Cush Wind Farm

Environmental Impact Assessment Report

Non-Technical Summary

Cush Wind Limited

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Contents

1.0 Introduction

Cush Wind Limited ('the Developer') has prepared this Environmental Impact Assessment Report (EIAR) for the construction of an 8 no. turbine wind farm project and associated site development works together with approximately 5.6 kilometres (km) of underground electricity line which will connect to the existing 110kV Dallow electricity substation at Clondallow.

The proposed wind farm is located in rural County Offaly, approximately 4km north of the town of Birr and c. 28km south-west of Tullamore in the townlands of Cush, Galros West, Boolinarig Big, and Eglish; while the proposed grid connection infrastructure will be located within private lands and public roads between the wind farm and the Dallow 110kV electricity substation.

Planning legislation requires that that planning applications for such projects be accompanied by an EIAR. An EIAR is a statement of the effects, if any, which the project, if carried out, would have on the environment. It provides information which a planning authority, in this case An Bord Pleanála ('the Board'), can use in undertaking a formal Environmental Impact Assessment (EIA) and in informing their decision making process. The EIAR can also be used by third parties to evaluate the project and its likely effects.

Galetech Energy Services (GES) has been appointed by the Developer to manage and co-ordinate the management and preparation of this EIAR. The content of the EIAR has been prepared by individual specialist and technical consultants who were appointed in order to undertake assessments and prepare chapters on specific environmental topics.

Volume I of the EIAR is arranged in 14 no. separate chapters which describe the project and addresses each component of the environment likely to be affected and their likely interactions. **Volume II** includes technical information and annexes associated with the EIAR.

The EIAR may be inspected or purchased at the public offices of the Board and Offaly County Council during public opening hours. The EIAR may also be inspected at the dedicated project website www.cushwindfarmplanning.ie.

A submission or observation in respect of the EIAR and the planning application may be made in writing to the Board; at 64 Marlborough Street, Dublin 1, D01 V902 or via the Board's website www.pleanala.ie/en-ie/observations; on payment of the €50 prescribed fee within the period of seven weeks and such submissions or observations will be considered by the Board in making the decision on the planning application.

2.0 Site Location

The proposed wind farm is located in rural County Offaly, approximately 4km north of the town of Birr and c. 28km south-west of Tullamore in the townlands of Cush, Galros West, Boolinarig Big, and Eglish. The location of the proposed wind farm, in a regional context, is illustrated in **Figure 1** below.

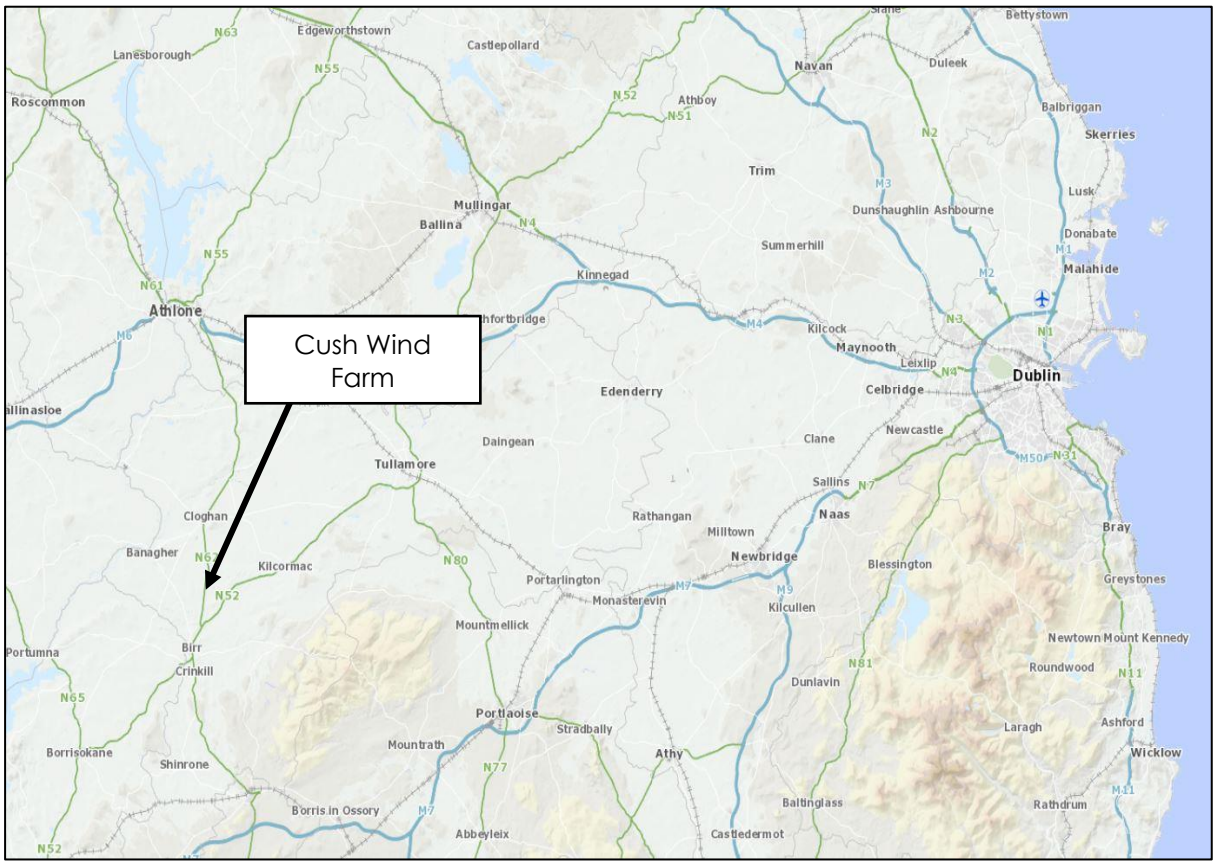

Figure 1: Project Site Location

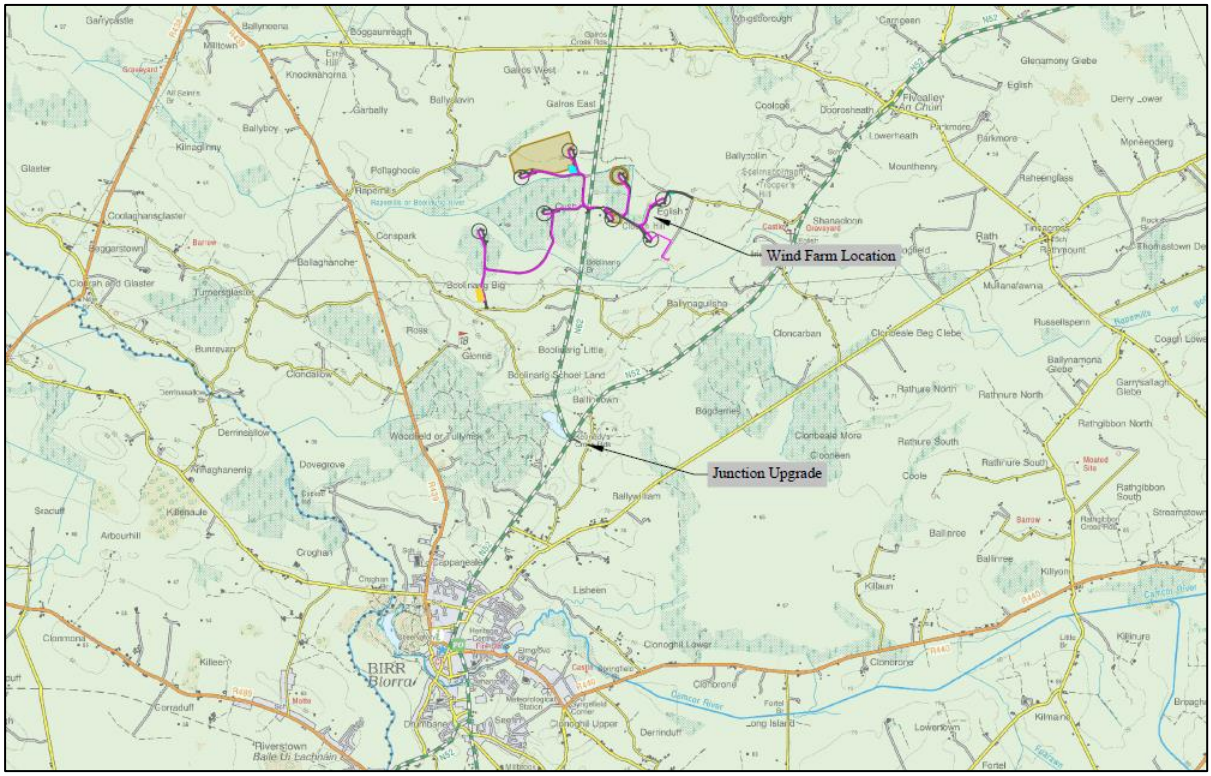

Figure 2: Overall Site Location

The local area is typical of the midlands region and comprises a generally flat landscape with occasional gentle undulations throughout. The most elevated section

of the proposed wind farm site is found along the eastern fringes. The ground slopes in a general westerly direction from this eastern section to the lowest point on the far west of the wind farm site which follows the valley of the Rapemills River.

