAPTER 9)

Identified impact	Mitigation	Residual effect												
Impacts on visual amenity caused by: <ul style="list-style-type: none"> • Turbines, anemometry masts and control buildings • Construction activities • Tracks and borrow pits • Grid connection apparatus • Cable laying. • Decommissioning • Cumulative effects with other wind farms 	Extensive input to layout design. Landscape management and habitat creation.	The residual effects are shown in the table below.												
		Construction					Operation							
		Significant					Not Significant							
		Receptors					Substantial	Moderate/ Substantial	Moderate	Negligible to Slight/ Moderate	Substantial	Moderate/ Substantial	Moderate	Negligible to Slight/ Moderate
		Viewpoints	8	9	4	22	8	9	3	23				
		Buildings/ Outdoor	460	210	295	2525	460	209	270	2551				
		Roads (including cycle routes)	2	5	4	17	2	4	5	17				
		Ferries	1	2	1	4	1	2	1	4				
		Walking Routes	1	1	2	16	1	1	2	16				
		Total	472	227	306	2584	472	225	281	2611				
The majority of significant effects upon the visual amenity of Shetland would occur within 15km of the periphery of the proposed Viking Wind Farm. These would generally be located in the central and northern mainland and parts of Yell and Whalsay, where views are orientated towards the proposed development.														
The relatively small scale of the Burradale and Cullivoe Wind Farms and the Converter Station in comparison with the proposed Viking Wind Farm (and the relatively localised and limited simultaneous and sequential visibility) would have the effect of not increasing the overall significance of the adverse effects upon the landscape and visual resource of the study area.														

20.3 EFFECTS ON NON-AVIAN ECOLOGY (ES CHAPTER 10)

Identified impact	Mitigation	Residual effect
<p>Direct impacts on non-avian ecology caused by:</p> <ul style="list-style-type: none"> • Construction of turbines and foundations, control buildings, substations, grid connection infrastructure, transformers, temporary and permanent anemometers, crane hard standings and construction compounds. • On site cabling and access tracks. • Watercourse crossings and borrow pits, including pollution and sediment release into water leading to changes in hydrology and hydrochemistry • Mobile plant operations and traffic. • Temporary noise. 	<ul style="list-style-type: none"> • Extensive input to layout design. • Pre construction surveys. • Work programming and awareness raising. • Micro-siting of infrastructure and demarcation of exclusion zones. • Control of pollution and sedimentation. • Minimising watercourse crossings. • Careful design of tracks, trackside drains and cable trenches. • Habitat reinstatement. • Careful design and reinstatement of borrow pits. • Habitat compensation and enhancement (through the Habitat Management Plan). 	<p>No significant adverse residual impacts are predicted for non-avian ecological receptors. For example, no significant impacts at a regional or national level are predicted to occur on the on the blanket bog of regional to national value. However, local adverse impacts, in terms of direct habitat loss to blanket bog of regional to national value will occur within the Viking study area. It is predicted that 197ha of blanket bog (of varying activity) will be lost after the construction areas have been restored and recovered.</p> <p>Blanket bog, as a general habitat type, is protected under European legislation, and there is a growing body of opinion that new developments should deliver net ecological gain, rather than simply be designed to achieve mere damage limitation. Therefore, significant measures to deliver compensation and ecological enhancement have been included in the design of the Viking Wind Farm and are outlined within the Viking Habitat Management Plan (HMP). Please see Appendix 10.9.</p>

