Chapter 3 Site Selection & Design

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3 Site Selection & Design

3.1 Introduction

3.1.1 This chapter describes the site identification and design iteration process which has been undertaken by the Applicant prior to arriving at the final design, described in **Chapter 4**.

3.2 Background

3.2.1 The Applicant proposes to construct the Proposed Development within the Shetland Islands Council (SIC) administrative area. The principles of the EIA process, that site selection and project design should be an iterative constraint-led process, have been followed as part of the Proposed Development. This has ensured that potential negative impacts, as a result of the Proposed Development, have been avoided or minimised as far as reasonably possible.

3.2.2 The Applicant is proposing revisions to the '2011 Permitted Development' (planning reference 2011/224/PPF). The Proposed Development will replace the two unbuilt, previously permitted turbines with one wind turbine and Battery Energy Storage System (BESS) with a total installed capacity up to 19.9 MW.

3.3 Site Selection and Alternatives

3.3.1 The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 state that the EIA Report must include "*A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects*" (Schedule 4.2) (Scottish Government, 2017).

3.3.2 The main alternatives including design, turbine specification, location, size, scale and inclusion of battery storage have been considered for the Proposed Development. This chapter explores these options and explains how the final design of the Proposed Development has evolved.

Location

3.3.3 The Proposed Development boundary covers an area of around 66 hectares (ha) and is located on land approximately 1.2 km north of Gremista, Lerwick on the Hill of Gremista at British National Grid Reference HU 46191 4516.

3.3.4 As noted above (**paragraph 3.2.2**), the Proposed Development is a revised design of a permitted scheme on the Site, which will sit alongside the existing operational turbine. The suitability of the Site for potential wind development was first considered during the application process for the permitted scheme. The opportunities and constraints identified during that process have been taken into consideration through the further design work for the Proposed Development.

3.3.5 In order to identify suitable locations for siting of turbines across the Site, the following technical and environmental factors that influence the feasibility of a potential wind farm were taken into account:

- Initial desk-based studies, onsite wind data, and the productivity of the operational turbine suggest that there is sufficient wind resource, and the Site is viable for continued wind energy development;
- Visual and technical arrangement with the operational turbine;
- Suitable terrain and topography;
- Available options to connect the Proposed Development to the electricity grid;

- Site access suitability for the delivery of turbine components, such as the blades;
- Environmental constraints such as ecology, ornithology, hydrology etc;
- Health and Safety requirements such as stand offs from public roads;
- Underground and overground services such as pipelines and telecommunication links;
- Appropriate ground conditions; and
- Cumulative effects with other wind farm developments.

3.4 Design Process

Design Principles

3.4.1 In an EIA, the identification of constraints should continue throughout the design process as more detailed surveys reveal additional constraints to development. In this way, the findings of the technical and environmental studies can be used to inform the design of a development, and hence achieve a 'best fit' within the environment of the Proposed Development.

3.4.2 The Applicant adopted the following principles during the design iteration process to ensure the final design of the Proposed Development was the most suitable for the Site:

- Avoided locating the turbine on the highest point of the site to minimise visibility;
- Respected cultural heritage constraints;
- Limited impact on protected habitats and species as far as possible;
- Avoided deep peat as far as possible;
- Respected engineering constraints including topography; and
- Maximised the potential generation of renewable energy.

3.4.3 The design of any energy generation development is driven by the key objective of positioning infrastructure so that it captures the maximum energy possible within a suitable area further informed by environmental and technical constraints. On site constraints which influenced the design are shown on Confidential **Figure 3.1**. Environmental designations within 10 km of the Site are discussed in more detail in **Chapter 4** and are shown in **Figure 4.1.**

3.4.4 It is important to note that the identification of a constraint did not necessarily result in the exclusion of that area from the potential development envelope; rather it meant that careful thought and attention were paid to the constraint and the design altered appropriately. The key constraints considered during the design process included:

- Landscape and visual constraints;
- Presence of cultural heritage features;
- Location of residential receptors;
- Presence of protected habitats and species; and
- Location of existing infrastructure.

3.4.5 The identification of constraints continued throughout the design evolution process as more detailed surveys refined the development envelope.

3.4.6 A description of how the various environmental and technical disciplines have contributed to the design through detailed assessment is described below. Information in respect of the survey work undertaken is provided in the technical chapters of this EIA Report.