Current land use within the project site is made up predominantly of peat bogs, agricultural pasture/grassland, and forestry, including commercial and woodland planting (of various species) and scrub. Areas to the north and northwest of the wind farm site comprise cutover private bog; areas to the east and west of the N62 exhibit commercial and woodland forestry plantation; and areas to the south and southeast are predominantly agricultural pasture. The wider landscape is characterised by large tracts of industrial cutaway peatlands and agricultural scrub; however, improved agricultural pasture is dominant in areas bordering the east and west of the wind farm site.

Figure 3: General View across the Wind Farm Site

3.0 Description of the Project

The project assessed within this EIAR comprises a wind farm, including all associated development works to accommodate its construction, installation, operation, maintenance and the export of electrical power to the national grid. This will include:-

- 8 no. wind turbines with a hub height of 114 meters (m), a rotor diameter of 172m, and an overall tip height of 200m;
- All associated turbine foundations and crane hardstand areas;
- Wind farm control building incorporating a medium voltage switchgear room;
- All underground internal electrical and communications cabling;
- Provision of new internal site access tracks and use of, and upgrades to, existing agricultural/forestry tracks;
- Upgrade of 2 no. site entrances from the N62 national secondary road for use during the construction phase only;
- Upgrade of 2 no. site entrances from the L30033 and L300321 local roads, respectively, for the operation phase only;
- 1 no. guy-wired meteorological mast with an overall height of 30 metres;
- 2 no. temporary construction compounds;
- 3 no. dedicated spoil deposition areas for the storage, as required, of excavated material;
- Felling of up to 23 hectares (ha) of forestry to facilitate the construction and operation of wind farm infrastructure; and,

- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure and environmental mitigation measures.

Off-site or secondary elements of the project which are included for assessment in this EIAR and are included in the current SID planning application, include:-

- Temporary alteration works to public roads along the turbine component haul route, including a vehicle turning area at the N52/N62 junction.

Off-site or secondary elements of the project which are included for assessment in this EIAR but are **not** included in the current SID planning application and will be subject to a separate licensing and/or consenting process, include:-

- A 110 kilovolt (kV) electrical substation and all associated electrical equipment, including a control building and battery electricity storage system;
- The installation of c. 5.6km of underground electricity cable to facilitate connection of the proposed electricity substation to the existing 110kV substation at Clondallow, County Offaly; and,
- The planting of 23ha of forestry on lands in the townlands of Drumagelvin, Drumleek South, Lisdonny and Moy, County Monaghan.

The layout of the proposed wind farm is illustrated at **Figure 4** below.

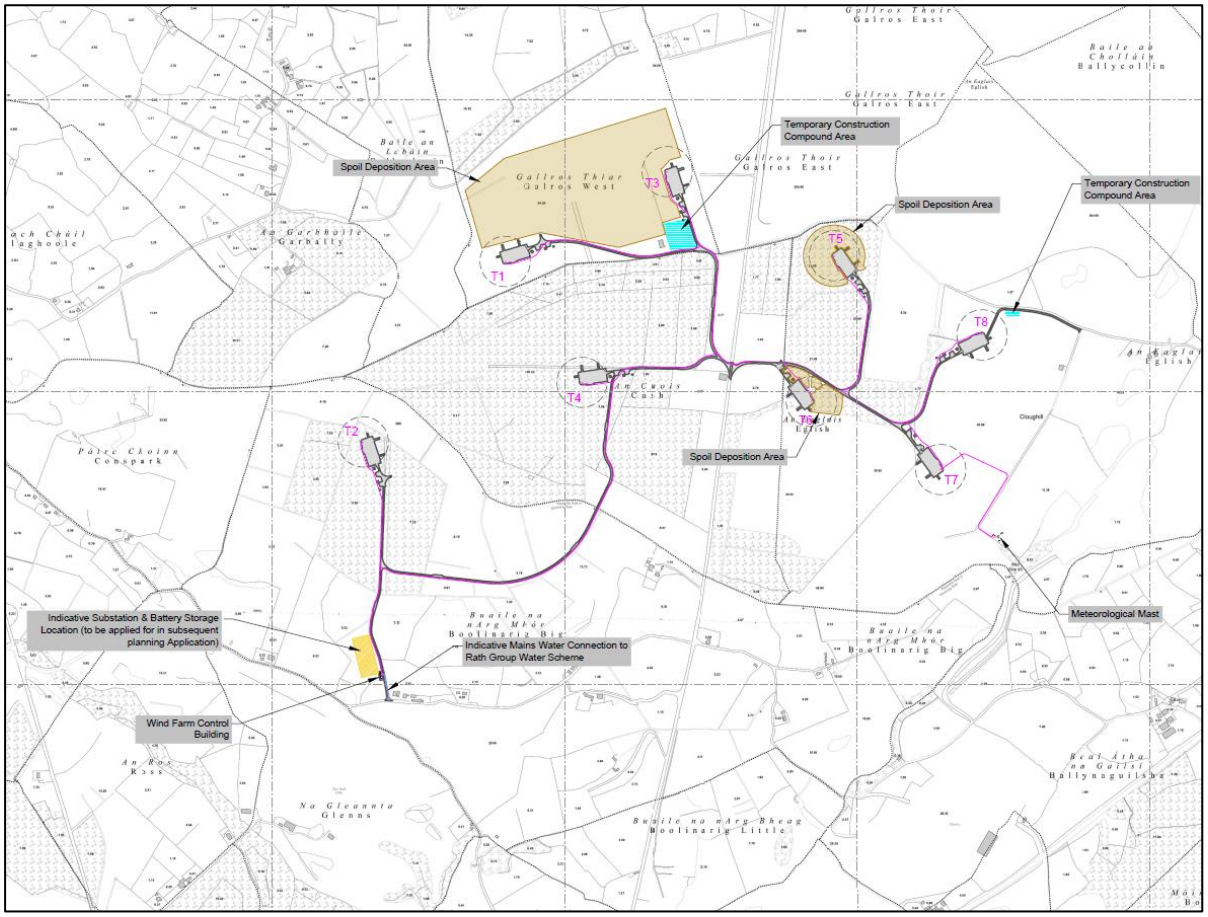

Figure 4: Layout of Wind Farm

4.0 Assessment of Project Alternatives

A description of the reasonable alternatives to this project has been provided, and details the assessment, evaluation and analysis undertaken. A range of alternate development options have been assessed through an iterative and recursive project

design and environmental assessment process, including the 'do-nothing' scenario, alternative locations, alternative designs and layouts, alternative grid connections; alternative design technologies; alternative replant lands, and alternative construction phase transport routes. The objective of this process was to arrive at a project which has inherent design characteristics and has the least likely adverse environmental effects.

The final project assessed in this EIAR has been selected as it strikes the best balance between the avoidance of any significant environmental effects and achieving the objectives of the project.

5.0 Population & Human Health

5.1 Background

The chapter presents an assessment of the likelihood of effects on population and human health. Human beings are an important element of the environment and any likely effects on the status of population and human health must be comprehensively addressed.

5.2 Methodology

The methodology used to inform the assessment generally comprised research of existing documents and information sources to fully understand the population, social and economic characteristics of the local area. Information sources included information from the 2022 National Census, local economic and community plans, and tourism information for county Offaly.

Consultation was also undertaken with a range of bodies including Failte Ireland, Offaly County Council, the Health and Safety Authority, and the Health Service Executive.

5.3 Description of Likely Effects

The assessment finds that the likelihood of effects during the construction phase are limited to effects on population sustainability, general amenity and well-being, economic and employment effects, effects on tourism, and the possibility of accidents or natural disasters. The assessment concludes that the project will result in both negative and positive effects on the above factors; however, the level of significance is at the lower end of the spectrum.

For example, amenity levels, in terms of local population, are likely to be subject to a minor adverse effect for the temporary duration of the construction phase; however, while these effects may be substantial at a personal level, they are not assessed to be significant in EIA terms, particularly given their short-term temporary duration.

Economic opportunities, through the provision of materials or services, will be available to local companies and direct employment during the construction phase is likely to involve the employment of up to approximately 100 people over a period of 15-18 months. Additionally, plant and materials will be sourced locally. The socio-economic benefits resulting from the construction of the project are likely to make a substantial positive effect on the local economy of the local area, through direct employment and rural diversification.

The operational phase of the project is not likely to result in any significant positive or negative effects in terms of population sustainability and residential amenity, general amenity and well-being, economic and employment effects and effects on tourism. While minor localised effects are likely to arise, both positive and negative; these

effects are not assessed as likely to be significant.

The Developer is committed to operating a community benefit fund in accordance with the Wind Energy Ireland (WEI) best practice and it will be available to the community at a rate of €2 euro per megawatt hour (MWh) produced, should the Renewable Energy Support Scheme (RESS) be awarded. An investment of approximately €37,000 per turbine per year for up to 15 years, is committed. The Developer has also committed to introducing a Neighbour Scheme which will offer electricity bill payers living within 1km of a wind turbine an annual contribution of €1,000 towards their electricity usage.

5.4 Mitigation Measures

The land on which the project has been sited is privately owned and there will be no unauthorised public access to the site. This will ensure that there are no impacts on the local population which could affect human health.

During the operational phase, the project will generally be unmanned. Operational monitoring activities will be carried out, remotely, on an ongoing basis. However, regular visits to the site will be undertaken for routine inspections and maintenance.