20.4 EFFECTS ON ORNITHOLOGY (ES CHAPTER 11)

Identified impact	Mitigation	Residual effect																																																						
<ul style="list-style-type: none"> • Direct loss of habitat to wind turbine bases, access tracks, site substation, converter station and ancillary infrastructure. • Modification of habitats that support bird populations, due to hydrological change resulting from the construction of access tracks, cable trenches, etc. • Indirect loss of habitat due to the displacement of birds by construction works and operation of the windfarm. • Mortality due to collision with wind turbine blades, overhead wires, guy lines and fencing. 	<ul style="list-style-type: none"> • Extensive input to layout design. • Restriction of construction activity in merlin territories during the breeding period. • Rescheduling of construction operations in response to surveys to minimise disturbance to breeding whimbrel. • Habitat management to provide additional breeding habitat for merlin, red-throated diver and whimbrel during operation of the wind farm. • Research into the reasons for the current whimbrel decline in Shetland. 	The summary effects are shown in the table below.																																																						
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="954 347 1285 378">Potential Effect</th> <th data-bbox="1292 347 1771 378">Mitigation</th> <th data-bbox="1778 347 2042 378">Residual Significance</th> </tr> </thead> <tbody> <tr> <td colspan="3" data-bbox="954 378 2042 408">Land Take</td> </tr> <tr> <td data-bbox="954 408 1285 438">All species</td> <td data-bbox="1292 408 1771 438"></td> <td data-bbox="1778 408 2042 438">Not significant</td> </tr> <tr> <td colspan="3" data-bbox="954 438 2042 469">Habitat Modification</td> </tr> <tr> <td data-bbox="954 469 1285 499">All species</td> <td data-bbox="1292 469 1771 499"></td> <td data-bbox="1778 469 2042 499">Not significant</td> </tr> <tr> <td colspan="3" data-bbox="954 499 2042 529">Construction Disturbance</td> </tr> <tr> <td data-bbox="954 529 1285 560">Merlin</td> <td data-bbox="1292 529 1771 608" rowspan="2">Restrictions on the timing and location of construction works</td> <td data-bbox="1778 529 2042 560">Not significant</td> </tr> <tr> <td data-bbox="954 560 1285 590">Whimbrel</td> <td data-bbox="1778 560 2042 590">Not significant</td> </tr> <tr> <td data-bbox="954 590 1285 620">All other species</td> <td data-bbox="1292 590 1771 620"></td> <td data-bbox="1778 590 2042 620">Not significant</td> </tr> <tr> <td colspan="3" data-bbox="954 620 2042 651">Operational disturbance</td> </tr> <tr> <td data-bbox="954 651 1285 681">Merlin</td> <td data-bbox="1292 651 1771 703" rowspan="2">Management to enhance the value of habitat in part of the Nesting quadrant</td> <td data-bbox="1778 651 2042 681">Significant</td> </tr> <tr> <td data-bbox="954 681 1285 711">Whimbrel</td> <td data-bbox="1778 681 2042 711">Not significant</td> </tr> <tr> <td data-bbox="954 711 1285 742">All other species</td> <td data-bbox="1292 711 1771 742"></td> <td data-bbox="1778 711 2042 742">Not significant</td> </tr> <tr> <td colspan="3" data-bbox="954 742 2042 772">Collision</td> </tr> <tr> <td data-bbox="954 772 1285 802">Whimbrel</td> <td data-bbox="1292 772 1771 825" rowspan="2">Management to enhance the value of habitat in part of the Nesting quadrant</td> <td data-bbox="1778 772 2042 802">Significant</td> </tr> <tr> <td data-bbox="954 802 1285 833">All other species</td> <td data-bbox="1778 802 2042 833">Not significant</td> </tr> <tr> <td colspan="3" data-bbox="954 833 2042 863">Decommissioning</td> </tr> <tr> <td data-bbox="954 863 1285 893">Merlin</td> <td data-bbox="1292 863 1771 916" rowspan="2">Restrictions on the timing and location of construction works</td> <td data-bbox="1778 863 2042 893">Not significant</td> </tr> <tr> <td data-bbox="954 893 1285 924">All other species</td> <td data-bbox="1778 893 2042 924">Not significant</td> </tr> </tbody> </table>		Potential Effect	Mitigation	Residual Significance	Land Take			All species		Not significant	Habitat Modification			All species		Not significant	Construction Disturbance			Merlin	Restrictions on the timing and location of construction works	Not significant	Whimbrel	Not significant	All other species		Not significant	Operational disturbance			Merlin	Management to enhance the value of habitat in part of the Nesting quadrant	Significant	Whimbrel	Not significant	All other species		Not significant	Collision			Whimbrel	Management to enhance the value of habitat in part of the Nesting quadrant	Significant	All other species	Not significant	Decommissioning			Merlin	Restrictions on the timing and location of construction works	Not significant	All other species	Not significant
		Potential Effect	Mitigation	Residual Significance																																																				
		Land Take																																																						
		All species		Not significant																																																				
		Habitat Modification																																																						
		All species		Not significant																																																				
		Construction Disturbance																																																						
		Merlin	Restrictions on the timing and location of construction works	Not significant																																																				
		Whimbrel		Not significant																																																				
		All other species		Not significant																																																				
		Operational disturbance																																																						
		Merlin	Management to enhance the value of habitat in part of the Nesting quadrant	Significant																																																				
		Whimbrel		Not significant																																																				
		All other species		Not significant																																																				
Collision																																																								
Whimbrel	Management to enhance the value of habitat in part of the Nesting quadrant	Significant																																																						
All other species		Not significant																																																						
Decommissioning																																																								
Merlin	Restrictions on the timing and location of construction works	Not significant																																																						
All other species		Not significant																																																						

