

Vistakon Ireland

Vistakon Wind Energy Project

Environmental Impact Statement

Issue | 18 December 2013

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List of Contributors

This Environmental Impact Statement (EIS) is based on an assessment, undertaken by Arup, of the environmental effects of the proposed wind energy project. The Arup study team drew on in-house resources including environmental, geotechnical, civil, traffic, infrastructure, air quality and climate, energy specialists and graphics.

Arup Sub-consultants

The following sub-consultants, working in accordance with specifications prepared by Arup, contributed to the preparation of this EIS:

Moore Group - Archaeological, Architectural and Cultural Heritage

Moore Group - Flora and Fauna

Aardwolf Wildlife Surveys – Bat survey and assessment

Brady Shipman Martin – Landscape and Visual, including the preparation of photomontages.

Preface

In December 2011, Vistakon applied for planning permission for a single wind turbine adjacent to their site in the National Technology Park. On appeal, An Bord Pleanála refused planning permission on the following grounds only:

'1. Notwithstanding the location of the site within the National Technology Park, Castletroy, it is considered that, by reason of its overall height and scale, the proposed wind turbine including rotor blades would constitute an excessively visually obtrusive feature in the landscape, which is characterised by low lying land and generally low rise development, when viewed from a wide range of vantage points in the surrounding area. The proposed development would, therefore, seriously injure the visual amenities of the area and be contrary to the proper planning and sustainable development of the area.'

'2. On the basis of the submissions made in connection with the planning application and the appeal the Board is not satisfied that the proposed development would not result in undue adverse impact on the amenities of nearby dwellings by reason of shadow flicker. It is considered that the proposed development would, therefore, seriously injure the residential amenities of dwellings in the vicinity of the site and be contrary to the proper planning and sustainable development of the area.'

The wind turbine that is now proposed will have a maximum hub height of 80m, which is 20% lower than the 100m turbine proposed in the 2011 application. The rotor diameter is also reduced by at least 20%, from 50.5m to 40m. By substantially reducing the height and scale of the turbine, Vistakon has addressed An Bord Pleanála's first reason for refusal.

The reduced size of the turbine described in this EIS also means that the predicted extent of shadow flicker effects is reduced. Notwithstanding the conclusions in the revised shadow flicker assessment included in this EIS, that no significant effects will be experienced at sensitive receptors, Vistakon will incorporate a shadow flicker control module in the turbine, to allow the turbine to be switched off for the duration of predicted impacts, and to ensure that best practice in the operation of the turbine is achieved. This will ensure compliance with existing guidelines, and in addition, the draft revisions to the Department of the Environment, Community and Local Government guidelines will also be complied with. In this way, Vistakon has eliminated the risk of undue adverse impacts on the amenities of nearby dwellings by reason of shadow flicker, and therefore has addressed An Bord Pleanála's second reason for refusal.

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Non-Technical Summary

Introduction

Johnson and Johnson Vision Care Ireland, trading as Vistakon Ireland Limited, (referred to as Vistakon in the EIS and this non-technical summary), intends to construct a wind turbine of up to 3MW and associated infrastructure on land adjacent to the northwest boundary of its existing manufacturing facility at the National Technology Park, Rivers, County Limerick. The wind turbine will generate power for the Vistakon facility.

Vistakon is a subsidiary of Johnson and Johnson Vision Care, Inc. Established in 1995, the Limerick facility is the only Vistakon manufacturing site outside the U.S. Globally, it is the largest producer of disposable contact lenses. The facility at Limerick is the most advanced in the contact lens industry and up to 1,000 people are employed on site.

All products are manufactured to rigorous specifications in a cleanroom environment. The production process is fully automated, and from start to finish the lens is untouched by hand. There are stringent quality and hygiene checks throughout and the plant's systems are run in accordance with ISO and FDA regulations.

The facility has over 30 advanced production lines to manufacture disposable contact lenses for the European and Japanese Markets. One-day, fortnightly, monthly and colour lenses are manufactured in the facility and shipped worldwide and utilize leading edge technologies in moulding, robotics, vision system and sterilization processes.

Vistakon operates under Environmental Protection Integrated Pollution Prevention Control Licence Register Number P0818-02.

The site, on which the proposed wind turbine will be situated, is currently in the ownership of Shannon Development, and is approximately 5.1 hectares in extent. The site location is shown in **Figure NTS1** and the site layout in **Figure NTS2**. Consent has been given by Shannon Development to apply for planning permission for the wind turbine on the site. Vistakon plans to acquire the site from Shannon Development.

Arup has been commissioned by Vistakon to prepare an Environmental Impact Statement for the proposed development.

Vistakon Environmental Health and Safety Policy

Vistakon implements an Environmental Health and Safety policy and is committed to protecting the health and safety of its employees, contractors and visitors and preserving the environment. It is Vistakon's goal to provide an injury and illness free workplace, prevent pollution and achieve healthy lifestyles.

Since operations began in 1996, there has been a very strong focus on continuously improving environmental performance. In 1999, the Vistakon facility at Limerick became the first contact lens manufacturing plant in the world to receive the ISO 14001 environmental management standard. It has been a global leader in

developing innovative processes and technologies resulting in significant environmental performance improvements and efficiencies. Vistakon has achieved very ambitious annual targets on carbon reduction and energy efficiency.

Site and Scheme Description

The site of the proposed wind turbine is adjacent to Plassey Park Road, within the National Technology Park, Limerick, which is situated approximately 5 kilometres to the east of Limerick City. The existing Vistakon facility is located to the south east of the site. The site, on which the proposed wind turbine will be situated, is approximately 5.1 hectares in extent. The site of the proposed turbine comprises bare ground, wet grassland, scrub and mixed broadleaved woodland and tree lines. It is low-lying and generally fairly level.

The proposed scheme comprises the construction and operation of a wind turbine of up to 3MW, and associated infrastructure. The proposed new wind turbine will provide power for Vistakon's operations on site.

The main elements of the proposed development will be:

- A wind turbine of up to 3MW, hub height of up to 80m and rotor radius of up to 40m.
- Concrete base.
- Transformer.
- Boundary fence.
- Underground high voltage power lines on site.
- Crane hard-standing.
- Access track.

The turbine will be of a typical modern design incorporating a tubular tower and three blades attached to a nacelle or hub housing the generator, gearbox and other operating equipment. The transformer will be housed within or adjacent to the turbine. The colour of the proposed turbine will be an off-white or pale grey colour with a matt finish. **Figure NTS3** shows a typical wind turbine of the type proposed by Vistakon.

The turbine foundation will comprise a reinforced concrete pad and will require piling.

An area of hardstanding will be required adjacent to the turbine foundation, to provide a stable base on which to lay down turbine components ready for assembly and erection and to site the two cranes necessary to lift the tower sections, nacelle and rotor into place. A new access track will be required on the site, to link the wind turbine, the construction compound and the existing site road infrastructure. The access road and crane pad will remain in situ following construction, in order to facilitate any future maintenance operations which may require cranes.

Underground cables will link the turbine to the Vistakon facility.

The turbine will be purchased from a reputable European turbine supplier. The turbine will be designed, manufactured and installed as per the International Electrotechnical Commission (IEC) standard IEC 61400 on *Wind Turbine*

Generator Systems. The turbine design and installation will be subject to third party verification. The turbine will have fire detection and suppression systems and lightning protection systems. The turbine blades will have automated ice detection and blade heating systems, which will be activated in cold weather conditions.

The turbine is projected to have an operating lifetime of 25 years. The wind turbine operations will be controlled from the Vistakon facility and will be operated and maintained in accordance with the relevant Health and Safety regulations.

The turbine will operate at all times when wind speeds are suitable, with the exception of downtime for maintenance.

Construction Activities

The duration of the construction period for the wind project is expected to be six months. It is anticipated that up to 20 construction workers will be employed on site at any one time. The main elements of the construction process will comprise site preparation, excavation and piling for the construction of the turbine foundation, excavation of trenches and laying of underground cables, delivery to site and erection of wind turbine, connection to on-site distribution and signal cables, and commissioning of site equipment. A temporary construction compound will be required. This will be located within the existing Vistakon facility. A crane hard standing will be constructed and will be located adjacent to the turbine base. A new access track will be constructed. Access to the site for construction vehicles delivering turbine components will be from the Plassey Park Road via an existing access point.

Construction traffic will comprise heavy goods vehicles, workforce traffic and general site traffic. Mobile cranes will be used to erect the turbine. Abnormal load vehicles will be required for the delivery of the wind turbine components. The construction phase will involve approximately 1000 Heavy Goods Vehicle trips over a 6 month period. This will equate to an average of six Heavy Goods Vehicles trips per day, with a peak of between 30 and 40 trips per day during certain construction activities, i.e. delivery of ready mix concrete. Construction staff will generate a peak of approximately 60 car/light goods vehicle trips per day. A construction management plan will be implemented and will include management of construction traffic. The impact of construction traffic on the local road network will be very slight.

Every reasonable effort will be made to ensure that any detrimental environmental effects will be minimised during the construction phase of the project. A construction environmental management plan will be prepared and implemented with the objective of keeping disruption and nuisance to a minimum. The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off or groundwater. Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery, and finally disposal to landfill. It is anticipated that 50 per cent of soil excavated for the turbine foundation may be reused to backfill over the lower turbine pad. The remaining subsoil will be re-used on site.

It is anticipated that, with proper management, the construction phase of the development will not have significant or long-term cumulative negative impacts.

Environmental Impact Statement

The Environmental Impact Statement, of which this is the non-technical summary, has been prepared to provide information on potential environmental impacts of the proposed turbine, and to propose mitigation measures to reduce the residual impacts of the proposed development. The Environmental Impact Statement will be submitted with the planning application for the proposed development.