5.5 Overall Findings

The overall conclusion of the chapter is that any adverse effects of the project on population and human health are unlikely to be significant. No specific mitigation measures, other than full adherence to all health and safety and public health guidance, have therefore been identified as being required.

6.0 Biodiversity

6.1 Background

This chapter provides an assessment of the likely significant effects on biodiversity as a result of the project. This assessment considers the ecological impact of the entire project through the construction, operational and decommissioning phases.

6.2 Methodology

A comprehensive desk study was undertaken to inform this ecological impact assessment, involving a thorough review of available information that is relevant to the ecology of the project site. Field surveys were undertaken by appropriately qualified ecologists between May 2020 and August 2023. These surveys applied best practice guidelines, as required for ecological assessment for proposed wind farm developments.

Surveys undertaken included:-

- Botanical surveys and Habitat mapping;
- Invasive species surveys;
- Aquatic and fisheries assessments including electrofishing under licence, biological water quality assessment and Freshwater Pearl Mussel surveys;
- Bird surveys, including:-
  - Six seasons of vantage point (VP) watch surveys from 2020-2023 covering the project site and surrounding lands;
  - Breeding Wader Surveys encompassing the grid connection route and wider surrounding area;
  - Breeding Raptor Surveys encompassing the proposed grid connection route and wider surrounding area;

  - Swan & Goose Feeding Distribution Surveys encompassing the grid connection route and wider surrounding area;
  - Hen Harrier Roost Surveys encompassing the grid connection route and wider surrounding area;, and;
  - Nocturnal Golden Plover Surveys.
- Dedicated non-volant mammal survey walkovers and deployment of wildlife trail cameras. Checks along the grid connection route and points of interest on the turbine haul route;
- Multi-season bat surveys including:-
  - Habitat Appraisal for Potential Bat Roost Features & Assessment of Habitat Risk
  - Activity surveys - Transect;
  - Passive detector surveys (including deployment at height);
- Other taxa surveys, including Marsh Fritillary survey.

Ecological surveys for the project were undertaken following specific guidelines for habitats and species and with reference to the relevant national legislation and policy. The importance of the habitats and species present is evaluated using the guidance document *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal, and Marine* published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018, updated 2019) and *Good Practice Guidance for Habitats and Species* (CIEEM 2021). This document outlines an accepted approach for the evaluation of potential impacts from such developments. The description and evaluation of likely and residual effects arising from the project on the existing terrestrial biodiversity of the study area and surrounding area follows guidelines published by the EPA (2022) with reference to CIEEM (2018, 2019 and 2021).

6.3 Description of Likely Effects

There are no nationally or European designated sites located within the project site. Part of the grid connection overlaps with the boundary of Ross and Glenns Eskers pNHA. However, this is along the existing road network and the habitats are not representative of those for which the pNHA is designated. The grid connection also lies adjacent to Dovegrove Callows pNHA along the existing road netword.

The project footprint will be primarily located within improved agricultural grassland (GA1), mixed broadleaved/conifer woodland (WD2), cutover bog (PB4), and conifer plantation (PB4). Bog woodland (WN7) is also present in the west of the project site. No Annex I habitats listed under the EU Habitats Directive were recorded within the project site, study area, haul route works locations, or along the grid connection route. No botanical species protected under the Flora (Protection) Order 2022, listed in Annex II or IV of the EU Habitats Directive (92/43/EEC) were recorded. Furthermore, no Bryophytes protected under the Flora (Protection) Order 2022 are documented for the study area (Flora Protection Order Map Viewer NPWS). No Third Schedule invasive plant species were recorded within the project site, at works areas on the haul route or along the grid connection route.

The vantage point surveys recorded a variety of bird species including raptors, waders and waterbirds. 17 no. primary target species were recorded during flight activity surveys. In general, there were very few 'at risk' flight events for any primary target species; the only exception was for European golden plover and northern lapwing.

A total of 4 no. non-volant mammal species were identified during the study, with one suspected badger sett recorded c. 32m south of the grid connection route. Overall, a moderate level of bat activity was recorded at the site, and a moderate-to-high

level of species diversity. The project site contains limited roosting opportunities and high-quality foraging habitat.

No habitat suitable for marsh fritillary was recorded during dedicated surveys.

In the absence of appropriate environmental controls, monitoring and mitigation there is a likelihood of effects upon biodiversity features of importance. The construction phase is identified as requiring the greatest degree of active environmental control. In the absence of appropriate mitigation, there is a likelihood of significant negative effects on designated sites, including the River Shannon Callows SAC and Middle Shannon Callows SPA associated with run-off of sediment and other potential contaminants to hydrologically connected watercourses. The loss and disturbance of areas of grassland and plantation/woodland is also likely to result in some localised displacement and disturbance of species. The likelihood of operational and decommissioning phase effects upon habitats and species is also assessed. For instance, likely operational phase collision effects of birds and bats with turbines is assessed based on the results of the surveys and the scientific literature; however, significant effects on these species are not assessed as likely.

6.4 Mitigation Measures

From the outset, an iterative process of constraints led design was employed for the project whereby independent ecological expertise was utilised at an early design stage in identifying the constraints and designing the site layout to take account of these constraints. The siting of the turbines and associated infrastructure was informed by the environmental constraints.

Mitigation measures, required to prevent adverse effects on downstream Natura 2000 sites are outlined in the Natura Impact Statement (NIS) for the project. The mitigation measures relate to protection of water quality flowing into the identified designated sites via Rapemills River. A detailed Surface Water Management Plan (SWMP) and Construction and Environmental Management Plan (CEMP) present detailed environmental controls to ensure best practice guidelines are implemented. If these measures are implemented in full, they will ensure that adverse effects on these Natura 2000 sites are avoided. These measures will also protect water quality locally within the watercourses draining the project site and therefore avoid any likely significant effects on local aquatic ecology.

Mitigation measures which aim to reduce the spatial and temporal effects on the receiving environment are detailed. An Ecological Clerk of Works (ECoW) will be appointed to oversee the implementation of the construction phase mitigation. Tree-felling and removal of mature vegetation will be undertaken outside of the bird breeding season (1st March – 31st August, inclusive).

Hedgerows and mature trees will be retained insofar as possible and all disruption to habitats outside of the construction footprint will be minimised. Pre-construction surveys will be carried out to ensure that the risk of disturbance of any protected mammal species is minimised and that all vegetation clearance and construction works will be carried out in accordance with the mitigation recommendations, relevant guidance and legislative requirements.

Operational phase monitoring and mitigation includes vantage point surveys for birds, passive detector bat surveys and fatality monitoring for birds and bats.

At the decommissioning phase, an decommissioning plan will be prepared in advance of the works and will include all appropriate surface water and spoil

management commitments. Following reinstatement, the site will be monitored by a suitably qualified ecologist for a 2-year period to determine the progress of revegetation and if necessary to introduce supplementary planting with native species.

6.5 Overall Findings

The mitigation measures described have been designed to minimise the effect of the project, from the construction of the project through the operational phase and onto decommissioning, on ecological receptors. The constraints-led design approach followed has been effective in identifying and, insofar as possible, avoiding likely effects to the receiving environment.

The ecological impact assessment has fully assessed the likelihood of adverse effects of all aspects of the project on the species and habitats in the receiving environment. Overall, it is assessed that the detailed monitoring and mitigation commitments will be effective in ensuring that there are no likely significant residual effects on biodiversity.

Separately, the Natura Impact Statement (NIS) has fully assessed the potential impacts of the project, on its own and in combination with other projects and plans, on designated Natura 2000 sites in the wider receiving environment. The implementation of detailed mitigation commitments will ensure that there are no significant effects on any European-designated nature conservation site.

7.0 Land & Soils

7.1 Background

This chapter provides an assessment of the likely and significant effects of the project on the land, soil and geological environment.

7.2 Methodology

A desk study of the project site and receiving environment (described below) was completed in advance of undertaking the walkover survey, visual assessments and site investigations. This involved collecting all relevant land, soil and geological information for the project site and surrounding area.

An initial site walkover, geological mapping and soil probing exercise was undertaken. Further site investigations, including trial pits and additional site walkovers and soil probes were also completed.

The project site is largely overlain by Cut Peat, with some basic shallow well-drained mineral soils located in the southeast of the project site at 2 no. proposed turbine locations (T7 and T8). A small area of basic poorly drained mineral soil is mapped towards the centre of the project site along the N62. The grid connection route from the proposed project site passes through areas mapped predominantly as Cut Peat. The mapped soil type at the N62/52 junction works along the haul route is Cut Peat.

GSI subsoils mapping show that the proposed project site is underlain predominantly by cutover raised peat with Gravels derived from Limestones mapped on the southeast and southwest of the project site and also underlying turbine locations T7 and T8. A small pocket of Till derived from Limestones is mapped towards the centre of the proposed project site along the N62.

Gravels and eskers are mainly mapped along the grid connection route to the west of the project site. Esker ridges are mapped to coincide with the Gravel deposits at

two locations along the proposed route. Areas of Fen Peat are mapped in low-lying areas between the Esker ridges.

The proposed 110kV substation, BESS and control building location (grassland) are located where there is a mapped transition from peat (Cut) into Gravels. The subsoil type at the replanting lands is sandstone/shale tills.

The overburden geology profile at the turbine locations on bogs typically has the following sequence – peat, shell marl and lacustrine clay.