Layout Evolution

3.4.7 There have been seven design iterations for the Proposed Development with layout seven being the final iteration. The key evolutions to the layout are discussed below:

Layout 1

3.4.8 Layout 1 was the layout permitted in 2011 (refer to **Figure 3.2**), the design process of which is detailed within Chapter 5 of the 2011 Environmental Statement (ES). This layout included three turbines up to 120 m from ground to tip height and considered site constraints known at the time. The northern most turbine, (T1) was constructed and has been operational since 2015. The other two turbines were not built out.

Layout 2

3.4.9 Since the consent of Layout 1 and the construction of T1, the adjacent land use to the west of the Site has increased in activity and the extent of the pier in Dales Voe, which is utilised for the decommissioning of oil terminals, is proposed to be expanded south into the headland. The proximity of these works would result in the permitted location of the western most turbine of Layout 1 becoming unviable for engineering reasons. It was therefore deemed necessary to reconsider the permitted layout. Turbine technology has also advanced since the 2011 ES was submitted, and due to the commercial availability of turbine models it was proposed to consider larger candidate turbine models from the 120 m tip height consented, to deliver increased energy generation. Therefore, consideration has been given to turbines up to a tip height of 149.9 m.

3.4.10 To retain a layout of three turbines in total, while maintaining sufficient separation distances to account for larger turbine models and discounting the western area of the site, the site boundary was expanded in 2020 to include land to the south, including the Hill of Gremista. This was the site boundary presented in the EIA Screening Request submitted to SIC in October 2020 (2020/229/SCR). The initial layout within this revised site boundary (Layout 2) included two turbines and took account of the constraints identified during desk studies. Layout 2 is presented in **Figure 3.3**.

Layout 3

3.4.11 Following the initial results of ornithology surveys and review of previous ornithological data from the permitted scheme and the cumulative Mossy Hill Wind Farm, the southern most proposed turbine location (T3) was revised to increase the distance from sensitive ornithological receptors. The northern proposed turbine (T2) was moved south to maintain even distance between the proposed turbines and the operational turbine (T1), to ensure a visually balanced layout. This also reduced impacts on an identified heritage asset near to T2. Layout 3 is presented in **Figure 3.4**.

Layout 4

3.4.12 The full breeding bird season survey was completed in summer of 2021. The data collected identified that the buffer around sensitive ornithological receptors needed to be increased further than previously understood. Therefore, the northern most turbine (T2) was moved east, and the site boundary was extended further south to enable the southern most turbine (T3) to be moved south-east. This updated ornithological data also identified that the previously permitted western most turbine location was no longer viable due to potential impacts on sensitive ornithological receptors.

3.4.13 The proposed turbine locations in Layout 4 also took account of initial peat depth data and avoided those areas of the site identified to be underlain by deeper peat. Turbine locations were restricted by the contours on the site, with areas of slope greater than 12 degrees considered to be unviable from an engineering perspective. Layout 4 is presented in **Figure 3.5.**

Layout 5

3.4.14 An indicative access track and hardstanding configuration was designed, taking account of the known ground conditions on site (peat depth and slope). This resulted in a further layout iteration (Layout 5) to ensure that appropriately sized hardstandings and access tracks with minimum cornering could be positioned within the layout. Layout 5 is presented in **Figure 3.6.**

Layout 6

3.4.15 Further peat depth surveys identified areas of deep peat greater than 3 m within the south of the Site. The layout was refined to avoid this, with the southern most turbine (T3) moved north. An alternative location for the northern most turbine (T2) was also identified to the east of the previous location. This presented a visually balanced layout while minimising impacts on the identified heritage asset noted above. It was also considered to be a favourable location from an engineering perspective as it allowed a less constrained approach route for the access track. The Site boundary was refined to accommodate this, to what is now the final Site boundary. Layout 6 is presented in **Figure 3.7.**

Layout 7

3.4.16 Consultation with British Telecommunications (BT) identified a telecommunication link they operate which crosses the Site from southwest to northeast. Analysis undertaken by BT identified that the proposed turbine locations within Layout 6 would result in an unacceptable impact to the operation of this link and they requested that a buffer of at least 111.25 m be maintained from turbine to link path. Ornithological constraints on the site and areas of steep slope limited movement of the proposed southern turbine location (T3) sufficient distance to the northwest to avoid impacts on the link without resulting in unacceptable impacts on sensitive ornithological receptors. It was also not considered feasible to move this turbine location to the southeast beyond the link buffer without resulting in unacceptable visual impacts. Due to the constraints identified, it was therefore considered that there was not a currently viable turbine location within the southern extent of the site. The proposed northern turbine location (T2) was relocated to avoid impacts on the telecommunications link. Due to constraints presented by the ornithological buffers and to minimise impacts on areas of peat, the most viable location was considered to still be the permitted turbine location. As a result of the identified constraints and the subsequent loss of one of the proposed turbines, the inclusion of a BESS was considered. The location at the Site entrance was identified as being the most suitable due to operational, topographic and engineering reasons.