The Environmental Impact Statement has been prepared in accordance with the relevant provisions set out in the Planning and Development Regulations 2001, as amended. Due regard has been given to guidelines and advice notes for the preparation of environmental impact statements published by the Environmental Protection Agency. The Environmental Impact Statement was also prepared with due regard to the 2006 Department of the Environment, Heritage and Local Government guidelines *Wind Farm Planning Guidelines*, with the 2008 Irish Wind Energy Association and Sustainable Energy Ireland guidelines *Best Practice Guidelines for Windfarms* and the 2011 Irish Wind Energy Association *Best Practice Guidelines for the Irish Wind Industry*.

Need for the Scheme

In recent years, Ireland has had among the highest energy costs in Europe. This places plants such as Vistakon at a disadvantage in European and globally in terms of cost competitiveness. Vistakon urgently needs to reduce its energy costs.

The proposed turbine will reduce the cost of operations for the facility, making it more cost efficient and will help it to sustain operations in the Limerick area.

In addition to the reduction in energy costs for the Limerick plant, the proposed wind energy project will reduce the uncertainty associated with volatility in the cost of electricity.

Vistakon's dependence on energy generated by the combustion of fossil fuels will be reduced as a result of the proposed turbine. The proposed development will contribute to helping Ireland to meet EU targets for reducing emissions of greenhouse gases, increasing the use of renewable energy and improving energy efficiency.

Alternatives Considered

Vistakon continuously strives to reduce its energy needs and become more energy efficient. Vistakon's electricity usage per lens produced was reduced by 30% during the period 2007-2010. 50% of that electricity used was sourced from renewable sources.

Vistakon has already installed sustainable systems for power generation and cooling. These are a natural gas-fired combined cooling and power plant and geothermal cooling. These were installed as part of Vistakon's on-going energy efficiency and carbon dioxide reduction programmes.

Alternative Sites

Sites outside the immediate vicinity of the Vistakon site were not considered for the location of the proposed wind turbine, as these are precluded by the current electricity regulatory framework.

During the selection process for the optimal location of the proposed wind turbine within the Vistakon site, the optimisation of wind energy opportunities on the site was taken into consideration within environmental, planning, engineering, health and safety, future development and commercial constraints. Proposed locations for the wind turbine were reviewed in the context of these constraints. The turbine location identified is based on an optimised technical, economic and environmental layout. Unforeseen ground conditions may require minor movements, referred to as micro-siting, of the position of the turbine. Any micro-siting of the proposed turbine would be agreed with Limerick County Council, prior to commencement of construction.

Turbine Height

A range of turbine heights were considered. Wind turbines come in a range of sizes from up to 12m high micro-turbines, of less than 7kW rated power, to up to 135m hub height turbines of 5+MW rated power. Vistakon's annual imported power requirement, with the combined cooling and power plant in operation, is approximately 80GWh. Micro turbines were not considered as they would make a negligible contribution to Vistakon's power requirements. Furthermore, small wind turbines are much more expensive per kW installed than large ones, primarily because controls, electrical connections and maintenance are a much higher proportion of the capital value of the system.

Wind speed generally increases with height. The power in the wind increases with the cube of the wind speed, so therefore taller turbines, benefiting from the increased wind speed, will produce much more power.

In a built up area, such as the National Technology Park, the presence of buildings and other structures in proximity to the turbine will result in decreased wind speeds at low level and increased levels of turbulence. The wind exposure improves with increased elevation, and significant improvements in energy yield can be achieved by locating the turbine hub above the most turbulent surface wind layers.

Increasing the hub height also allows for increased 'swept area'. This is the area of the circle swept out by the turbine rotors. The amount of energy extracted from the wind is directly proportional to the swept area.

In summary, the power production of a wind turbine increases dramatically with height. In pre-planning discussions with Limerick County Council, the optimum height that was considered to be acceptable was a hub height of 80 metres.

Visual Impact of Different Turbine Heights

A visual impact study of different turbine heights, up to 100m, was undertaken. Zone of theoretical visibility maps were prepared for the different height turbines. These are maps which show the zone around the turbine in which it is theoretically visible.

Commercial scale wind turbines are large scale structures that are distinctive in almost any landscape and will be visible over a wide area. This was clearly demonstrated in the comparative zone of theoretical visibility maps, prepared in the course of the study.

Planning and Policy Context

International, national and local development policies support the appropriate development of wind energy. Subject to normal planning and sustainable development criteria, the proposed project will be in compliance with these policies.

The Limerick County Development Plan has a specific policy objective in relation to projects such as Vistakon's proposal, the development of an individual wind turbine on an industrial site.

Objective IN O59: Individual Wind Turbines (Chapter 8 – Page 33, Limerick County Development Plan):

"The Council will consider applications for individual wind turbines in areas designated not suitable for wind energy on Map 8.4 on industrial or education zoned lands and which are related to an existing development primarily to serve the energy needs of the applicant. Such applications will need to demonstrate that they will not detract from the amenity value of nearby residential areas and will be subject, where necessary, to the provisions of Article 6 of the Habitats Directive which may require appropriate assessment of such developments. Such applications will also be subject to normal planning criteria."

The proposed Vistakon turbine complies with this objective. The EIS demonstrates that the turbine will not detract from the amenity of nearby residential areas and an appropriate assessment screening report has been prepared.

Human Beings

Employment will be directly provided for approximately 20 workers during the construction of the wind turbine. There will also be associated secondary employment and economic activity associated with the construction of the proposed development.

The increase in traffic, generated by the construction of the wind turbine will not be significant.

Shadow flicker is the flickering shadow cast by the rotating blades of a wind turbine when the sun is in particular directions. Wind turbines can cause shadow flicker at the windows of nearby houses, when a specific combination of conditions coincides. A shadow flicker assessment has been undertaken during the preparation of the EIS. No significant shadow flicker effects are predicted arising from the operation of the proposed turbine. Vistakon commits to taking all necessary measures, including switching off the wind turbine if necessary, for the duration of

any identified period of time when shadow flicker is experienced at a sensitive location.

It is envisaged there will be no recreational amenity impacts as a result of the proposed wind turbine.

There will be no significant impact on land use, property values, agriculture or tourism as a result of the proposed development.

The potential noise, air and visual impacts are addressed below.

Overall, other than visual impacts from a limited number of viewpoints, there will be no significant, long term, adverse impacts on human beings as a result of the construction and operation of the proposed wind turbine. There will be no significant cumulative impacts on human beings.

Flora and Fauna

The impacts of the proposed wind turbine on flora and fauna were assessed.

The site of the proposed wind turbine is not covered by any nature conservation designation.

Fourteen designated nature conservation areas occur within 15km of the site of the proposed development, six of which are Natura 2000 sites, and eight of which are proposed Natural Heritage Areas. Natura 2000 sites are important habitats for flora and fauna which are protected under European Directives for the conservation of habitats and species. The closest Natura 2000 site is the Lower River Shannon candidate Special Area of Conservation which includes the main channel of the River Shannon, located approximately 150m to the northwest of the turbine site; and the Mulkear River, which flows at a distance of approximately 250m to the north. The remaining Natura 2000 sites are located in excess of nine kilometres from the site of the proposed turbine.

Due to the proximity of the proposed turbine to the Lower River Shannon Special Area of Conservation, an Appropriate Assessment screening report was prepared to assess the potential for the proposed development to impact negatively on the integrity of the Special Area of Conservation. The Appropriate Assessment screening report concluded that there will be no impact on the integrity of the Lower River Shannon candidate Special Area of Conservation. There will be no impact on other designated sites given their distance of removal and lack of biological connectivity.

A bat survey of the site was undertaken. Of the ten recorded bat species in Ireland, eight have been recorded within a ten kilometre radius of the site. Foraging bat species detected during the bat survey were common pipistrelle and soprano pipistrelle. Leisler's bat was detected flying high over the site on three occasions. Daubenton's bat was present on the nearby Mulkear River but was not detected on-site. No bat roosts were recorded on site. The nearest known bat roost (soprano pipistrelle) is six kilometres northwest of the site.

Mitigation measures have been incorporated into the project design, to minimise impacts on flora and fauna. In addition, best practice will be implemented during all construction activities to prevent potential impacts to surface waters. To ensure a safe distance from the turbine for low-flying bats along hedgerows, a vegetation-

free buffer zone of 50m minimum from the nearest vegetation to the turbine rotors will be cleared. This will reduce the risk of collision and/or barotrauma to species that mainly fly low along hedgerows, tree lines and forest edge such as lesser horseshoe, brown long-eared and pipistrelle bats. Apart from this clearance in the immediate vicinity of the turbine, trees and treelines will be retained where possible.

The impact on local bat populations from the operation of the proposed turbine is expected to be minor. All bat species confirmed or expected on, or near the study site, are expected to persist. Vistakon will facilitate the monitoring of the site as part of any future wind turbine bat mortality study.

With the proposed mitigation measures implemented, there will be no significant impact on flora and fauna in the vicinity of the proposed wind turbine.

Landscape and Visual

The proposed development was assessed with regard to its visual impact, the extent to which it will be seen, and its impact on the existing landscape character.

Once installed, the physical scale and movement of the turbine will give rise to significant change in the immediate landscape. However, the turbine has been located to minimise visual and other environmental impacts. In addition, the turbine will be painted in an off-white or grey colour with a matt finish to help it blend in effectively with typical Irish skies. Lighting for aviation safety, will comprise a small warning light at the top of the nacelle or turbine hub.

In general, construction impacts will be temporary, negative and localised in nature.

During the operational stage, landscape and visual impacts will mainly arise from the physical built presence of the turbine and the movement of the blades. The wind turbine will be visible over a wide area of the surrounding landscape. The impacts of the proposed turbine on views will range from slight, through moderate, to significant, depending on the viewpoint, distance and intervening topography. During operation, the proposed turbine will impart a moderate to significant impact or change to the landscape character area in its local setting. Refer to **Figure NTS4** for typical photomontage views of the proposed turbine.

The cumulative visual impacts of the proposed turbine in conjunction with other visual elements in the neighbourhood and the proposed windfarm at Castlewaller, approximately thirteen kilometres from the site, were also assessed. Cumulative impacts on views will range from no impact to slight.

There will be a slight increase in the overall cumulative impact on landscape character where views of Castlewaller are possible from the local landscape.