Subsoils at turbines T7 and T8 are glacial till dominated (i.e. silt/clay and sand/gravels) as they are located outside of the cutover raised bog areas.

Mineral subsoils (silt/clay) are present at the substation, BESS and control building location which is a grassland area.

A Geotechnical and Peat Stability Assessment undertaken for the project site determined the site is suitable for wind farm development and is considered to be at low risk of peat failure or ground instability.

7.3 Description of Likely Effects

The excavation of peat, soil, subsoil and possibly bedrock (where present) will be required for all groundworks; including site levelling, the installation of infrastructure (e.g. turbine foundations, substation foundation, hardstands and electrical cabling) and for access track formation and will, therefore, give rise to direct effects on these receptors. The excavation of soils and subsoils will also be required along the grid connection route; while minor levels of excavation are predicted at haul route works locations.

Bedrock is likely only to be encountered if piling is carried out, as evidenced by the results of the preliminary site investigations undertaken.

Due to the shallow nature of the works along the grid connection (c. 1.2m) and the fact the cable will largely be placed within the carriageway of public roads effects on soils, subsoil and bedrock will not likely be significant.

These works will result in a direct, permanent loss of soil, subsoil and bedrock at excavated locations, however the overall effect is determined not to be significant due to the following:-

- The peat, soils and subsoils and bedrock at the project site are generally classified as 'low to medium' importance;
- A minimal volume of peat, soil, subsoil and bedrock; in comparison to the total resource present on the site; will be removed to allow for the construction of the project;
- The peat, soil, subsoil, and bedrock which will be removed during the construction phase will be localised to the footprint of infrastructure only; and,
- No turbines or related infrastructure will be constructed within or near any designated sites for the protection of ecological features or geological heritage.

During the construction phase, sources of contaminants (such as oil-based substances or other hazardous chemicals) will not be stored at the site except where this is done within safely bunded areas that safely contain all spillages and prevent the migration of contaminants. Refueling will be done with a double skinned bowser with spill kits on the ready in case of accidental spillages. The risk is considered to be low once mitigation measures are implemented.

With regard cumulative effects, the assessment concludes that significant effects are unlikely to arise predominately due to the localised and near surface nature of the construction works. All effects relating to the project are assessed to be contained within the immediate vicinity of the project site and it is assessed that there is no pathway for the development to act in combination with other projects.

The development will not be constructed within or near any designated sites for the protection of geological feature such as geological heritage, NHAs or SACs.

The geological impact assessment undertaken in this chapter outlines that significant effects will not occur due to the localised nature of the construction works and therefore there is no potential for cumulative effects.

7.4 Mitigation Measures

The excavation of peat, soil and subsoil will have a direct effect on the geological environment and no specific mitigation measures are proposed. The excavation of materials will be completed in accordance with best practice for the management and treatment of such materials.

7.5 Overall Findings

No significant impacts on the land, soil or the geological environmental are likely to occur during the construction, operation or decommissioning of the project.

8.0 Water

8.1 Background

This chapter provides an assessment of the likely and significant effects of the project on water aspects (hydrology and hydrogeology) of the environment.

8.2 Methodology

A desk study of the project site and receiving environment was completed in advance of undertaking a walkover survey, field mapping and site investigations. This involved collecting all relevant geological, hydrological, hydrogeological and meteorological information for the project and surrounding area. The desk study included consultation of the following data sources:-

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive/EPA Catchments Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 15 (Geology of Galway - Offaly). Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland (2004); Groundwater Body Initial Characterization Reports;
- OPW Past Flood Event Mapping (www.floodinfo.ie);
- OPW Flood Mapping (www.floodinfo.ie);
- Ordnance Survey Ireland (OSI) – 6 inch and 1;5000 scale basemaps; and,
- Offaly County Development Plan (2021 – 2027) Strategic Flood mapping;
- Aerial photography (www.bing.com/maps, www.geohive.ie, www.google.com/maps).

Subsequently, surface water sampling was completed and tested for a range of hydrochemistry parameters.

A Stage 3 Flood Risk Assessment including flood modelling was also completed, as well as a geotechnical assessment (carried out by Fehily Timoney & Company) used to inform the assessment contained within the Water Chapter.

In terms of regional surface water catchments, the proposed project site is located within the Lower Shannon Catchment area and mainly situated inside the Shannon (lower) sub-catchment (i.e. Rapemills River). The grid connection route extends into the Shannon (lower) (Little Brosna River) sub-catchment.

On a more local scale, the proposed project site is situated inside the Rapemills River catchment while the grid connection also extends into the Little Brosna River catchment. The Rapemills River passes through the project site then flows into the River Shannon approximately 10.5km downstream of the project site.

Approximately 2.7km of the grid connection is located in the Rapemills River catchment while the other 2.9km is located in the Little Brosna River catchment. The Little Brosna River flows approximately 1km to the southwest of the existing Dallow substation, at Clondallow, before joining the River Shannon a further 12km downstream.

Along with the natural watercourse network at the wind farm site, there are manmade drainage ditches present also. The integration of the wind farm drainage infrastructure with the existing land and forestry drainage, in a manner that avoids water quality impacts in downstream water bodies, is a key component of the project design.

Due to the presence of the overlying peat (which results in minimal recharge) and the low permeability of the underlying marl and lacustrine deposits, groundwater movement through the underlying glacial deposits will be relatively slow unless higher permeability sands and gravels horizons are present. The primary risks to groundwater at the site would be from cementitious materials, hydrocarbon spillage and leakages and potential piling works at turbine bases.

8.3 Description of Likely Effects

During each phase of the project (construction, operation, and decommissioning) a number of activities will take place at the proposed site, some of which will have the potential to significantly affect the hydrological regime or water quality at the proposed site or downstream of the project site. These significant potential effects generally arise from sediment input from runoff and other pollutants such as hydrocarbons and cement-based compounds.

Surface water drainage measures, pollution control and other preventative measures have been incorporated into the project design to minimise significant impacts on water quality and downstream designated sites.

A Planning-Stage Surface Water Management Plan (SWMP) and drainage plan will be the principal means of significantly reducing sediment runoff arising from construction activities and to control runoff rates. The key surface water control measure is that there will be no direct discharge of wind farm runoff into local watercourses or into the existing bog drainage network. This will be achieved by avoidance methods (i.e. stream buffers) and design methods (i.e. surface water drainage plan). Preventative measures also include fuel and concrete management and a waste management plan which will be incorporated into the Construction and Environmental Management Plan.

No significant impacts to surface water (quality and flows) and groundwater (quality and quantity, and any local groundwater wells) will occur as a result of the proposed

project provided the proposed mitigation measures are implemented. This EIAR presents proven and effective mitigation measures to mitigate the release of sediment which will reduce the concentration of suspended solids to acceptable levels. The storage and handling of hydrocarbons/chemicals will be carried out using best practice methods which will ensure the protection of surface and groundwater quality. The project drainage system will be designed to slow surface water runoff from the proposed site by providing greater attenuation. This will ensure that the project does not alter downstream surface water flows and will not contribute to downstream flooding.

A hydrological assessment of potential impacts on local designated sites was undertaken. The Rapemills River and Little Brosna River ultimately drains into the River Shannon while flowing through the River Shannon Calllows SAC and the Middle Shannon Callows SPA. The Little Brosna River also flows through the River Little Brosna Callows SPA.

Following implementation of the appropriate mitigation measures as outlined in the EIAR no significant impacts on these designated sites will occur as a result of the project.

The Stage 3 Flood Risk Assessment undertaken for the project site informed the wind farm layout at an early design stage and therefore most of the proposed infrastructure is located outside of fluvial flood zones associated with the Rapemills River. The proposed project will have no impact on flood risk elsewhere in the locality and this largely due to the avoidance of fluvial flood zones as an early design measure.

A Water Framework Directive (WFD) Compliance Assessment has been completed for all waterbodies (surface water and groundwater bodies) with the potential to be impacted by the Proposed Project. With the implementation of the mitigation measures detailed in this EIAR there will be no change in the WFD status of the underlying groundwater body or downstream surface waterbodies as a result of the project. The project has been found to be fully compliant with the WFD and will not prevent any waterbody from achieving its WFD objectives.

An assessment of potential cumulative effects associated with the project and other developments on the hydrological and hydrogeological environment has been completed. With the implementation of the mitigation measures detailed in this EIAR, the cumulative assessment found that there will be no significant effects on the hydrological and hydrogeological environments.

8.4 Mitigation Measures

Two methods will be employed to control drainage water within the site during construction, thereby protecting downstream surface water quality and aquatic habitats. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt, to allow settlement and cleaning prior to its release.

During the construction and decommissioning phases, all runoff will be treated to a high quality prior to being released. There will be no risk of increased flooding down-gradient of the site as a result of the project due to these drainage measures. Effects on water quality during the construction phase of the wind farm will be imperceptible

to none. A surface water monitoring programme will be put in place during the construction phase.

During the operational phase, drainage control measures will ensure that surface runoff from the developed areas of the project site will continue to be of good quality and will therefore not affect the quality of downstream rivers and streams. The present drainage regime of the site will not be altered in any way. No effects on surface water quality are anticipated during the operational phase.

8.5 Overall Findings

Overall, no significant effects on the water environment, including WFD status, will occur during the construction, operation or decommissioning of the project.