3.4.17 The final Layout 7 and the key on site constraints which have influenced the design are presented in **Confidential Figure 3.8**.

3.4.18 Alternative turbine model parameters were considered further at this stage. A tip height of 149.9 m was considered the optimal model for the site when taking into consideration the following:

- a visually balanced layout with the operational turbine;
- no requirement for visible aviation lighting;
- separation distance from the operational turbine and operational performance;
- engineering restrictions on blade length due to the required access track configurations and slope contours on site; and
- renewable procurement market options.

3.4.19 Layout 7 comprises one three-blade horizontal axis turbine with a blade tip height of up to 149.9 m with an indicative installed capacity up to 5 MW as well as a BESS with a maximum installed capacity of up to 14.9 MW. The final Proposed Development layout (Layout 7) is presented in **Figure 1.2.**

3.4.20 It is considered that the iterative design process has considered all reasonable alternative options for the site and that the layout presented is the optimal one for the site given the constraints identified.

Other Site Infrastructure

Site Access and Site Tracks

3.4.21 The proposed access to the Site has been carefully considered throughout the design process. It is proposed all components including blades will be transported from the Greenhead Port terminal and transferred along Gremista Road for approximately 1 km to the Site. The blade components would be moved to site under escort. The public road network would be utilised for the full delivery route.

3.4.22 The Site tracks have been designed to follow the existing operational turbine tracks as far as possible with new tracks being constructed from the operational turbine to the proposed turbine. The new tracks have been designed to minimise the landscape and visual impacts, hydrogeological and hydrological impacts, and excessive gradients to ensure the safe delivery of turbine components and associated parts.

3.4.23 The BESS will be accessed via the existing tracks from the operational turbine.

Crane Hardstanding

3.4.24 The proposed crane hardstanding has been designed to accommodate the proposed candidate model turbine and the engineering requirements for construction, while minimising impacts on the local constraints. It is acknowledged that impacts on the heritage asset identified (refer to **Chapter 8**, Asset 1), have not been able to be fully avoided during the design process. The location of the heritage asset at the crane hardstanding is situated approximately 10 m south. This heritage asset will be carefully fenced to ensure no direct impacts occur. Micrositing during construction will look to minimise impacts as far as possible, otherwise suitable mitigation will be implemented during construction to record any features present. Further details are provided within **Chapter 8**.

Battery Energy Storage System

3.4.25 The BESS area is situated at the site entrance within the site boundary covering an area of 0.3 ha. The BESS will comprise 12 battery containers, 12 Power Control Units (PCUs), parking area, substation, communication building and Low Voltage (LV) board. The proposed location for the BESS is shown on **Figure 3.9**.

Micrositing

3.4.26 To be able to address any localised environmental sensitivities, unexpected ground conditions or technical issues that are found during detailed intrusive site investigations and construction, it is proposed that agreement is sought for a 50 m micrositing allowance around the Proposed Development infrastructure. The technical assessments (presented in **Chapters 5 to 12**) have considered the potential for micrositing and it is considered that the proposed infrastructure could be microsited without resulting in an increase in effect significance or potential new effects. During construction, the need for any micrositing would be assessed and agreed with the onsite Environmental Clerk of Works (ECoW) and Archaeological Clerk of Works (AcoW).

3.5 Summary

3.5.1 The EIA Report is based on the final layout selected for the Proposed Development, as described in detail in **Chapter 4.** The final layout comprises a single turbine up to a of height 149.9 m, BESS, crane hardstanding, and site access tracks.

3.5.2 The final Proposed Development layout has been informed by a robust design iteration process, taking into account potential environmental, landscape and visual impacts and their effects, physical constraints, and health and safety considerations. The information used to inform the design iteration process included baseline data, review of preliminary visualisations, ongoing impact assessments and wind yield optimisation.

3.5.3 The EIA process has been an iterative one, so that potential effects identified throughout the EIA and design process could be avoided and overall impacts of the Proposed Development avoided or reduced.

3.5.4 The assessment of potential effects of the Proposed Development is addressed in **Chapters 5 to 12** of the EIA Report. The residual effects after mitigation and good practice have been applied are provided in each relevant technical chapter and are summarised within **Chapter 14**.

3.6 References

Scottish Government (2017). The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017. Available at: http://www.legislation.gov.uk/ssi/2017/102/contents/made