The impact of the wind turbine within the landscape will very much depend on by whom it is experienced and how.

Noise and Vibration

The environmental noise and vibration impact assessment of the construction and operation of the proposed wind turbine was undertaken. The impact of the proposed wind turbine is assessed in accordance with criteria outlined in the Environmental Protection Agency *Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites*.

Compliance with the Vistakon Integrated Pollution Prevention and Control noise limits is assessed based on the cumulative impact of wind turbine noise and existing facility noise.

Noise propagation modelling was undertaken as part of the noise impact assessment. The noise impact of the construction phase of the proposed wind turbine on the nearest houses will be negligible.

The highest predicted noise levels as a result of the operation of the proposed turbine and also the cumulative wind turbine noise levels are within the Department of Environment Heritage and Local Government limit values, including the more onerous limits outlined in the draft revision of the guidelines.

In terms of audible wind turbine noise, the noise impact at the residential noise sensitive locations will be negligible.

Piling may be required for the foundation of the turbine, and this will be managed to minimise the temporary noise and vibration impacts arising from this work. Whilst the construction phase is not expected to give rise to significant noise and vibration impacts, as a matter of good practice, reference will be made to British Standard BS5228 which offers detailed guidance on the control of noise and vibration from demolition and construction activities. No significant vibration impacts are predicted arising from either the construction or operation of the proposed development.

As all predicted noise levels comply with the relevant limits, no mitigation measures are proposed for the operational phase of the development. Design measures to minimise the noise impact include selection of a wind turbine with low sound power emissions and location of the wind turbine to ensure a distance in excess of five hundred metres to the nearest noise sensitive location.

Air Quality and Climate

There will be minor emissions to the atmosphere during the construction phase. Containment and dust suppression techniques during construction will be sufficient to ensure that any off site impacts are negligible. Therefore, it is not envisaged that the turbine will have any significant adverse impacts on ambient air quality or climate.

Operation of the turbine will displace electricity generation using fossil fuels. Fossil fuel combustion results in emissions of oxides of nitrogen from all fuel sources and sulphur dioxide and particulates emissions from liquid and solid fuels. These emissions will be reduced, resulting in improved air quality at the power stations. Thus, during operation, long-term beneficial impacts are predicted for both air quality and climate.

Soils, Geology, Surface Water and Groundwater

The bedrock geology underlying the site comprises Carboniferous Limestones. No karst solution features have been mapped by the Geological Survey of Ireland on the site. However, karst features may be present due to the nature of the bedrock.

Geotechnical investigations in the general area indicate that soils in the study area are characterised by made ground over limestone derived glacial till. No sites of geological interest are located within the site of the proposed turbine or within ten kilometres of the site.

There are no watercourses or drainage ditches within or adjacent to the site of the proposed wind turbine. The Mulkear River is located approximately 250 metres to the north of the site. The main channel of the River Shannon is located approximately 750 metres northwest of the site. There is no possibility that site runoff will flow directly to the Mulkear River or the River Shannon.

The site has been subject to historic flooding events.

Groundwater vulnerability at the site of the proposed turbine is moderate. The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off or groundwater.

Excavation of the foundation of the turbine will involve excavation of approximately 972 cubic metres of spoil, of which 50 per cent may be reused as backfill over the lower pad. It is envisaged that the remaining subsoil will be reused on site for landscaping purposes.

It is considered that overall there will be no significant impacts on soils, geology, surface water or groundwater as a result of the construction and operation of the proposed development.

Material Assets

Existing material assets associated with the site of the proposed development were assessed, projections of resource use were made for the construction and operation of the proposed development, and the impact assessed.

The Irish Aviation Authority (IAA) was consulted in relation to the proposed scheme. It identified the potential for effects on its radar installation at Woodcock Hill, approximately located within 16 kilometres from the site. In response to these concerns, an Aviation Impact Assessment was completed. The Aviation Impact Assessment determined that the proposed wind turbine is likely have a minor impact on the Shannon primary surveillance radar and the Woodcock Hill secondary surveillance radar. The Irish Aviation Authority was consulted in relation to the outcome of the Aviation Impact Assessment. It advised that mitigation measures could be implemented to eliminate any impact on the radar installations.

It is considered that the proposed development will have an overall neutral impact on local settlement and undeveloped land resource. It is anticipated that property values in the Rivers area will not be affected as a result of the construction or operation of the proposed development.

There will be no significant impact on the road infrastructure and traffic as a result of the construction phase of the proposed wind turbine.

The operation of the wind turbine will reduce the consumption of mains electricity at the Vistakon facility. At certain stages, if there is surplus power, it will be exported to the national electricity grid. No significant impact on existing power infrastructure is envisaged.

There will not be a significant impact on the Limerick County Council water supply, as a result of the construction of the proposed development.

There are no known mineral resources located within the site boundary.

Archaeology, Architectural and Cultural Heritage

There are no recorded archaeological sites within the site of the proposed wind turbine development.

There are eleven recorded archaeological sites within 2 kilometres of the site, and which are listed in the Record of Monuments and Places. The nearest recorded site is 210 metres from the site of the proposed turbine. No features of archaeological, architectural or cultural heritage interest were noted during site inspection.

The proposed development will not impact directly on any recorded archaeological site or on any architectural or cultural heritage features.

There will be no significant visual impacts on archaeological, architectural or cultural heritage features as a result of the proposed wind turbine.

Given the extent of the ground disturbance that previously took place on the site of the proposed development, it is unlikely that there are in situ archaeological finds or features present. It is therefore recommended that construction can proceed without further archaeological mitigation. With regard to indirect impacts, it is proposed that the existing tree and hedge line be retained, where feasible, to provide a level of screening from the surrounding areas.

It is always possible that stray finds may be present in material being disturbed on the site. In the event of archaeological material being uncovered such material will be fully resolved to professional standards of archaeological practice (Policy Guidelines on Archaeological Excavation – Department of Arts, Heritage, Gaeltacht and the Islands). The developer is aware of the National Monuments Legislation (1930-1994) which states that in the event of the discovery of archaeological finds or remains, the Department of the Environment, Heritage and Local Government should be notified immediately and that any subsequent investigation should be facilitated and funded by the developer.

There will be no significant residual impacts on the archaeological, architectural or cultural heritage resource as a result of the construction or operation of the proposed wind turbine.

Cumulative Impacts, Other Impacts and Interactions

The wind energy project has been assessed in the context of other developments in the area and with planned wind energy projects which are proposed for the area. For each environmental topic, where the potential for cumulative impacts has been identified, these have been assessed. Similarly where the potential for interactions has been identified, these have been assessed. All potential significant impacts and

interactions are identified and assessed under the heading of the main environmental topic.

Viewing and Purchasing the Environmental Impact statement

The full Environmental Impact Statement, of which this is a non-technical summary, can be viewed and purchased at the offices of the Planning Department, Limerick County Council, County Hall, Dooradoyle, County Limerick.

For inspection purposes only.
Consent of copyright owner required for any other use.

1 Introduction

1.1 Introduction

Johnson and Johnson Vision Care Ireland, trading as Vistakon Ireland Limited, (referred to as Vistakon in this EIS), intends to construct a single autoproducing wind turbine of up to 3MW, and associated infrastructure on land adjacent to the northwest boundary of its existing manufacturing facility, at the National Technology Park, Rivers, County Limerick.

A previous planning application for a single 3MW wind turbine (of hub height up to 100m, and rotor radius of approximately 50.5m), in the same location as the proposed wind turbine, was refused permission by An Bord Pleanála in 2012. Vistakon intends to re-apply for planning permission for a turbine with a reduced hub height of up to 80m and total height of up to 120m, in the same location as in the previous application.

The site, on which the proposed wind turbine will be situated, is currently in the ownership of Shannon Development, and is approximately 5.1 hectares in extent. The site location is shown in **Figure 1.1 Site Location**. Vistakon plans to acquire the site from Shannon Development. Consent has been given by Shannon Development to apply for planning permission for the wind turbine on the site.

Arup has been commissioned by Vistakon to prepare an Environmental Impact Statement for the proposed development.

1.2 Background

Vistakon has already installed sustainable systems for power generation and cooling at its plant at Rivers. These are a natural gas-fired combined cooling and power plant and geothermal cooling. See also **Section 2.3.1**.

The proposed development, a wind energy project, is the next logical step for Vistakon to take in the greening of its energy supply. The proposed wind energy project will improve the cost competitiveness of the Vistakon facility and will further reduce its CO₂ footprint.

The turbine will reduce Vistakon's reliance on electricity consumed from the national grid. In addition, the project will lead to a reduction in the cost of operations and will result in an improvement in the environmental performance of the Vistakon facility.

1.3 Vistakon Profile

Vistakon is a subsidiary of Johnson and Johnson Vision Care, Inc. Established in 1995, the Limerick facility is the only Vistakon manufacturing site outside the U.S. Globally, it is the largest producer of disposable contact lenses. The facility at Limerick is the most advanced in the contact lens industry and up to 1,000 people are employed on site.

All products are manufactured to rigorous parameter specification within a class 100,000 cleanroom environment. The production process is fully automated, and from start to finish the lens is untouched by hand. There are stringent quality and

hygiene checks throughout and the plant's systems are run in accordance with ISO and FDA regulations.

The facility has over 30 advanced production lines to manufacture disposable contact lenses for the European and Japanese Markets. One-day, fortnightly, monthly and colour lenses are manufactured in the facility and shipped worldwide and utilize leading edge technologies in moulding, robotics, vision system and sterilization processes.

The site of the proposed development is located within the National Technology Park at Rivers, County Limerick, and is adjacent to Plassey Park Road.

1.4 Vistakon Environmental Health and Safety Policy

Vistakon implements an Environmental Health and Safety policy and is committed to protecting the health and safety of its employees, contractors and visitors and preserving the environment. It is Vistakon's goal to provide an injury and illness free workplace, prevent pollution and achieve healthy lifestyles.