9.0 Air Quality & Climate

9.1 Background

This chapter comprises an assessment of the likely impact on air quality and climate associated with the project during its construction, operation and decommissioning phases.

9.2 Methodology

The methodology employed as part of this assessment comprised a desktop appraisal and evaluation of existing environmental conditions; the likely effects which may arise during the construction, operational and decommissioning phases; and identification of measures to off-set or reduce likely adverse effects.

9.3 Description of Likely Effects

The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for effects from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within several hundred metres of the construction area.

The effect of the construction, operation and decommissioning of the project on Ireland's total national greenhouse gas emission is compared to Ireland's 2020 total greenhouse gas emissions and obligations under Irelands EU 2030 commitments. Any adverse effects are predicted to occur during the construction phase, with the dominant sources of greenhouse gas emissions as a result of the project arising from construction traffic and embodied energy for turbine construction.

The generation of electricity to the national grid during the operational phase will lead to a net saving for the development in terms of greenhouse gas emissions. The generation of 187,000 megawatt-hours per year of electricity from the project will lead to a net saving in terms of greenhouse gas emissions. The production of this renewable electricity results in the project having a net positive annual effect on greenhouse gas emissions.

9.4 Mitigation Measures

A range of measures have been proposed to minimise the emission of greenhouse gases during the construction phase; while a Dust Management Plan has been prepared to ensure that significant levels of dust are not generated.

9.5 Overall Findings

Due to the size, nature and location of the project, increased road traffic emissions resulting from the project are expected to have an imperceptible impact on air quality. The project will, once operational, result in a long-term positive effect on air quality and a reduction in greenhouse gases.

10.0 Landscape

10.1 Background

This chapter describes the landscape context of the project and assesses the likely landscape and visual impacts of the scheme on the receiving environment. Although closely linked, landscape and visual impacts are assessed separately.

Landscape Impact Assessment (LIA) relates to assessing effects on the landscape as a resource in its own right and is concerned with how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character. Visual Impact Assessment (VIA) relates to assessing effects on specific views and on the general visual amenity experienced by people. Cumulative landscape and visual impact assessment is concerned with additional changes to the landscape or visual amenity caused by the project in conjunction with other developments, or actions that occurred in the past, present or are likely to occur in the foreseeable future.

10.2 Methodology

The production of this assessment involved baseline work in the form of desktop studies and fieldwork comprising professional evaluation by qualified and experienced Landscape Architects. This entailed a desktop study, fieldwork to inform the assessment and an appraisal which estimated the significance of landscape and visual impacts base on a balance of receptor sensitivity weighed against the magnitude of effects. Cumulative landscape and visual effects were also assessed in respect of other surrounding developments that are either existing or permitted.

This assessment uses methodology as prescribed in the following guidance documents:-

- European Union (2017) Guidance *on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);*
- Environmental Protection Agency (EPA) publication '*Guidelines on the Information to be contained in Environmental Impact Statements* (2022) and the accompanying *Advice Notes on Current Practice in the Preparation of Environmental Impact Statements* (Draft 2015);
- Landscape Institute and the Institute of Environmental Management and Assessment publication entitled '*Guidelines for Landscape and Visual Impact Assessment – Third Addition'* (2013);
- Scottish Natural Heritage (SNH) '*Guidance Note: Cumulative Effect of Wind' Farms* (2012);
- Department of the Environment, Heritage, and Local Government (2006) *Wind Energy Development Guidelines for Planning Authorities 2006;*
- Department of the Housing, Planning, and Local Government (2019) *Draft Revised Wind Energy Development Guidelines;* and,
- Scottish Natural Heritage (SNH) '*Visual representation of wind farms: Best Practice Guidelines*' (version 2.2 - 2017).

10.3 Description of Likely Effects

The project site is deemed to have Low Landscape Sensitivity to Wind Development,

due to being located within a robust, rural and highly modified landscape, which is classified as having the 'ability to absorb' wind development. The central study is deemed to have Medium-Low Landscape Sensitivity to Wind Development. As the higher sensitivity areas are offset from the proposed project and trace distinctly different landcover/landform areas than the site itself, although there is some overlap between the bog landscape (Moderate sensitivity within Offaly County Development Plan 2021-2027) which the site is partially located in, and the 'Wetland' area of Lough Boora. The wider study is deemed to have Medium-Low Landscape Sensitivity to Wind Development. While there is a number of distributed areas of higher sensitivity, this is balanced with the surrounding lower sensitivity landscapes and land uses/values.

There will be direct physical impacts on the site during the construction and operational stages of the development, but such effects are considered to be modest in scale and nature in this already modified rural setting. The site itself is deemed to experience High-Medium Magnitude of Impact, resulting in Moderate to Slight final significance. Within the central study area, the magnitude of landscape impacts is deemed to be 'Medium', which, combined with the previously identified 'Medium-low' landscape sensitivity, results in a landscape impact significance of 'Moderate-slight'. This is due to the introduction of tall moving structures, although there is some thematic relationship with the surrounding peat bog context where the landscape was once used to harvest fuel for energy and will now harvest wind as a source of energy.

Beyond the central study area (<5km), the turbines will have a lesser background influence on prevailing landscape character. Landscape impacts beyond 5km are considered to be no greater than 'Slight' diminishing to 'Imperceptible' with distance, and as the proposed wind farm becomes a comparatively small-scale component of the overall landscape fabric.

Visual impacts were assessed at 32 visual receptor locations throughout the study area, which were deemed to range widely in sensitivity from Very High to Low. Those locations with the highest levels of sensitivity tend to be sensitive heritage features such as the Birr Castle and Clonmacnoise. Other views with medium to high sensitivity typically relate to elevated areas of terrain that afford distant views across the landscape, designated scenic views within the County Development Plans, and areas that provide a notable degree of scenic and/or recreational amenity. Medium-low sensitivity tends to be attributed to less remarkable and contained views from local and regional roads, often comprising a range of typical anthropogenic land uses.

As a result of the relatively flat landscape contained within the central study area, combined with the numerous layers of hedgerows and mature tree lines, a notable degree of containment is apparent throughout the low-lying parts of the study area. However, there are opportunities for close proximity views along road corridors. Thus, the most notable visual impacts are likely to occur in the central study area. Three viewpoints were selected solely to represent local community views (with 9 others which are representative of local community views in combination with ither receptors). VP11 and VP12 are both located along the L3006 to the north of the site, while VP17 is located to the south of the site, along the boundary of Birr Golf Club. All three views are of medium-low sensitivity due to the limited number of receptors and transitional manner of views along the enclosed local roads. VP11 and VP12 feature the Meenwaun Wind Farm development in the immediate surrounds, while VP17 has views north to the wider baseline context of Cloghan and (permitted) Derrinlough. VP11 features the lowest magnitude of impact, at medium-low, resulting in a

moderate final significance. VP17, which features high-medium magnitude of impact, resulting in a moderate (negative/long term) impact. VP12 also features High-medium impacts, resulting in moderate significance of impact. The nearest settlement to the proposed development is that of Birr, which is represented by VP21, VP22, VP23, and VP24. Although these are also representative of the multitude of heritage features within Birr. VP22 is also representative of the N52 national road as it passes through Birr. A second view representative of a centre of population and national road is VP3, located along the N62 at Ferbane (north of the study area). In terms of impacts, the extent of the proposed project is less visible from Birr, (VP22) but the framed nature of the view increases the magnitude of impact (which is mitigated by the separation provided by intervening vegetation along the horizon), resulting in a medium magnitude of impact and a significance of moderate. At Ferbane, the proposed project is visible across a broader extent of the view and with greater surrounding context. As such, the magnitude is medium-low, resulting in moderate-slight significance.

Finally, the east of the study area features the majority of the elevated viewpoints, and therefore features clear visibility of the proposed development in its entirety, as well as in combination with the surrounding land uses (as discussed below). This is represented in VP17 in particular, as the slightly elevated location allows clear views across the wider landscape, as does VP30.

In terms of cumulative impact, when viewed from the north, the project provides depth and additional intensity / clutter to the combination of the Meenwaun/Cloghan/Derrinlough developments. The proposed Carrig Renewables Wind Farm, located in the southwest of the study area most often presents in the background of these northern (southfacing) views, relating to the existing and permitted cumulative developments adding visual clutter in the distance (where visibile). This cumulative relationship is represented in VP1, VP2, VP3, VP4, VP5, VP6, VP7, & VP8. VP5 in particular offers clear views of this pattern, where the proposed project is viewed in the central background of Derrinlough and Cloghan developments, filling in the background and any visual spaces between these two schemes.

When viewed from the south of the study area, the project presents in the foreground, while the permitted and existing wind development (in particular Derrinlough and Cloghan) are visible between the project's wind turbines. There is a higher degree of clutter present at greater distances as there is a reduction in depth/perspective and visual separation between the arrays. When viewed from elevated and oblique angles, the proposed project extends the proportion of the lowland landscape which is occupied by turbines.

Overall, there is a balance between the increase in clutter and intensity of development against the containment of a number of medium-large wind energy developments in a relatively uniform/cohesive area. In particular given the relationship most have with the cutover bog or conifer forestry land use.

Overall, it is deemed that the addition of the project to the permitted baseline will have Medium cumulative impact, as with the combination of the project with the surrounding wind development, there is the beginnings of an (relatively localised – 7km radius) area which may come to be defined by the large wind energy development within it, particularly as the N62 runs between turbines at multiple locations.