20.5 NOISE EFFECTS (ES CHAPTER 12)

Identified impact	Mitigation	Residual effect
<p>Noise during construction caused by:</p> <ul style="list-style-type: none"> • Machinery and vehicles. • Drilling and blasting. • Crushing plant. <p>Noise during operation caused by:</p> <ul style="list-style-type: none"> • Mechanical and aerodynamic noise from turbines. 	<ul style="list-style-type: none"> • Input to layout design. • Locating equipment to minimise noise impacts, maximising natural screening. • Appropriate phasing of the works, equipment to be employed, working hours, and use and control of blasting. • Using quietest plant and deploying or moving plant at appropriate times. • Appropriate scheduling of operations where noise and vibration may have an adverse effect. • Training and supervision of operatives. • Efficient operation and maintenance of plant. 	<p>The adopted noise criteria may be exceeded at five receptor locations during operations at the closest borrow pits. The closest borrow pits to each of these receptors are small borrow pits which will be used for a short time period to provide material for the initial stage of tracks onto the site. Noise impacts will be minimised as much as possible by adopting the mitigation measures described, and all activities will be restricted to appropriate daytime hours to minimise the disturbance caused. It is considered that, due to the temporary nature and the appropriate scheduling of the activities at the borrow pit, the impact can be considered to be of moderate significance.</p> <p>The predicted noise levels at the closest sensitive receptors during the operational phase of the development are below the noise assessment criteria set out in ETSU. The predicted impact at the closest sensitive receptors is, therefore, deemed to be not significant.</p>

20.6 EFFECTS ON CULTURAL HERITAGE (ES CHAPTER 13)

Identified impact	Mitigation	Residual effect
<ul style="list-style-type: none"> • Direct impacts on known and unknown archaeological remains. • Direct and indirect impacts on listed buildings, Scheduled Ancient Monuments and their settings. 	<ul style="list-style-type: none"> • Extensive input into layout design. • An archaeological watching brief during all ground breaking works. • An environmental clerk of works will be employed full time on site and will supervise any required archaeological staff. • Complete avoidance of known archaeological sites. • Micro-siting of access tracks and turbines away from archaeological sites where possible. • If in any instance disturbance of a known site cannot be avoided it is advised that an archaeological excavation may be required to ensure that the site is preserved by record. • Archaeological sites will be fenced off including a 10m buffer zone prior to plant entering the sites to ensure that these remains are not damaged during the construction phase. 	<p>A considerable amount of archaeological research has been carried out in the course of this study, new sites of archaeological interest have been discovered and excavations of them may subsequently be carried out as part of the project. It is therefore safe to say that the project has advanced the knowledge of the cultural history of the Shetland Islands.</p> <p>The undertaking of the mitigation measures outlined here prior to and during the construction of the proposed wind farm will lead to <i>Minor</i> overall residual effects on archaeology. The fencing off of known archaeological sites in the vicinity of the application area to at least a distance of 10 m from the visual edge of each site will ensure that these sites are preserved <i>in situ</i> and thus will not be impacted upon by the construction of the wind farm.</p> <p>Where sites are located within 10m of access tracks, turbine bases and buildings attempts should be made to preserve these <i>in situ</i>. However, if sites cannot be entirely avoided, excavation prior to commencement of construction will ensure that the sites or site elements that would be disturbed will be preserved by record. The attendance of a watching brief officer(s), supervised by an environmental clerk of works, during all ground breaking works on site will ensure that any archaeology encountered will be identified and recorded to an appropriate level. This will also ensure preservation by record.</p>