Since operations began in 1996, there has been a very strong focus on continuously improving environmental performance. In 1999, the Vistakon facility at Limerick became the first contact lens manufacturing plant in the world to receive the ISO 14001 environmental management standard. The Vistakon Annual Environmental Report (AER) 2012 states that Vistakon has maintained its ISO 14001 Certificate, with no observations or non-conformances.

The AER also states that further work has been undertaken by Vistakon to divert waste from landfill to recycling, and the plant is currently recovery/recycling some 98% of waste generated.

Water and energy awareness training is provided to Vistakon staff.

Vistakon is a global leader in developing innovative processes and technologies resulting in significant environmental performance improvements and efficiencies. Vistakon has achieved very ambitious annual targets on carbon reduction and energy efficiency. **Section 2.3.1** of the EIS describes existing renewable energy techniques used by Vistakon.

1.5 Outline of Proposed Scheme

The proposed scheme comprises the construction and operation of a single wind turbine of up to 3MW, and associated infrastructure. The proposed new wind turbine will provide power for Vistakon's operations on site.

The main elements of the proposed development will be:

- a wind turbine of up to 3MW with a hub height of up to 80m and a rotor radius of up to 40m,
- concrete base,
- transformer,

- boundary fence,
- underground high voltage power lines on site,
- crane hardstanding, and
- access track.

The proposed wind turbine will be located on land owned by Shannon Development and which is located to the northwest of and adjacent to the existing Vistakon manufacturing facility. Vistakon plans to acquire the site from Shannon Development.

The proposed development is described in detail in **Chapter 3 Site and Scheme Description** of this EIS. The layout of the proposed development is shown on **Figure 3.1 Site Layout** of this EIS. Photomontages of the proposed scheme have been prepared and are shown on **Figures 8.1.1 – 8.16.3** of this EIS.

The turbine will be owned and operated by Vistakon.

1.6 Environmental Impact Statement

1.6.1 Purpose and Screening

Schedule 5 of the Planning and Development Regulations, 2001 (S.I. 600 of 2001), as amended specifies the types and size of developments that require an EIS to be submitted as part of a planning application. With reference to the proposed development, S.I. 600 of 2001 Fifth Schedule, Part 3 (i) requires that an EIS be submitted as part of a planning application where

“Installations for the harnessing of wind power for energy production (windfarms) with more than 5 turbines or having a total output greater than 5 megawatts.”

The proposed development is for one turbine only, and will have an output of less than 5 megawatts, and is therefore well below the threshold. An EIS was requested by Limerick County Council. This EIS has been prepared to provide information on the potential environmental impacts of the proposed turbine and to propose mitigation measures to reduce the residual impacts of the development. The EIS will be submitted with the planning application for the proposed development.

1.6.2 Statutory Requirements for the Contents of an EIS

This EIS has been prepared in accordance with the relevant provisions set out in the Planning and Development Regulations 2001, as amended. Schedule 6 of the 2001 Regulations specifies the information to be contained in an EIS, including the following:

“A description of the proposed development comprising information on the site, design and size of the proposed development

A description of the measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse effects

The data required to identify and assess the main effects which the proposed development is likely to have on the environment

An outline of the main alternatives studied by the developer and an indication of the main reasons for his or her choice, taking into account the effects on the environment.”

Information is also required on the following matters:

“A description of the physical characteristics of the whole proposed development and the land-use requirements during the construction and operational phases

A description of the main characteristics of the production processes, for instance, nature and quantity of the materials used

An estimate, by type and quantity, of expected residues and emissions (including water, air and soil pollution, noise, vibration, light, heat and radiation) resulting from the operation of the proposed development.”

Aspects of the environment likely to be significantly affected by the proposed development are also to be described, including in particular:

“human beings, fauna and flora,

Soil, water, air, climatic factors and the landscape,

Material assets, including the architectural and archaeological heritage, and the cultural heritage.

The inter-relationship between the above factors.”

A description is required of the likely significant effects (including direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative) of the proposed development on the environment resulting from:

“The existence of the proposed development,

The use of natural resources,

The emission of pollutants, the creation of nuisances and the elimination of waste”.

In addition, a description is required of the forecasting methods used to assess the effects on the environment.

A summary in non-technical language of this information is also to be included.

Finally, any difficulties encountered by the developer in compiling the required information should be indicated.

This EIS has been prepared in compliance with the above requirements. The format used is the grouped format, in which each topic is addressed in a separate section. This is designed to allow the reader to access the issues of interest to them as easily as possible. However, some topics may overlap. For example, effects on human beings are addressed in a number of chapters including *Landscape and Visual Assessment*, *Air Quality and Climate Assessment* and *Noise and Vibration* as well as *Human Beings*. Issues not directly addressed in individual chapters and

interactions between environmental issues are considered in **Chapter 14** of this EIS, *Cumulative Impacts, Other Impacts and Interactions*. Cumulative impacts are also addressed in each chapter, insofar as they are relevant.

1.6.3 EPA Guidelines

This EIS has been prepared with due regard to the guidelines on the preparation of environmental impact statements published by the EPA. These are contained in *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* published in 2003 and *Guidelines on the Information to be contained in Environmental Impacts* published in 2002.

1.6.4 Other Guidelines

This EIS was also prepared with due regard to the following guidelines:

- Department of the Environment, Heritage and Local Government guidelines *Wind Farm Planning Guidelines (2006)*, and the draft revision to this document, which was issued for public comment in December 2013.
- Irish Wind Energy Association *Best Practice Guidelines for the Irish Wind Energy Industry (2012)* (prepared by Fehily Timoney & Company).

1.6.5 Summary of Consultation Process

Discussions were held with Limerick City and County Council Planning during the preparation of the EIS, to ensure that issues relating to the proposed project were addressed.

Four communications companies were consulted in preparing the EIS, in relation to the proposed project, namely Meteor, Vodafone, Three and O2. Responses which were received indicated that there would be no adverse effect on telecommunication services in the area.

Parties consulted for the previous application

Parties consulted for the previous application are listed below.

- Limerick County Council (Heritage Officer)
- Limerick City Council (Director of Services - Planning)
- Clare County Council (Director of Services - Planning)
- Irish Aviation Authority (Aviation Executive)
- RTÉ
- O₂ Ireland
- Eircom
- Meteor Mobile Communications Ltd.
- An Garda Síochána
- UPC Communications Ireland Limited
- Irish Coast Guard Headquarters

- TG4
- Commission for Communications Regulation
- TV3
- Tower Com Ltd.
- Arra Communications
- An Taisce (Heritage Officer)
- Wireless Connect Ltd.
- Munster Broadband
- 3G Ireland Ltd.
- ESB Telecoms
- Vodafone
- Premier Broadband
- TETRA Ireland Communications Ltd.
- Department of Arts, Heritage and Gaeltacht (Development Applications Unit)
- National Parks and Wildlife Service
- Office of Public Works
- Inland Fisheries Ireland
- BirdWatch Ireland
- Department of Communications, Energy and Natural Resources
- Fáilte Ireland
- The Heritage Council
- Irish Raptor Study Group
- Irish Wildlife Trust
- Department of Tourism, Culture and Sport
- Limerick Clare Energy Agency
- University of Limerick
- Shannon Development
- Sustainable Energy Authority of Ireland
- Irish Broadband (Imagine Communications Group)
- Health Service Executive
- Geological Survey of Ireland
- Shannon Airport

Follow-up discussions and meetings were held with representatives of a number of the above bodies. The written responses received are summarised in the following section.

1.6.6 Consultation Written Responses for the Previous Application – Key Points

The key points in the consultation written responses are outlined below:

Limerick County Council (Heritage Officer)

The Limerick County Council Heritage Officer's response by letter on the 3rd August 2010 included references to policies of the Castletroy Local Area Plan and the County Development Plan (2005-2011) regarding the development of renewable energy projects, and comments on the overall height of the turbine.

The letter also recommended a buffer zone from the Lower River Shannon SAC and that bird deflectors would be required should wire braced anemometers be set up prior to the eventual development of the wind turbine.

Irish Aviation Authority (Aviation Executive)

The IAA responded by letter on the 6 July 2011. The letter stated that the site location was within 16km of the IAA Woodcock Hill Secondary radar installation, and that an assessment of the impact on this would be required. This assessment was completed.

An Garda Síochána

An Garda Síochána responded by letter on the 12th September 2011, stating that the proposed development would not pose any difficulties to Garda Communications infrastructure in the area and that a copy of the proposal had been forwarded to TETRA Ireland.

An Taisce (Heritage Officer)

An Taisce responded by letter on the 4th August 2010. The letter included comments on a sustainability strategy for energy and resource consumption.

3G Ireland Ltd

BT Communications Ireland responded on behalf of 3G Ireland Ltd (Three) by letter on the 22nd August 2011. The letter stated that initial findings determined that a windfarm in this area could potentially impact the Three network. The letter stated that BT did not have co-ordinates at that stage, and therefore a full impact assessment would need to be completed once a layout for the turbine was agreed. BT were subsequently provided with full details of the proposal, and the current revised proposal.

Department of Arts, Heritage and Gaeltacht (Development Applications Unit) - Ecology

The Department responded by letter on 13 August 2010, recommending that, as well as standard ecological issues covered by EIA, the proposed environmental assessment looks at bird and bat collision risk and at mitigation to ensure no pollution of nearby watercourses. The letter stated that the recommendations were based on the papers submitted to the Department on a pre-planning basis.

Department of Arts, Heritage and Gaeltacht (Development Applications Unit) – Archaeology

The DAU responded by letter on the 5th August 2010. The letter outlined recommendations regarding architectural heritage, including a recommendation that an assessment of the impacts on architectural heritage be undertaken.

Office of Public Works

The OPW responded by letter on the 10th August 2010. The letter refers to a risk of flooding at the site.

University of Limerick

Vistakon has had on-going consultation with the University of Limerick in relation to the proposed development. The University is strongly in favour of the project.

Health Service Executive

The Environmental Health Service of the HSE responded by letter on the 8th July 2011, requesting that specific impacts be included in the EIS including impacts of noise, vibration and dust, the impacts on surface and ground water, impacts of emissions to air, impacts of shadow flicker, and a waste management plan for the construction phase.