10.4 Mitigation Measures

Aside from construction stage mitigation measures to minimise land and vegetation disturbance and dust emissions, there are no specific mitigation measures to be implemented. The appropriate management and reinstatement of excavations, in a timely manner, will ensure that any adverse effects caused, for example at site entrances or road upgrade locations, are minimised insofar as possible. Similarly, the progressive reinstatement and landscaping of the site will remediate any short-term adverse effects on the local landscape.

Given the highly visible nature of commercial wind energy developments it is not generally feasible to screen them from view using on-site screening measures typically employed for other forms of development during the operational phase. Instead, landscape and visual mitigation measures have been incorporated into the siting and design of the development at an early stage (see **Chapter 2**). In the case of this project, the guidance provided in the *Wind Energy Development Guidelines for Planning Authorities 2006* (and 2019 revision) was the principal consideration.

The project has embedded landscape and visual mitigation measures and thus, the assessment of likely landscape and visual effects is equivalent to any appraisal of residual effects in this instance. Some of the general mitigation measures that will be implemented to make the development less intrusive and less eye catching on a localised level include:-

- The colour will be industry standard off-white/light grey semi-matt non-reflective finish;
- Transmission lines between individual turbines and the substation will be placed underground;
- Special care will be taken to preserve any features, insofar as possible, which contribute to the landscape character of the study area; and
- Counter rotation of blade sets will be avoided.

10.5 Overall Findings

Based on the landscape, visual, and cumulative assessment, it is not considered that there will be any significant landscape or visual effects arising from the project, however there is potential for localised moderate visual impacts, in particular within the immediate surrounds, specifically in combination with existing and permitted cumulative development.

11.0 Cultural Heritage

11.1 Background

This chapter has been prepared to assess and define any likely significant impacts or effects which the construction, operation and decommissioning of the project may have on the archaeological, architectural and cultural heritage resource. The chapter includes an identification of likely significant impacts or effects which may arise and outlines mitigation measures, based on current information, which may be used to avoid, reduce or offset any likely adverse effects.

Construction phase effects may arise as a result of the development of turbine foundations and hardstand areas, access tracks, underground cabling, grid connection works, road upgrade works and associated activities; each of which will involve the mechanical excavation of overburden down to and through geologically deposited strata at their identified locations. Operational phase effects may arise as a result of the visual effects resulting from the presence of the proposed wind turbines in the landscape. Decommissioning phase effects are assessed as likely to be similar

to the construction phase but of a reduced magnitude and significance.

As a result of carrying out this assessment, the following likely archaeological, architectural and cultural heritage direct, indirect, construction, operational, cumulative and residual effects have been assessed.

11.2 Methodology

There is no professional standard for defining the extent of a study area when assessing the likelihood of effects on archaeological, architectural or cultural heritage remains. A 1km study area has been applied around the wind farm to assess the presence of statutorily protected archaeological remains (RMP sites). In addition, a 20km study area has been applied around the wind farm to assess the presence of any World Heritage Sites, sites included in the Tentative List as consideration for nomination to the World Heritage List; while a 5km study area has been applied around the wind farm site to assess the presence of National Monuments, sites with Preservation Orders or Temporary Orders, Protected Structures, Conservation Areas or Proposed Conservation Areas.

A 1km study area has been applied around the wind farm to record the presence of any structures recorded on the National Inventory of Architectural Heritage (NIAH). An assessment has also been made of any historic gardens or designed landscapes as recorded on the NIAH that may exist within the project site.

A 100m study area has been applied around the proposed grid connection, while the area of land take associated with the temporary alteration works at the N52/N62 junction and the forestry re-plant lands have also been assessed.

Research has been undertaken in two phases. The first phase comprised a desk review, namely a paper and digital survey of archaeological, historical and cartographic sources. The second phase involved field inspections of the project site.

11.3 Description of Likely Effects

There are no Recorded Monuments or any additional statutorily protected archaeological features within the footprint of the project. As a result, there will be no direct or indirect construction phase effect on the recorded archaeological resource.

There will be no direct construction phase effect on the recorded archaeological, architectural or cultural heritage resource. It is assessed that there will be a likely permanent, direct and imperceptible construction phase effect on any previously unrecorded archaeological remains that may exist within the project site and which may be discovered during the construction phase. It is assessed that there will be a likely temporary, reversible and imperceptible construction phase visual and noise effect on the archaeological resource. It is assessed that there will be a likely permanent, direct and imperceptible construction phase effect on any townland, parish or barony boundaries that may be impacted on by the project. There will be no direct or indirect construction phase effect on any watercourses. Where access tracks are required to cross manmade drainage ditches, these will be piped or spanned with an appropriate bridging structure. Where access tracks cross a natural watercourse, bottomless culverts will be installed (where possible). Crossing the Rapemills River will be fully clear span, negating the need for any in-river culvert structures.

It is assessed that there will be a likely long-term, reversible and moderate operational phase visual effect on 1 no. Recorded Monument located within 1km of the wind farm. It is assessed that there will be a likely long-term, reversible and slight-not

significant operational phase visual effect on 8 no. Protected Structures within 5km of the wind farm. It is assessed that there will be a likely long-term, reversible and moderate operational phase visual effect on 1 no. structure recorded on the National Inventory of Architectural Heritage located within 1km of the wind farm.

Archaeological monitoring of all excavations associated with the construction of the wind farm shall be carried out. Archaeological monitoring of all excavations associated with the grid connection infrastructure shall be carried out. Archaeological monitoring of all excavations within the temporary haul route works at the N52/N62 junction shall be carried out. Archaeological monitoring of all excavations at townland, parish and barony boundaries shall be carried out. Written and photographic records will be created of any townland, parish or barony boundaries that may be impacted on. A redundant record (RMP MO020-024) is located with the southern forestry replant lands. Even though this feature is now considered to be non-archaeological, a 30m buffer zone will be established around its perimeter.

There are no Recorded Monuments within the wind farm site. There are 4 no. Recorded Monuments within 1km of the wind farm site, 2 no. of which are no longer extant. It is assessed that there will be a likely long-term, reversible and moderate operational phase visual effect on these Recorded Monuments. In addition, it is assessed that there will be a likely long-term, reversible and imperceptible operational phase visual effect on one National Monument with a Preservation Order within 5km of the wind farm site; a likely long-term, reversible and slight-not significant operational phase visual effect on approximately 391 Protected Structures within 5km of the wind farm site; and a likely long-term, reversible and imperceptible operational phase visual effect on Birr Castle and Demesne.

It is assessed that there will be no likely decommissioning phase effects on the archaeological, architectural or cultural heritage resource. The decommissioning phase will result in the removal of infrastructure and is likely to result in an improvement in the archaeological, architectural and cultural heritage resource. However, any improvement will be negligible given the low magnitude and significance of the predicted construction and operational phase effects.

Likely direct effects on the archaeological, architectural and cultural heritage resource have been assessed and mitigated. As such, cumulative direct effects will not occur during the construction or decommissioning phases of Cush Wind Farm.

An assessment of National Monuments within 5km of the wind farm site has been undertaken to assess for likely cumulative effects during the operational phase. The likelihood of additional turbines being visible in the wider landscape from National Monuments is such that cumulative effects could occur, as it is not possible to mitigate the effects on setting arising from turbines at the operational stage. There is 1 no. National Monument within 5km of the wind farm site. There are no additional wind farms (either existing, permitted or proposed) within 5km of the above-mentioned National Monument. As such, it is assessed that there will be no operational phase cumulative effect on this National Monument.

it is assessed that the operation of the wind farm, in combination with all developments listed at **Chapter 1 (Volume I)**; including Derrinlough Wind Farm, Cloghan Wind Farm and Meenwaun Wind Farm; is likely to result in a long-term, reversible and slight cumulative visual effect with the Cush Wind Farm on the archaeological, architectural and cultural heritage resource.

11.4 Mitigation Measures

A redundant record (RMP MO020-024) is located with the southern forestry replant lands. Even though this feature is now considered to be non-archaeological, a 30m buffer zone will be established around its perimeter.

Archaeological monitoring of all excavations associated with the construction of the wind farm; of all excavations associated with the grid connection infrastructure; of all excavations within the temporary alteration works at the N52/N62 junction; and of all excavations at townland, parish, barony or county boundaries shall be carried out. Written and photographic records will be created of any townland, parish, barony or county boundaries that may be impacted on.

11.5 Overall Findings

Following the implementation of mitigation measures outlined, the likely residual effects of the project remains imperceptible to moderate. This assessment has further concluded that the project will not result in any likely significant cumulative effects with other existing, permitted or proposed development.

12.0 Noise & Vibration

12.1 Background

This assessment comprises an assessment into the likely environmental noise and vibration impacts of the project.

12.2 Methodology

The methodology adopted for assessing the noise impact of the wind energy development is based on the guidance in the document *Wind Energy Development Guidelines for Planning Authorities 2006* published by the Department of Environment, Community and Local Government, which are based on the UK document ETSU-R-97 The Assessment and Rating of Noise from Wind Farms which describes a detailed method for deriving maximum values of wind turbine noise, when measured at an external location in the vicinity of a house. Maximum values, or limits, are primarily based on the background noise levels and how it varies with wind speed, in the absence of wind farm.