20.7 EFFECTS ON SOIL AND WATER (ES CHAPTER 14)

Identified impact	Mitigation	Residual effect
<ul style="list-style-type: none"> • Suspended solids discharge • Soil erosion. • Potential fuel, lubricating oil, chemical, cement or hydraulic oil spillage. • Construction or decommissioning triggering peat slide. • Increased surface run off. • Decreased infiltration. • Flooding. • Construction works altering hydrological pathways within peat deposits. • Culverting of watercourses impeding flows. • Creation of temporary drainage route. • Damage to water supply infrastructure. • Dewatering. 	<p>Extensive input to layout design.</p> <p>Best practice methods in all design and construction activities.</p> <p>Appropriate track design and construction methods.</p> <p>Peat management plan to lay down appropriate peat handling and management.</p> <p>CAR applications in respect of watercourse crossings, to be discussed individually with SEPA.</p> <p>Appropriate drainage design including upslope cut-off trenches.</p> <p>Pollution Prevention / Site Management / Waste Management Plans.</p> <p>Cable trenches designed so as not to provide preferential drainage paths.</p> <p>Sediment management incorporated into drainage designs.</p>	<p>With the proposed mitigation in place the majority of impacts on the soil and water environment will not be significant. There are however three effects evaluated as being of significance.</p> <p>There are two currently active site processes which have potentially significant effects during construction of the wind farm: soil (peat) erosion and peat instability. Although these processes have been assessed as having potentially significant effects, neither has been assessed as being likely to occur. It should also be noted that these two processes will continue to occur at this site without development proceeding.</p> <p>Erosion is occurring naturally on the site at present. Construction activities may exacerbate this situation. Following the precautionary principle, soil (peat) erosion caused by construction has been identified as having a potentially significant (moderate significance) effect. The Peat Management Plan, within the Habitat Management Plan (Technical Appendix 10.9) gives advice on best practice for this issue along with some innovative techniques that may beneficially influence local peatland habitat and could result in a positive environmental effect in localised areas.</p> <p>There is also the potential for a significant adverse impact (moderate significance) from lowering of groundwater levels in the areas adjacent to cut tracks and associated drainage features. It would be expected to be localised and the impact may be more limited in areas exhibiting erosion features and/or shallow peat depth. This is a process that has occurred to varying degrees at other peatland developments and should be carefully mitigated against and monitored at this site in order to minimise the long-term effects. Following construction of tracks, this effect is likely to become manifest over a longer-term than the other significant effects identified and may become evident during the operational phase and could continue as a permanent feature into the decommissioning phase.</p>

20.8 EFFECTS ON ROADS AND TRAFFIC (ES CHAPTER 15)

Identified impact	Mitigation	Residual effect
<ul style="list-style-type: none"> • Congestion. • Wear and tear to the road network. • Impact on local communities such as Lerwick North and Voe. • Increase in HGVs. • Increase in traffic when site operational. 	<ul style="list-style-type: none"> • Routing; preferred route to the site access points is to use the Spine Road Network to reach either a direct access junction or to a side arm junction leading to upgraded carriageway which in turn leads to an access junction. • Road/Junction improvements; mitigation will involve the construction of five new accesses. These are likely to be in the form of widened priority junctions wide enough to handle the abnormal loads as well as general construction traffic. • Traffic management; ensure the efficient transport of components and materials to the site, whilst minimising disruption to other road users and ensuring the safety of contractor personnel and the public. 	<p>There will be a short term adverse impact on the local highway network resulting from the construction traffic and movement of abnormal loads. However, a combination of mitigation measures detailed in the Transport Statement can be agreed to minimise any potential adverse impact.</p> <p>There is likely to be a minor impact on the wear and tear of particular roads. This is however likely to be covered by a wear and tear agreement to ensure the condition remains as before the scheme.</p> <p>Proposed junction improvements at Sella Ness, Access, A968/B9076 Junction south of Mossbank and A968/A970 Junction at Voe will result in larger junctions with increased capacity and potentially safer designs.</p> <p>Localised widening and route improvement at the side roads to two access points will upgrade routes and improve the safety and operation of the roads.</p> <p>In general, the impacts are relatively minor and are typically confined to the construction period only.</p>

20.9 EFFECTS ON AIR AND CLIMATE (ES CHAPTER 16)

Identified impact	Mitigation	Residual effect
<ul style="list-style-type: none"> • Air quality from dust generation during construction, fugitive emissions from industrial and vehicle movement and dust from traffic. • CO₂ emissions from the impact the development will have on the peat bogs. • Vehicle emissions. 	<p>Dust control:</p> <ul style="list-style-type: none"> • Minimise the creation of dust by planning and design; • temporarily suspend the activity or operation if the creation of dust cannot be avoided. • prevention of roads becoming dusty, • control of vehicle speeds. • use of wind breaks • use trees or shrubs around the site. <p>CO₂ emission mitigation:</p> <ul style="list-style-type: none"> • Minimise peat bog impact. • Floating roads will be used on areas where the peat is greater than 1m deep. • Submerged foundations will be used on deeper areas of peat. • Tracks will be designed to avoid acting as drainage channels or barriers to water flow. • Habitat improvement activities, for example, blocking drains and re-wetting areas will be undertaken. 	<p>The impacts of dust will be adequately mitigated by following best practice guidance for dust suppression.</p> <p>The CO₂ “payback period” (the time taken for the CO₂ emitted as a consequence of construction and operation of the wind farm to be offset by the reduction in CO₂ emissions caused by the generation of electricity) was calculated to be 2.8 years for the best case scenario, 6.8 years for the intermediate case scenario and 48.5 years for the worst case scenario.</p> <p>It is considered that the intermediate scenario represents the most likely payback period depending on the accuracy of the input data. The results indicate that it is crucial that the peat bogs on site are disturbed as little as possible to prevent extensive loss of peat.</p>