Geological Survey of Ireland

The GSI responded by letter on the 23 August 2011 and recommended GSI links for use when undertaking any environmental report or EIS, especially the sections on Soils and Geology and Surface Water and Groundwater. GSI also requested notifications of ground excavations etc.

Shannon Airport

Shannon Airport responded by letter on the 30th June 2011. The response indicated that although Shannon Airport did not have any design parameters at that stage, in general terms, the proposed development and its location was unlikely to give rise to any direct objection on behalf of the Dublin Airport authority plc (Shannon Airport).

1.6.7 Key Points identified, relevant to the current application, relating to the previous EIS and to new and/or changed Planning documents, and guidelines

The documentation prepared for the previous planning application and appeal, in the light of the Limerick Council Planning reports, the An Bord Pleanála (ABP) Planning Inspector's report and reasons for refusal were reviewed and addressed in this EIS. The County Development plans and guidance on wind turbine planning were reviewed for any changes. The recently-published Limerick County Council's Economic and Spatial Plan for Limerick was also reviewed.

Key points identified in the above document and reports are addressed in detail in the relevant chapters of this EIS. Issues identified in the Limerick County Council Planner's report and in the An Bord Pleanála Inspector's report, in relation to the previous EIS, include the following:

- The An Bord Pleanála Inspector's report considered that the issue of roads and access for delivery of equipment to the site was not fully identified and described within the body of the EIS. However the Inspector was satisfied that the road network was capable of accommodating the delivery of the turbine and its components. The most likely delivery route for the wind turbine components to the site for the proposed turbine is described in **Section 4.9.2 Construction Traffic** of this EIS.

- The An Bord Pleanála Inspector's report referred also to the junction at entrance to the National Technology Park which may require minor widening to allow manoeuvring of the expected large oversized loads. An assessment of the junction using Auto Track has been carried out. Refer to **Section 4.9.2 Construction Traffic** of this EIS for further details.
- The An Bord Pleanála Inspector's report referred to the fact that although the results of the Shadow Flicker assessment in the previous EIS were that no third party dwelling is located within a 500m zone of the turbine, that six houses outside the 500m guideline distance from the turbine are potential shadow flicker sensitive receptors, and that four of these might experience shadow flicker for a period greater than the limits set in the Department's guidelines. The potential impacts of shadow flicker on the six dwellings in question, as a result of the proposed turbine are addressed in **Chapter 6 Human Beings** of this EIS.
- The An Bord Pleanála Inspector's report considered that the visual impact of the turbine would be significant. Photomontages of the proposed reduced-height turbine have been prepared for this EIS. Five additional close-range photomontages (taken from locations close to residences) have been included to illustrate the existing screening provided by vegetation and buildings in the vicinity of the proposed turbine. A Landscape and Visual assessment of the proposed turbine has been carried out (refer to **Chapter 8** of this EIS).
- The An Bord Pleanála Inspector's report considered that there may be potential significant impacts on the bat populations in the vicinity of the site, which would be compounded through the "the removal of lengths of hedgerows and trees which may support the bat populations".
- As recommended by the bat specialist who assessed the potential impact of the development on bats, to ensure a safe distance from the proposed turbine for low-flying bats along hedgerows, a vegetation-free buffer zone of 50m minimum from the nearest vegetation to the turbine rotors will be cleared. This will significantly reduce the risk of collision and/or barotrauma to bat species that mainly fly low along hedgerows and tree lines. Potential impacts on bats, and proposed mitigation measures, are addressed in **Chapter 7 Flora and Fauna** of this EIS. With this, and other mitigation in place, the specialist concluded that there would not be a significant impact on bats.
- Limerick County Council's Planning Report refers to a submission from the Development Applications Unit with concerns regarding the fact that the site is close to the Lower River Shannon candidate Special Area of Conservation (cSAC) (Site Code 2165). The letter from the Development Applications Unit to Limerick County Council states (a) that Limerick County Council must ensure there is no potential impact on water quality in the Lower River Shannon cSAC as a result of the proposal, particularly through surface and ground water during the construction phase of the proposal, and (b) Limerick County Council must ensure there is no potential impact on the cSAC as a result of the site being in a flood risk area.

The site is low lying and level, which can result in pools and puddles forming on parts of the site during wet weather. There are no watercourses or drainage ditches within or adjacent to the site of the proposed wind turbine. The nearest watercourse, the Mulkear River (part of the Lower River Shannon cSAC), flows at a distance of approximately 250m to the north of the turbine site. A flood barrier runs along the

entire bank of the Mulkear River in the vicinity of the site, separating this part of the National Technology Park from the River.

Vistakon operates under an Integrated Pollution Prevention and Control Licence (IPPC Licence Reg. No. P0818-02). Storm water from the existing Vistakon surface water drainage network is discharged via an emission point to the Mulkear River in compliance with the conditions of its IPPC licence. Conditions of the IPPC licence include monitoring of storm water discharge, and automatic diversion of storm water to the firewater retention facility should storm water at the Vistakon facility exceed the trigger levels set out in the IPPC Licence. Also, it is a condition of the licence, that in the event of a fire or a spillage at the Vistakon facility, any contaminated storm water will be automatically diverted to the containment pond at the facility.

During operation, storm water drainage from the access road and crane hardstanding will infiltrate directly to ground.

Mitigation measures to prevent storm water runoff to the Mulkear River during construction are proposed in **Section 4.10.5** of the **Chapter 4 Construction Activities**. Refer also to **Chapter 11 Soils Geology, Surface Water, and Groundwater**.

1.7 Difficulties Encountered During the Study

No significant difficulties were encountered during the preparation of this EIS.

1.8 References

Department of the Environment, Heritage and Local Government guidelines (2006) *Wind Farm Planning Guidelines* (2006),

Environmental Protection Agency (2003) *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* EPA, Wexford,

Environmental Protection Agency (2002) *Guidelines on the Information to be contained in Environmental Impacts* EPA, Wexford.

Irish Wind Energy Association (2012) (Prepared by Timoney Fehily) *Best Practice Guidelines for the Irish Wind Energy Industry*, IWEA Naas.

2 Need for the Scheme and Alternatives Considered

2.1 Introduction

This chapter sets out the need for the proposed development. It also outlines the process by which the optimum wind turbine location within the site was selected.

2.2 Need for the Project

2.2.1 Energy Costs

In recent years, Ireland has had among the highest energy costs in Europe. This places plants such as Vistakon at a disadvantage in European and globally in terms of cost competitiveness. Vistakon's annual imported power requirement, allowing for the new Combined Electricity and Cooling Plan in operation, is approximately 80GWh. The annual cost of electricity at the site is approximately €7 million. Vistakon is under continuous pressure to reduce costs, and become more competitive in order to remain in business and thus continue as a major employer and contributor to Limerick's economy. Wind energy has been identified as the best solution to help control Vistakon's electricity costs and secure Vistakon's future in Limerick.

Vistakon's proposal to develop a renewable energy source on-site will reduce the cost of operations for the facility, making it more cost efficient and will help it to sustain operations in the Limerick area.

In addition to the reduction in energy costs for the site, the proposed wind energy project will reduce the uncertainty associated with volatility in the cost of electricity in the Irish market.

This volatility is driven by the following factors:

- Irish electricity is predominantly generated from imported fossil fuels
- There is increasing demand for fossil fuels in emerging economies, which increases the cost of fossil fuels.
- There is also increasing demand for resources, including fossil fuels, in developed economies, again increasing the cost.
- Investors are tending to move from equities to commodities, which also increases the cost.

As can be seen in the following **Table 2.1**, since 2010, the underlying trend in wholesale price indices for energy products (including electricity) by the manufacturing industry has been upward.

Table 2.1 Wholesale Price Indices (excluding VAT) for Energy Products (Fuels purchased by Manufacturing Industry) (Base: Year 2010 = 100)

Energy Fuels	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Petrol	2010	96.0	96.3	100.6	100.5	101.1	100.7	99.6	99.2	100.3	99.7	100.9	105.3	100.0
	2011	106.6	106.2	109.9	111.5	111.1	109.5	111.3	108.2	110.7	109.6	108.8	109.6	109.4
	2012	112.2	113.5	117.1	118.0	114.2	111.4	113.8	117.8	117.1	117.0	112.7	111.2	114.7
	2013	112.5	114.9	112.8	111.5	111.7	112.6	114.1	113.4	111.5	-	-	-	-
Autodiesel	2010	94.9	94.7	98.7	99.9	101.0	100.7	100.0	99.8	101.2	100.6	102.8	105.7	100.0
	2011	107.7	108.9	112.2	112.5	109.4	111.0	111.9	108.8	111.4	111.6	114.2	113.2	111.1
	2012	116.6	115.6	117.7	116.6	115.1	112.0	114.7	118.3	118.4	118.8	115.7	113.7	116.1
	2013	114.8	116.4	114.7	112.3	112.1	112.0	114.0	113.7	115.0	-	-	-	-
Gas Oil (other than autodiesel)	2010	91.9	91.1	97.4	98.1	103.1	103.1	101.2	100.6	102.2	101.2	104.2	105.9	100.0
	2011	109.6	110.3	114.7	115.8	111.5	113.6	114.9	110.9	114.3	113.8	117.9	116.3	113.6