The background noise environment has been established through noise monitoring surveys undertaken at several noise sensitive locations (NSLs) surrounding the project. Typical background noise levels for day and night periods at various wind speeds have been measured in accordance with best practice guidance contained in the Institute of Acoustics document 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG). Prevailing noise levels are primarily attributable to wind noise in foliage, local road traffic noise and other agricultural and anthropogenic sources in the area.

When considering a development of this nature, the likely noise and vibration effects on the surroundings must be considered for the short-term construction and decommissioning phases and the long-term operational phase.

12.3 Description of Likely Effects

The assessment of construction and decommissioning phase noise and vibration has been conducted in accordance best practice guidance contained in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise* and *BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration*. Subject to the methodologies to be implemented, the characteristics of activities during the

construction and decommissioning phases, and the short-term duration of the activities, noise associated with the construction and decommissioning phases is not expected to result in significant effects. Similarly, significant effects from vibration are not likely to occur.

Based on detailed information on the site layout, turbine noise emission levels and turbine height, worst-case turbine noise levels have been predicted at NSLs for a range of operational wind speeds. The predicted noise levels associated with the project will be within best practice noise limits recommended in Irish guidance at all dwellings. Therefore, it is assessed that significant noise effects will not occur.

No significant vibration effects are associated with the operation of the site.

12.4 Mitigation Measures

The various contractors involved in the construction and decommissioning phases will be obliged, under contract, to take specific noise abatement measures and comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise* and *BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration*.

An assessment of the operational phase noise levels, both specific to the project and in combination with the existing Meenwaun and Cloghan Wind Farm's, as well as the consented (and under construction) Derrinlough Wind Farm, has been undertaken in accordance with best practice guidelines and procedures. The findings of the assessment confirm that predicted operational phase noise levels will be within the relevant best practice noise criteria curves for wind farms. Therefore, noise mitigation measures are not required for the operational phase of this project.

12.5 Overall Findings

In summary, the noise and vibration effect of the project is not likely to be significant in the context of current national guidance.

13.0 Shadow Flicker

13.1 Background

Shadow flicker from wind turbines can occur when a particular combination of weather conditions coincide at specific locations at particular times of the day and year. It usually occurs when the sun is low in the sky and shines on a building or location from behind a rotating wind turbine. This can cause the shadow of the turbine blades to flicker on and off as the turbine blades rotate. The project has been carefully designed to reduce the potential impact of shadow flicker as far as is reasonably possible and the location of each wind turbine has been carefully chosen to reduce the potential impact in relation to shadow flicker.

An assessment of the potential number of hours per year likely to be experienced under exceptional 'worst case' shadow flicker on properties within 2,000m (10-times overall tip height) from the proposed wind turbines has been undertaken.

13.2 Methodology

This assessment has been carried out in accordance with all statutory guidelines and uses techniques which are recognised as best practice by the relevant environmental health organisations.

WindPro software, a detailed computer software model which can estimate the likely

occurrence of shadow flicker, was used to predict the likely effect of the project. The prediction model assesses the likelihood of shadow flicker occurring at receptor locations relative to the wind turbine locations and with long term average sunshine hours.

13.3 Description of Likely Effects

As the proposed wind turbines will not be operational during the construction phase, shadow flicker will not occur.

The 'worst case' model results indicate that 23 no. receptors are predicted to experience shadow flicker in excess of 30-minutes per day. However, this calculation is a 'worst case' scenario and is not representative of likely shadow flicker. The 'worst case' scenario can only occur under a rare and specific combination of circumstances occurring simultaneously i.e. when the sun is at a certain position in the sky, the sun is shining, the turbines rotor is rotating and rotating parallel (directly or indirectly) to the shadow receptor.

The 'expected' results over the course of a year; which, while also being likely to significantly overestimate the actual shadow flicker impact and are a more realistic prediction of likely shadow flicker levels; are also presented. None of the 106 no. receptors surveyed is likely (expected) to experience shadow flicker in excess of 30-hours per annum.

The highest prediction of shadow flicker effects relates to H057, which is predicted to experience 25.15 hours per year. The next highest prediction of shadow flicker effects relates to H084, which is predicted to experience 14.30 hours per year. Notably, each of these two receptors are economically involved in the project. All remaining receptors are likely to experience less than 14-hours of shadow flicker per year, with 45 no. dwellings likely to experience no shadow flicker at all.

Shadow flicker levels are marginally increased at a number of receptors as a result of the inclusion, in the assessment, of the Derrinlough Wind Farm, Cloghan Wind Farm and Meenwaun Wind Farm; it is noted that there are no additional exceedances of the 30-minute per day criterion while all dwellings remain below the applicable annual limit of 30-hours. Under 'expected' cumulative conditions, the greatest level of shadow flicker (hours per year) remains 25:15 at H057; while 34 no. dwellings are expected to experience no shadow flicker at all.

13.4 Mitigation Measures

The following mitigation measures relate solely to the Cush Wind Farm and are not applicable to the Derrinlough Wind Farm, Cloghan Wind Farm and Meenwaun Wind Farm; however, it is assumed that these wind farms will implement similar measures.

As there is no likelihood of effects during the construction phase, no mitigation measures or monitoring proposals are required, or proposed.

The likelihood of shadow flicker effects have been minimised, and avoided where possible, through the design process and assessment of project alternatives. However; shadow flicker effects remain, as discussed above.

The wind turbines will each be fitted with shadow flicker curtailment software, inherent to their design, to facilitate their shut down as required. If the sun is shining, the software will turn off the turbine at the predetermined times when shadow flicker is predicted to occur based on the prediction model. This approach will be implemented, as necessary, to ensure that actual levels of shadow flicker do not

exceed either of the relevant limits, i.e. 30-minutes per day or 30-hours per year at any of the receptors located within 10-times tip height (2,000m) of a proposed turbine.

The level of turbine curtailment required to ensure that shadow flicker limit values are not exceeded will have an imperceptible effect on the overall renewable energy output of the project.

Within 12-months of the commencement of commercial operations, a shadow flicker survey will be undertaken by a suitably qualified person to verify the results of the prediction model and to ensure the effective operation of the curtailment software. Monitoring will be undertaken when and where the model predicts shadow flicker is expected to occur.

13.5 Overall Findings

This chapter has assessed the likelihood of shadow flicker effects at all dwellings (106no.) located within 10-times the overall tip height (2,000m) of the proposed wind turbines using a shadow flicker model. Shadow flicker is a rare phenomenon and can only occur during the infrequent coincidence of a number of specific, variable meteorological and geographic factors. The shadow flicker model is also based on a number of precautionary assumptions which significantly overestimate the likely shadow flicker impact at any receptor.

There is no likelihood of any effects during the construction or decommissioning phases as the proposed wind turbines will not be operational. Similarly, secondary developments associated with the wind farm, such as the proposed grid connection infrastructure and haul route alteration works, are not capable of causing shadow flicker.

During the operation phase, 23 no. receptors are predicted to exceed the 30-minutes per day criterion in a 'worst case' modelled scenario. Under the 'expected' shadow flicker assessment model, none of the receptors are predicted to exceed the 30-hours per year criterion, either singularly (on the basis of assessment of the project alone) or cumulatively.

During the operational phase, technological mitigation measures will be implemented to shut down the wind turbines at predetermined times when shadow flicker exposure could potentially breach the 30-minutes per day limit (based on meteorological conditions). These measures will ensure that no dwelling/receptor will experience levels of shadow flicker which exceeds the limits set out in current guidance and, therefore, it is concluded that the project will not result in any likely significant shadow flicker effects, either individually or in combination with other existing, permitted or proposed developments.

14.0 Material Assets

14.1 Transport & Access

14.1.1 Background

The assessment provides a detailed description of the haul route to be followed from the chosen port facility to the subject site, including the traffic management and improvement works required along the road network and at junctions and roundabouts. It also details the breakdown and schedule of the number and size of vehicles associated with the construction, operation and decommissioning phases of the development. The effect of increased construction traffic on the local road network has also been assessed.

14.1.2 Methodology

This assessment used the following method, further details of which are provided in the following sections:-

- Legislation and guidance review;
- Desk study, including review of available maps and published information;
- Site walkover, including review of road network to be used;
- Evaluation of likely effects;
- Evaluation of the significance of these effects; and
- Identification of measures to avoid and mitigate any likely effects.

14.1.3 Description of Likely Effects

It is assessed that, during the construction phase, there will be a temporary increase in traffic flows on the local road network due to vehicles carrying turbine components and construction materials. A number of oversized loads will be required to carry the long blades, towers and heavy turbine components to the site and will necessitate temporary alteration works along the project haul route.

Once these components are delivered and installed, traffic entering the site will be substantially reduced, with maintenance vehicles visiting the site only intermittently. The haulage route and traffic assessment concludes that the local road network will be able to accommodate the additional traffic volume associated with the construction of the wind farm. A Traffic Management Plan, to be agreed with the local authority, will also help to minimise the impact on local roads and traffic and to provide for the safety of all road users.

14.1.4 Mitigation Measures

A series of mitigation measures have been proposed to reduce the level of potential impact associated with the project on Transport and Access. The project has generally been assessed as having the likelihood to result in likely, negative, of short-term duration and ranging between slight and moderate. Following the implementation of mitigation measures, the likely final effects have been assessed as imperceptible-to-slight, direct, indirect, negative (temporary), and positive (long-term).