20.10 SOCIO ECONOMIC EFFECTS (ES CHAPTER 17)

Identified impact	Mitigation	Residual effect
<p>Construction:</p> <ul style="list-style-type: none"> • New employment opportunities • Restrictions on some agricultural activities • Occupation of tourist accommodation • Displacement of employment • Supply chain opportunities • Social impacts: migration, employment, training, inter-community communication (all positive); uncertainty and negative perceptions, price increases (all negative). <p>Operational:</p> <ul style="list-style-type: none"> • Revenue generation and income. • Community and social benefits. • Economic and environmental benefits at the national scale. 	<p>Construction phase:</p> <ul style="list-style-type: none"> • Implementation of a communication strategy. • Use of local contractors. • Extended construction period to maximise use of local resources. • Use of raw materials from local sources, where possible. • Careful planning of vehicle movements through a traffic management plan. <p>Operation phase:</p> <ul style="list-style-type: none"> • Implementation and monitoring of the community benefit scheme. • Commitment to an access plan that maximises the potential benefits of the development through provision of public access through organised tours, development of mountain bike routes away from restricted areas, promotion of alternative walking routes, improvement in car parking, promotion of Shetland as a sustainable community with respect to energy production to generate an energy tourism market and the development of tourism view points. • Employment of local people to fulfil long-term employment roles, where possible. • Ensuring that revenues are used as tax efficiently as possible. • Ensuring that part of the land rental is shared, as is enshrined in crofting law, amongst the crofters and grazing committees as well as landlords. • Active consideration of additional, follow-on developments to encourage wider renewable energy schemes (e.g. in wave and tidal energy) in addition to improvements in household level energy efficiency. 	<p>Residual effects arising from the scheme are hard to quantify and are qualitatively described below:</p> <ul style="list-style-type: none"> • increased perception of the Shetland Islands working towards becoming sustainable with respect to energy production and being of national strategic importance in meeting the UK Government's goals for renewable energy production; • long term socio economic benefits from recirculation of income created by the project, 50% of which will remain in the Shetland community • long-term, regional socio-economic benefits through the development of follow-on initiatives and other spin-offs associated with development of the local manufacturing and service base.

20.11 EFFECTS ON TELECOMMUNICATIONS AND AVIATION (ES CHAPTER 18)

Identified impact	Mitigation	Residual effect
Interference with: <ul style="list-style-type: none"> • TV and radio Broadcasts • Radio communications • Air traffic control 	<ul style="list-style-type: none"> • Provision of alternative means of receiving TV and radio broadcast where it is shown that the wind farm has adversely affected reception. • Re-routing of radio communications links where necessary, by arrangement and negotiation with the operators. • Changes to missed approach procedures at Scatsta airport. 	Residual effects on all of these issues are, at worst, negligible.

20.12 EFFECTS ON RECREATION AND TOURISM (ES CHAPTER 19)

Identified impact	Mitigation	Residual effect
<ul style="list-style-type: none"> • Restriction of access. • Effects on visitors' perceptions (both positive and negative). • Disturbance of recreational activities. 	<p>Mitigation measures during the construction phase include:</p> <ul style="list-style-type: none"> • the development of a communication strategy to be used by Viking Energy to provide consistent and regular updates to both the public and other interested parties, such as tourists; • careful planning of vehicle movements through a traffic management plan to minimise disruption to both local and tourist traffic during the construction period; and • the extension of construction period to 5 years with a reduction in number of workers requiring accommodation annually resulting in adequate accommodation being available without the availability of accommodation for tourists being affected. <p>Mitigation measures during the operation phase include:</p> <ul style="list-style-type: none"> • commitment to an access management plan that maximises the potential benefits of the development through provision of public access with organised tours, development of tourism view points, development of mountain bike routes away from restricted areas, promotion of alternative walking routes, improvement in car parking; • promotion of Shetland as a sustainable community with respect to energy production; and • promotion of Shetland as a green energy tourist destination. 	<p>The Viking Wind Farm development is unlikely to have an overall significant impact on tourism in Shetland. The development is not located within a designated area or close to any of the most popular tourist attractions in Shetland. The turbines are located away from key tourist attractions and based on experience from elsewhere, visitors should not be put off from coming to Shetland.</p> <p>The Viking Wind Farm development will provide opportunities to promote Shetland as a green tourist destination, and the provision of new access tracks will increase and enhance recreation facilities.</p>