Energy Fuels	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
	2012	120.3	120.0	122.0	120.5	119.9	115.5	118.4	122.8	124.2	125.1	120.9	119.1	120.7
	2013	119.9	122.9	119.5	116.7	116.6	116.4	119.2	118.9	120.3	-	-	-	-
Fuel Oil	2010	92.8	92.9	96.8	97.8	103.2	102.5	102.3	101.9	102.2	101.2	103.0	103.6	100
	2011	107.0	107.5	113.5	116.0	111.7	114.0	115.5	110.9	113.9	114.3	117.1	116.5	113.2
	2012	120.7	120.8	124.0	122.7	120.6	116.8	119.0	124.3	124.4	120.9	117.6	115.6	120.6
	2013	117.7	120.4	117.5	115.0	115.4	115.2	116.1	115.4	116.5	-	-	-	-
Electricity	2010	99.5	93.1	84.5	86.4	97.8	97.6	98.3	97.8	101.8	104.0	108.8	130.4	100.0
	2011	117.4	112.2	121.7	119.0	110.5	105.0	104.8	111.3	109.4	112.5	118.0	115.3	113.1
	2012	114.4	121.5	115.0	118.6	115.4	106.4	109.8	111.7	119.7	123.8	127.2	122.5	117.2
	2013	121.4	120.4	152.4	125.5	111.8	104.6	112.3	111.5	117.8	-	-	-	-
Petroleum fuels ¹	2010	93.2	93.1	97.5	98.4	102.6	102.2	101.5	101.2	101.9	101.0	103.0	104.5	100.0

Energy Fuels	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
	2011	107.5	108.1	113.3	115.1	111.2	113.1	114.5	110.4	113.3	113.5	116.3	115.5	112.7
	2012	119.4	119.3	122.1	120.9	119.1	115.4	117.8	122.6	122.8	120.9	117.5	115.5	119.4
	2013	117.2	119.7	117.0	114.6	114.7	114.5	116.0	115.5	116.6	-	-	-	-
Energy Products	2010	97.4	93.1	88.8	90.4	99.4	99.1	99.4	98.9	101.8	103.0	106.8	121.7	100.0
	2011	114.1	110.9	118.9	117.7	110.7	107.7	108.1	111.0	110.7	112.8	117.4	115.4	113.0
	2012	116.1	120.8	117.4	119.4	116.7	109.4	112.5	115.3	120.7	122.9	124.0	120.2	118.0
	2013	120.0	120.2	140.5	121.8	112.8	107.9	113.5	112.9	117.4	-	-	-	-

¹ Energy products excluding electricity.

Source: CSO online publication *Wholesale Price Index Introduction of Updated Series Base Year 2010 = 100* (Table 5) (CSO website accessed 01/12/2013)

2.2.2 Reduced Dependency on Fossil Fuels

Reducing the emissions of greenhouse gases, increasing the use of renewable energy and improving energy efficiency are part of the Irish Government's contribution to the achievement of EU targets on climate and energy. The proposed development will contribute to helping Ireland in meeting its targets.

The proposed development will reduce the Vistakon facility's dependence on energy generated by the combustion of fossil fuels.

The carbon footprint at the Vistakon facility will be reduced significantly as a result of the proposed wind turbine. This will deliver significant environmental as well as financial benefits.

2.2.3 Local Context

2.2.3.1 National Technology Park

Vistakon is a major industry in the National Technology Park. The proposed wind turbine development underlines Vistakon's intention to remain in the National Technology Park and will facilitate the expansion of Vistakon's operations, which will be of great benefit to the Park.

The proposed wind turbine will be a visual symbol of renewable energy for the National Technology Park and the City of Limerick. It will be an iconic statement supporting the National Technology Park's branding as a location for leading edge sustainable technological development.

2.2.3.2 University of Limerick

The University of Limerick is very supportive of the proposed Vistakon wind energy project. Links have been set up with the Physics and Energy Department, the Materials and Surface Science Institute, and the BSc Energy degree programme of the University. It is planned that the turbine will be available for research and teaching for undergraduate and postgraduate students. The project will therefore be of significant academic benefit for the University, particularly in relation to renewable energy and sustainability.

2.3 Alternatives Considered

2.3.1 Alternative Renewable Energy Options

Vistakon's electricity usage per contact lens produced was reduced by 30% during the period 2007-2012.

Approximately 50% of the electricity used on site is sourced from renewable sources. This was achieved with a sustainability-focused strategic vision, and proactive employee participation.

Vistakon has already installed sustainable systems for power generation and cooling. These are a natural gas-fired combined cooling and power plant and

geothermal cooling. A combined cooling and power plant generates electrical power and recovers the waste heat from the power generation in absorption chillers to provided cooling. The geothermal cooling system uses the earth as a heat sink via a heat pump. Alternative renewable energy systems completed in 2012 include the installation of LED lighting, and Compressor Heat Recovery.

These systems were installed as part of Vistakon's on-going energy efficiency and CO₂ reduction programmes.

Vistakon also takes an active role in supporting and promoting sustainable transport options in the wider community. In contribution to Limerick's role as a Smarter Travel City, Vistakon has installed two charging points for electric vehicles on their site, and these are now in regular use.

2.3.2 Alternative Site Selection

Sites outside the immediate vicinity of the Vistakon site were not considered for the location of the proposed wind turbine, as these are precluded by the current electricity regulatory framework, as determined by the Commission for Energy Regulation.

2.3.3 Alternative Turbine Locations within the Vistakon Site

In the previous application, alternative turbine locations within the Vistakon site were considered. Constraints on the location of the turbine on the Vistakon site included the following:

- Site boundary.
- 'Set back' - distances from the turbine to roads, dwellings, overhead lines, ownership boundaries and so on.
- Environmental constraints.
- Location of noise-sensitive dwellings, if any, and assessment criteria.
- Location of visually-sensitive viewpoints, if any, and assessment criteria.
- Location of dwellings that may be affected by 'shadow flicker', that is flickering shadows cast by rotating blades when the sun is in particular directions, and assessment criteria.
- Constraints associated with communications signals, for example microwave link corridors or radar.

The wind turbine locations considered in the previous application were appraised in the context of the Irish Wind Energy Association and Sustainable Energy Ireland (now the Sustainable Energy Authority Ireland) guidelines *Best Practice Guidelines for the Irish Wind Industry* (IWEA 2012), and the Department of the Environment, Heritage and Local Government's *Planning Guidelines* (DEHLG 2006).

During the selection process in the previous application for the optimal location of the proposed wind turbine within the Vistakon site, the optimisation of wind energy opportunities on the site was considered within constraints outlined under the following headings as explained below.

- Alternative Turbine Heights

- Environmental, Planning
- Engineering, Health and Safety
- Future Development, Commercial

2.3.4 Turbine Height

The power production of a wind turbine increases dramatically with height. In the previous application Vistakon's preference was for a 100m high turbine. This was refused permission. The feasible alternative for Vistakon is an 80m hub height turbine. The average wind speed for a turbine with a hub height of 80m is 5.7 metres per second.

2.4 Environmental/Planning

Under the environmental / planning heading the following topics were addressed for the previous application:

- Visual Impact
- Noise
- Cultural Heritage
- Nature Conservation
- Ground Conditions | Geology
- Proximity to Roads and Railways
- Proximity to Power Lines
- Interference with Communication Systems
- Aircraft Safety
- Shadow Flicker
- Land Use Planning and Permitting.

A number of the above topics have been revised or updated in this EIS. These include a revised visual impact study (including revised photomontages and an additional five photomontages), a revised noise impact assessment and a revised shadow flicker assessment. Proximity to roads was re-assessed to include proximity of the wind turbine to the proposed Limerick Northern Distributor Road). The planning files of Limerick County Council were reviewed to address any changes in planning since the previous application.

An aviation impact assessment was completed for the previous project, and as the proposed turbine will be in the same location as the previous application, the aviation impact assessment of the previous application is included as **Appendix G** to this EIS.

Additional consultation with broadcast communication services providers was carried out for this EIS i.e. with O2, Vodafone, Three and Meteor, all of which have masts in the general area. Consultation of the Commission for Communications Regulation's (ComReg) website (www.comreg.ie) (accessed 17 Oct 2013), which

includes online mapping of ‘mobile’ communication masts, indicated a number of communication masts in the general area of the proposed turbine, the nearest of which are listed in the following **Table 2.1**.

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Table 2.1 Approximate Locations of ‘Mobile’ Communication Masts

Telecommunications Company	General locations of Masts (identified on ComReg online mapping), in relation to the location of the proposed wind turbine (as indicated on ComReg online mapping.
Vodafone	Immediately south of the turbine location – at the site of the Vistakon manufacturing facility; Further to the northwest of the turbine location; Limerick University campus, northwest of the turbine location. Further south of the turbine site (south of the R445) Further southwest of the turbine location (south of the of the R445)
O2	Northwest of the turbine site; Limerick University campus, northwest of the turbine location. South of the R445 Southwest of the turbine location (south of the R445)
Three	Northwest of the turbine site. South of the R445 Southwest of the turbine location (south of the R445)
Meteor	South of the R445 Southwest of the turbine location (south of the R445)

No potential for interference with commercial broadcasters was identified in the responses from the broadcast communication services providers.

With regard to aviation safety, an aviation impact assessment was completed for the previous project, and as the proposed turbine will be in the same location as the previous application, the aviation impact assessment of the previous application is included as **Appendix G** to this EIS.

2.4.1 Shadow Flicker

Shadow flicker is the flickering shadow cast by the rotating blades of a turbine when the sun is in particular directions. Wind turbines can cause shadow flicker at the windows of nearby houses, when a specific combination of conditions coincides. A shadow flicker assessment has been undertaken for the turbine - refer to **Section 6.2.3.2**.

2.4.2 Land Use Planning and Permitting

As part of the turbine location selection process, the Limerick County Development Plan's policies and objectives in relation to wind energy in general and the siting of wind energy projects in industrial plants. Meetings were held with Limerick County Council to discuss the potential landscape and visual impacts of the project, and also the planning strategy. Refer to **Chapter 5 Planning and Policy** for more details on the Development Plan's policies and objectives.

2.5 Engineering/Health and Safety

The health and safety risks associated with the construction and operation of the wind energy project were identified and evaluated through the conceptual design process. A desk study of generic risks associated with wind turbines was completed. Potential operational risks were also addressed.

2.6 Development of the Vistakon Plant

The Vistakon site is subject to on-going development, reconfiguration, consolidation and expansion, as an intrinsic part of Vistakon's industrial activities in a dynamic market. In 2012, Vistakon was granted planning permission for the construction of a 3,535sq.m ground floor extension with a mezzanine, to the existing facility, and for the provision of 128 additional car parking spaces, and a new personnel access/egress road with security barriers from the extended car park to connect to the existing Plassey Park Road, and a 2.7m high steel sliding gate. Also in 2012, Vistakon was granted planning permission for a 5,171sq.m extension at ground and mezzanine levels to wrap around the north western side of the existing building with an external link corridor along the front facade of the existing building. These developments have been constructed.