14.1.5 Overall Findings

Overall, it has been identified that there is no likelihood of significant effects on transport and access which could arise as a result of the construction, operation or decommissioning of the project either individually or in combination with other existing, permitted or proposed developments.

14.2 Aviation

14.2.1 Background

This section assesses the likelihood of effects on aviation arising from the construction, operation or decommissioning of the project.

14.2.2 Methodology

The assessment involved consultation with various stakeholders including the Irish Aviation Authority (IAA) and Department of Defence. In addition, publications issued by the IAA and the Department were reviewed to determine if the project site was assessed as being of significance or if significant effects were likely. A desktop study was also undertaken to determine the presence of aerodromes or airstrips within 20km

of the wind farm site.

This assessment has also had regard to the *Draft Air Corps Wind Farm/Tall Structures Position Paper* (August 2014) which sets out the Air Corps position on the appropriate siting and management of wind farms and tall structures. This assessment includes a detailed review of this position paper, a comparison of the project site with identified 'Danger Areas', 'Restricted Areas' and 'Low Level Flying Areas'.

14.2.3 Description of Likely Effects

Due to the general 'low level' of activity during the construction phase, it is assessed that there will be no likely impact on aviation. During the erection of wind turbines, cranes will be fitted with appropriate aviation warning lighting to alert pilots to the presence of tall structures.

Following the completion of the construction phase, no significant effects are assessed as likely to occur. The installation of aviation warning lighting is inherent to the project design; and its operation during the operational phase will ensure that any civil and military aviation activities occurring then the vicinity of the project are sufficiently aware of the presence of the wind turbines.

The project site is not located within any of the 'Danger' or 'Restricted' areas as identified at Annex A, B or C of the *Draft Air Corps Wind Farm/Tall Structures Position Paper*. The project site is located within a 'Military Operating' area (MOA 5) as defined in the Position Paper and per Section 2.b(2)(d) proposals for objects exceeding 45m in height above ground level must be referred to the Irish Air Corps for further assessment. As identified above, the Department of Defence (Irish Air Corps) was consulted but a response has not been received.

14.2.4 Mitigation Measures

The wind turbines will, as requested by the IAA in its consultation response, be fitted with aviation warning lighting in accordance with the specification to be agreed with the IAA and the Planning Authority.

14.2.5 Overall Findings

This assessment concludes that the project is unlikely to result in any significant effect on aviation. The project site is not located within an area identified as being of particular sensitivity or importance in the *Draft Air Corps Wind Farm/Tall Structures Position Paper* on military aviation or located close to any civilian aerodrome, airfield or airport. Accordingly, with the installation of appropriate aviation warning lighting, no significant effects are assessed as likely to occur. Therefore, it is assessed that significant effects on aviation are unlikely to arise as a result of the project, either individually or in combination with other existing, permitted or proposed developments.

14.3 Telecommunications

14.3.1 Background

This section assesses the likely effects of the project upon a range of communications infrastructure, including telecommunication networks, broadcast radio and television and fixed infrastructure such as telecommunication masts and the .

14.3.2 Methodology

The methodology followed to assess the likelihood of significant effects on telecommunication networks consisted of desk based research and consultation with

various telecommunication companies and relevant authorities. It was established that the project site was located within 5km of the Irish Low Frequency Array (I-LOFAR) system. The majority of the proposed wind farm (turbines) are located further than 5km from the closest point of the I-LOFAR, however 1 no. turbine (Turbine T2) is located just under 5km (c. 4.95km) away. I-LOFAR consists of 12 international stations in Germany, Poland, France, UK, Sweden and Ireland, with additional stations and a central hub in The Netherlands, operated by the Netherlands Institute for Radio Astronomy. I-LOFAR is the Irish addition to this network and is located within the grounds of Birr Castle, immediately west of Birr, County Offaly. As the project is located within 5km of I-LOFAR, consultation was also carried out with the I-LOFAR consortium.

14.3.3 Description of Likely Effects

No significant effects are assessed as likely to occur during the construction phase.

The operation of wind turbines can affect electromagnetic transmissions in two ways: by blocking or deflecting line of sight radio or microwave links or by 'scattering' transmission signals. However, given the findings of the desk based survey and consultation process, significant levels of blocking, deflecting or scattering are not assessed as likely to arise.

2rn (RTE Transmission Network) advised that there is potential for localised interference to the terrestrial television network. 2rn have requested that the Developer enter into a protocol arrangement to ensure the appropriate remediation of any adverse effects which may be experienced.

The early-stage consultation with telecommunication operators in the vicinity of the project site has confirmed that services are unlikely to be affected.

Consequently, in the absence of mitigation, it is assessed that the project is unlikely to result in any significant effect on telecommunications in the area.

Whilst a consultation response was not received from I-LOFAR, owing to the location of the system within 5km of the project site, it was considered appropriate to commission a specific Radio Telescope Impact Assessment (RTIA) in order to ascertain the significance and likelihood of effect on the frequency array. The applicant commissioned Pager Power; a specialist consultancy based in Suffolk, U.K; to carry out the RTIA and the report was sent to I-LOFAR in May 2022 for comment. To date there has been no response from I-LOFAR.

Based on assessment of these primary mechanisms within the RTIA, the proposed development is not predicted as likely to have a significant impact on I-LOFAR.

14.3.4 Mitigation Measures

As significant effects are not assessed as likely to occur during the construction phase, no specific mitigation measures are proposed.

In its consultation response, 2rn recommended that a protocol agreement be entered into to ensure that any complaints received from members of the public are appropriately managed, addressed, and remediated. This is a standard protocol for wind energy developments and has been agreed between the parties.

While assessed to be unlikely, if significant signal interference in any form is identified and is directly attributed to the project, appropriate remedial measures will immediately be undertaken. A range of technical measures are available to mitigate any instances of interference including signal amplifiers, active deflectors and relay transmitters, repeater stations, booster units, realignment of domestic aerials,

installation of higher quality aerials and the installation of suppression equipment. Remedial works will be promptly undertaken, at the Developer's expense, to ensure uninterrupted telecommunication, broadcasting and mobile phone service provision.

14.3.5 Overall Findings

It can be concluded that, on the basis of this desktop assessment, the extensive consultation with stakeholders, and the Radio Telescope Impact Assessment, the project will not result in any likely significant effects on the telecommunications network. The implementation of mitigation measures will ensure that possible identified effects on telecommunication signals or links are appropriately managed and mitigated. Therefore, it is assessed that significant effects on telecommunications are unlikely to occur as a result of the project, either individually or in combination with other existing, permitted or proposed developments.

14.4 Resources & Utility Infrastructure

14.4.1 Background

This section provides details of the likelihood of significant effects or interactions with existing renewable and non-renewable resources and existing utility infrastructure; including existing or permitted wind farms, quarries, mining operations and utility infrastructure (electricity lines and phone lines).

14.4.2 Methodology

The methodology followed in this assessment involved a desk based study to identify resources and utility infrastructure which could be affected by the project followed by an evaluation, based on experience, as to whether these resources were likely to be affected.

14.4.3 Description of Likely Effects

The construction phase of the project is not likely to have any significant effects on existing resources or utility infrastructure. The construction phase will not restrict the export of energy generated from other sources nor will it impact upon existing utility services. While there is a possibility interaction with utility services (e.g. accidental collision with overhead wires during the construction phase), this can be mitigated through good construction practices.

The construction phase will result in the extraction of non-renewable resources in the form of stone and gravel for the construction of access tracks and concrete for turbine foundations, building foundations and electrical equipment plinths.

The operational phase of the project will not result in any effect on existing utility infrastructure or renewable or non-renewable resources. The connection of the project to the national grid will strengthen the electricity network infrastructure in the wider region.

14.4.4 Mitigation Measures

No specific mitigation measures are proposed or required during the construction or operational phases.

14.4.5 Overall Findings

This assessment concludes that the project is unlikely to result in any significant adverse effect on renewable and non-renewable resources or on utilities infrastructure. The operation of the project will bring about a benefit in terms of electricity generated from renewable sources and a strengthening of national electricity grid infrastructure

in the wider region of the project site. This assessment similarly concludes that the project is unlikely to result in any significant adverse cumulative effects in combination with existing, permitted or proposed developments.

15 Interactions of the Foregoing

All environmental factors are interrelated to some degree. The assessment of these interactions is an important requirement of the environmental impact assessment process. Having assessed the interaction of likely effects during the construction and operational phases, the likely interactions are not assessed as likely to result in any effects that could magnify effects through the interaction or accumulation of effects.

16 Summary of Effects

This Non-Technical Summary has outlined, in summary format, the findings of the EIAR for the project. Full details are set out in the EIAR and its accompanying technical appendices.

The EIAR has assessed that any likely adverse effects of the project, and their interactions, can be managed and mitigated and that there are lasting social and environmental benefits as a result of the project. Whilst the project will have some minor adverse residual effects on the local environment, these will be addressed through mitigation measures, good management and proposed construction techniques and are not assessed as likely to be significant.

The project will make a positive contribution to sustainable energy generation in Ireland and will also help diversify and sustain the rural economy through construction, as well as operation and maintenance activities. Overall, the combined effects which have been assessed within this EIAR demonstrate that the project will not result in a likely significant adverse effect on the environment.