Potential turbine locations were considered in the context of site plans, to ensure that the turbine will fit coherently within the site as it develops over time. The proposed turbine will not be located in any area specifically reserved for future development and expansion on the Vistakon site.

Proposed locations for the wind turbine were reviewed in the context of the constraints identified under the above headings. Several iterations of the turbine layout were completed. This resulted in an optimum location which satisfied the constraints. In general terms, the constraints described above significantly limited the available turbine location opportunities.

2.7 Future Development in the General Area around the Vistakon Facility

Shannon Development markets the undeveloped sites around the Vistakon facility as part of the marketing of the National Technology Park. The site to the southwest of the Vistakon plant, on the other side of Plassey Park Road, has been designated as a strategic site for a major foreign direct investment project. It is planned that the lands to the north and northwest of Vistakon would be used for small and medium businesses and advanced manufacturing, consistent with development already located in the Park.

In the assessment of the alternatives for the proposed wind energy development, the potential impacts on future developments on the adjacent lands were considered.

2.8 References

Department of the Environment, Heritage and Local Government (2006) *Planning Guidelines*,

Irish Wind Energy Association (2012) (prepared by Fehily Timoney & Company) *Best Practice Guidelines for the Irish Wind Industry*. Naas: IWEA.

Sustainable Energy Authority of Ireland (SEAI) (2013) *Electricity and Gas Prices in Ireland- 2nd Semester (July-December) 2012*.

3 Site and Scheme Description

3.1 Introduction

This chapter presents a description of the proposed wind energy project. The site and the neighbouring land uses are described.

3.2 Site Description

The site of the proposed wind turbine is low lying and generally level and lies adjacent to Plassey Park Road, within the National Technology Park, Limerick, which is situated approximately 5km to the east of Limerick City. The existing Vistakon facility is located to the south east of the site. The site of the proposed wind energy development has an area of 5.1 ha. The site of the proposed turbine comprises bare ground, wet grassland, scrub and mixed broadleaved woodland and treelines.

It is proposed to locate the wind turbine at grid reference Easting 163344; Northing 158172 in the northwestern portion of the site. The wind turbine site layout is shown on **Figure 3.1**.

3.3 Existing Facility

The Vistakon plant operates under an IPPC licence (Licence No. P0818-02) and comprises a main production building and a number of ancillary utilities and facilities. The main production operations and supporting functions are conducted primarily inside the main production building. This building houses the following areas:

- Manufacturing Area
- Administration and Laboratory
- Canteen
- Offices

Outside of the main building, on the site are located:

- Service Compound
- Utilities
- Sprinkler pumps (diesel driven)
- Warehouse chemical store
- Water room
- Electrical sub-station and transformers
- Process/manufacturing area bunds
- Tanker offloading/loading area with full tanker containment
- Tank Farm
- Thermal Oxidiser
- Fire water retention pond
- Combined Cooling and Power Compound
- Parking for the site is located to the south of the site, in front of the administration area.

3.4 Neighbouring Land Uses

The Vistakon facility lies within the National Technology Park which comprises a 263 hectares enterprise and industrial area situated on the R445, 5 km east of Limerick City. The Technology Park is bounded by the Rivers Mulkear, Shannon and Groody on the eastern, northern and western sides, respectively, and by the R445 on the southern side. The Technology Park has approximately 80 high-technology and knowledge-based companies and employees over 3,000 skilled people (National Technology Park website, accessed October 2013).

The Vistakon facility is bounded to the south east by UL Bohemians RFC, and to the west by Plassey Park Road. The northern and southern boundaries comprise undeveloped land. There are residential areas at the southeastern boundary.

The land immediately to the north and east of the site comprises relatively open undulating farmland. The River Mulkear flows to the east and north east of the Vistakon site and the River Shannon flows further north of the site.

The Limerick University campus is located approximately 1km to the northwest of the Vistakon facility.

Planning permission was granted in September 2012 for a change of use from offices to a Brothers of Charity Day Care Centre (Planning Ref. 12534), approximately 650m west of the proposed wind turbine).

The suburbs of Castletroy and Annacotty lie to the west and south of the Vistakon facility. The area in general comprises a mix of enterprise and industrial parks, hotels, schools, housing estates, and sports clubs. Castletroy Golf Club is located to the southwest.

Roads in the vicinity of the Vistakon facility include Plassey Park Road immediately to the west. The R445 road and the M7 Limerick to Dublin motorway are located further south.

3.5 Principal Design Objective

The principal design objective for the proposed development is the design and construction of a wind turbine in an optimum location on the Vistakon site, which will contribute to Vistakon's electrical power requirements whilst at the same time reducing its carbon footprint.

3.6 Main Features of the Development

3.6.1 Introduction

The main features of the development include:

- One wind turbine of up to 3MW.
- Associated transformer located within or adjacent to the turbine.
- Buried electrical and fibre-optic cabling in the Vistakon site.
- Crane pad.
- Access track to the wind turbine.
- Boundary fence.

In addition, a temporary construction compound will be established on site for the duration of the construction period. The turbine location identified is based on an optimised technical, economic and environmental layout. Unforeseen ground conditions may require minor movements (micro-siting) in the position of the turbine. Any alteration to the location of the proposed works would be agreed with Limerick County Council, prior to commencement of construction.

3.6.2 Wind Turbine

3.6.2.1 Turbine structure

The proposed turbine will have a capacity of up to three MW. The turbine will have a hub height of up to 80m with a rotor radius of up to 40m.

The turbine will be of a typical modern design incorporating a tubular tower and three blades attached to a nacelle, housing the generator, gearbox and other operating equipment.

The proposed turbines will be off-white or pale grey colour with a matt finish.

The transformer will be housed within or adjacent to the turbine.

3.6.2.2 Turbine Foundations

The foundations will comprise a reinforced concrete pad. Refer to **Chapter 4 Section 4.5.5** for details.

3.6.3 Crane Pad

The wind turbine will require an area of hardstanding adjacent to the turbine foundation to provide a stable base on which to lay down turbine components ready for assembly and erection, and to site the two cranes necessary to lift the tower sections, nacelle and rotor into place. The area of the crane pad will be approximately 40m x 60m (refer also to **Chapter 4**). The crane pad will remain in situ following construction, in order to facilitate any future maintenance operations which may require cranes. It is likely that the existing construction car park will be suitable for this purpose.

3.6.4 Cabling

Underground cables within the site will link the turbine to the Vistakon facility. Typically the cables will be laid in a trench one metre deep and one metre wide. Refer also to **Chapter 4**.

3.6.5 Access Track and Boundary Fence

An access track will be constructed, as indicated on the planning drawings, to link the turbine site with the existing construction car park. The existing site boundary fence will be extended to enclose the site of the turbine, as required.

3.7 Wind Turbine Operations

The wind turbine will have a capacity of between two and three megawatts. It is projected that it will have an operating lifetime of 25 years. The wind turbine operations will be controlled from the Vistakon facility.

3.7.1 Hours of Operation

The turbine will operate at all times when wind speeds are suitable, with the exception of downtime for maintenance. The exact wind speeds at which generation will occur will ultimately depend upon the machine selected during the detailed design process. However, it is anticipated that the turbines will typically start to generate electricity at wind speeds of about 2m per second, rising to its maximum output at wind speeds of about 12m per second to 13m per second. If wind speeds exceed 25m per second, for a ten minute mean, or if the wind speed exceeds 30m per second the turbine will automatically shut down.

3.7.2 Routine Maintenance

It is envisaged that routine maintenance or servicing of the turbine will be carried out twice a year, with a main service at 12 monthly intervals and a minor service at 6 monthly intervals. In year 1, there will be an initial service 3-month after commissioning. The turbine will be switched off for the duration of the service.

3.7.3 Unscheduled Repairs to the Turbine

During the 25-year operational period, it is possible that unscheduled repairs or maintenance of the turbines may require large items of plant, such as cranes, to be returned to the site, along with additional maintenance staff.

3.8 Operational Health and Safety

The wind turbine will be operated and maintained in accordance with the relevant health and safety regulations. Turbine location is in compliance with Department of Environment's Guidelines in relation to distance from roads and buildings.

The turbine will be purchased from a reputable European turbine supplier. The turbine will be designed, manufactured and installed as per the International Electrotechnical Commission (IEC) IEC 61400 on *Wind Turbine Generator Systems*. The International Electrotechnical Commission (IEC) has developed standards, specifically, "*WT 01 System for conformity testing and certification of wind turbines*", for the purpose of improving the safety of operations of turbines. An accredited certification body reviews the design assumptions, test results, manufacturing process, site specific conditions and tower and foundation designs. All modern wind turbines are subject to certification standards. The turbine foundations and structural design will be completed by experienced wind turbine designers to IEC and EN standards. The turbine design and installation will be subject to third party verification.

The turbine will be designed with extensive fire detection and fire suppression systems. All controls will be remotely monitored. The turbine will immediately shut down in the event of a fire. The Vistakon site has a trained emergency response team on site 24hours per day, seven days per week. The turbine will include lightning protection systems in the event of a lightning strike.

The turbine blades will have automated ice detection and blade heating systems activated in cold weather conditions. Wind turbines with ice on their blades are forbidden to start up.

The construction will be subject to strict quality control standards and on-site supervision. The turbine is located on an active industrial site and will be subject to regular inspection and maintenance. The turbine operation will be covered by a full maintenance contract.

3.9 Decommissioning

The projected operational lifetime of the wind project is 25 years. When the wind project ceases operation, all major components and most above-ground structures

will be removed from the site. In the case of the foundation works, the upper sections will be removed and the voids backfilled with appropriate materials. Underground cables and concrete foundations will be left in place as removal would be likely to cause more disturbance than leaving them in situ. The surface will then be restored.

4 Construction Activities

4.1 Introduction

This chapter describes the construction of the proposed development and outlines the measures that will be taken to ensure that the adverse impacts of the construction activities are avoided or minimised.

4.2 Geotechnical Investigation

Prior to detailed design, and construction, a site specific ground investigation will be undertaken to determine the ground conditions underlying the wind turbine.

4.3 Construction Programme

The construction period for the wind project is expected to be six months. The construction process will comprise the following:

- Site Preparation
- Relocation of existing buried services.
- Construction of turbine foundation, including transformer base, if necessary.
- Excavation of trenches and laying of underground cable.
- Installation of transformer.
- Movement onto site and erection of wind turbine.
- Connection to on-site distribution and signal cables.
- Reconfigure the existing connection to the ESB Networks system.
- Commissioning of site equipment.
- Site restoration.

It is envisaged that some of the above construction activities will be carried out concurrently in order to minimise the overall length of the construction programme.

4.4 Site Preparation

Site preparation works will include the “site establishment” set up by the contractor which will include the following:

- Setting up of access control to the site.

- Site office.
- Site facilities (canteen, toilets, drying rooms, etc.)
- Office for construction management team.
- Secure compound for the storage of all on-site machinery and materials.
- Temporary car parking facilities.
- Permanent and temporary fencing.
- Erection of signage.

Prior to commencement of construction, the contractor will consult Vistakon's records and drawings to establish the location of existing buried services.

4.5 Construction Methods

The proposed wind energy project will be constructed employing best practice in safety and efficiency.

4.5.1 Construction Safety

As required by the *Safety, Health and Welfare at Work (Construction) Regulations 2013*, a Health and Safety Plan will be prepared which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed as the development progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations.

Safety on site will be of paramount importance. During the selection of the relevant contractor and the respective subcontractors their safety records will be investigated. Only contractors with the highest safety standards will be selected.

Prior to working on site, each individual will receive a full safety briefing and will be provided with all of the safety equipment relevant to the tasks the individual will be required to perform during employment on site.

Safety briefings will be held regularly and prior to any onerous or special task. 'Toolbox talks' will be held to ensure all workers are fully aware of the tasks to be undertaken and the parameters required to ensure the task will be successfully and safely completed.

All visitors will be required to wear personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team.

Regular site safety audits will be carried out throughout the construction programme to ensure that the rules and regulations established for the site are complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is again put in place.

4.5.2 Construction Compound

A temporary construction compound with approximate dimensions of 50m x 50m will be required. This will be located within the Vistakon site.

The temporary construction compound will include a site office for the construction management team and site facilities for the construction staff. The compound will be serviced with electrical power, water supply and toilet facilities. It is envisaged that the existing Vistakon facility will supply these services. The compound will be used as a storage area for the various components, fuels and materials required for construction. The compound will be fenced off to prevent entry to adjacent land and to ensure site security is maintained. The compound will be reinstated to its original condition at the end of the construction period.

Temporary parking for construction staff will be provided at the Vistakon facility.

4.5.3 Underground Cables

The new power lines which will run from the proposed turbine to the existing on site substation and to the ESB Networks system will be laid underground.

Detailed construction and trenching specifications for the laying of underground cables will depend on the ground conditions encountered at the time.

An electricity transformer will be installed within or adjacent to the turbine.

4.5.4 Site Access

Access to the site for vehicles delivering turbine components will be from Plassey Park Road via the existing entrance to the temporary car park at the Vistakon

4.5.5 Construction of Turbine Foundations

The foundation type used for the proposed turbine is usually a square, circular or octagonal reinforced concrete pad which may have a central column or plinth. The requirement for a plinth depends on site conditions, loading and anchoring arrangement for the turbine tower. Typical dimensions vary from 14m to 18m overall length or diameter, however the dimensions of the pad depend on the ground conditions and turbine size. The pad may not be of uniform thickness.

Given the anticipated ground conditions of encountering soft soil in the upper 6m of the soil profile, the foundation pad will have to be piled into the underlying bedrock which, based on bedrock levels revealed in the site investigation undertaken in the technology park (refer to **Chapter 11 Soils, Geology, Surface Water and Groundwater**), is possibly less than 10m below ground level. The competency of the bedrock underneath each pile foundation will be proven, to a minimum of 5m below pile to ensure there are no voids or cavities in the limestone bedrock. During construction, an area, some 1-2m bigger than the pad size to 3.0m below ground level, will be excavated to facilitate the placing of the edge shutters. The sides of the excavation will be battered back for safety. Concrete will be placed in two pours with the lower pad followed by the central stub column. It will be finished just below ground level. The ground will be backfilled above the lower pad

in compacted layers of suitable material. The surface will be dressed with topsoil to facilitate the re-vegetation of area around the turbine. It is estimated that an excavation of the order of 18m x 18m by 3m deep can be expected, generating some 972m³ of spoil which can be reused to backfill the lower pad, and if suitable will be used as fill or landscaping material in other areas of the site.

Prior to detailed design and construction, a site specific ground investigation will be undertaken to determine the ground conditions underlying the wind turbine. This will include the determination of the appropriate ground stiffness moduli and soil/rock parameters for the turbine base design. This investigation will enable optimum design of the turbine foundation.

In the event of any evidence of soil contamination being found during work on site, the appropriate remediation measures will be employed. Any work of this nature would be carried out in consultation with, and with the approval of the Environmental Protection Agency and the Environmental Department of Limerick County Council.

Once the turbine has been installed, the surface area surrounding the turbine will be restored.

4.5.6 Crane Hard Standing

The superstructure of the wind turbine will be assembled on site from a number of components. The assembly of the structure will require significant crane work. A hard standing (some 40m x 60m) will be required to accommodate crane movements and to support the cranes during the lifting and assembly process. Generally, only minimal falls of the order of 1-5% are permitted along and across the hard standing area. The hard standing will be located immediately alongside the turbine pad, with its alignment selected to minimise disruption of the site and to facilitate delivery and unloading of the various turbine components.

Surface topsoil and any soft/loose underlying soil will be removed over the footprint of the crane hard standing, with the topsoil being set aside for later re-use. The area will be covered with a geotextile and overlain with engineering fill to a depth required to give a suitable bearing capacity for the crane operations. The hard standing will be left in place for significant maintenance works during the lifetime of the turbine and for decommissioning. When not in use it will be covered by a separation membrane and spread with the topsoil, which had been removed, to encourage the re-generation of vegetation.

4.5.7 Site Access and On-site Track

A new track will be required within the site, to link the wind turbine, the construction compound and the existing road infrastructure on site. The access track to the turbine will be from the existing construction car park.

The track will be used by construction vehicles and will be retained throughout the lifetime of the wind project for use by maintenance vehicles. The access track will be constructed from the nearest access road to the construction site. The access track will require large radius bends to accommodate delivery of the crane and turbine

components. The access track will be finished in a stone or gravel material and will be typically free draining to the ground.

Track length will be kept to a minimum, to reduce construction time, road stone requirements and environmental impact. Track gradient has been generally kept to less than 8 degrees to allow construction plant to move safely around the site and to facilitate turbine component delivery.

The track will be constructed first, and vehicles will be restricted from using any other routes whilst on site. The access track on site will be approximately 6m wide to accommodate cranes and delivery vehicles required for turbine erection. The track will be constructed from local stone sourced from a local commercial quarry (refer to **Chapter 12 Material Assets** for further details).

Construction of the track will involve removal of surface vegetation and soil removal, placing of geotextile on the exposed surface, (if required), overlaying the geotextile with compacted stone to approximately 500mm depth (the depth will depend on the nature of the underlying strata). Excavated soil will be used to dress back the sides of the track to encourage re-vegetation through utilising the natural seed bed in the soils. If karst features are uncovered beneath the access road during the detailed site investigation, geogrids or stone platforms would be constructed in these areas.

The construction of the access road should not require any cut and fill of material as there is a gentle incline running from west to east across the site towards the turbine location. Alterations to ground level due to construction of the access road will be minimal. However, the presence of poor ground conditions may require either the excavation of poor ground, ground improvement or a thicker capping layer for the pavement design. Excavated material will be reused elsewhere on site as either general fill or landscaping material.

4.5.8 Turbine Erection

The superstructure of the wind turbine will be assembled on site from a number of components. The tower will be formed in steel sections typically comprising 4 to 5 long tapered sections, or pre-cast concrete sections approximately 4 m in length. Tower sections will be lifted from delivery trailers into place from the crane hardstanding. The rotor, comprising the blades and a hub will be assembled on the ground prior to lifting into place. The nacelle will also be lifted into place by the cranes.

In general, it takes approximately one week to assemble the wind turbine and using a two crane method.

4.5.9 Other ancillary developments

For some turbine models there is an external transformer with typical dimensions of 1m width x 2-3m length x 2m height (approximately). If external, it is located close to the turbine and sometimes over the footprint of the foundation. Other turbines include the transformer within the turbine shaft.

4.5.10 Commissioning

Once construction has been completed, commissioning will commence. Commissioning tests will usually involve standard electrical tests for the electrical infrastructure as well as the turbine, and inspection of routine civil engineering quality records.

4.6 Materials Source and Transportation

In so far as possible, construction materials will be from local sources.

Wind turbine components will be imported. The method of transporting these components is described in **Section 4.9.2**.

4.7 Employment and Accommodation

Through the construction phase there will be some variation in the numbers working on site. It is anticipated that up to 20 construction workers will be employed on site at any one time.

Temporary office accommodation and other construction facilities will be installed on site for the construction phase. All temporary units will be of a high standard in accordance with statutory regulations as a minimum.

The co-ordination of people and materials on-site will be one of the key activities throughout the construction phases. A construction management plan will be put in place prior to the commencement of the works. This plan will designate traffic routes, timings and parking arrangements.

Typical working hours during the construction phases will be:

Start	Finish
0700	1900 Monday – Friday
0700	1300 Saturday

It may be necessary to work overtime or night shifts (including at weekends) at certain critical stages, such as pouring the turbine foundation, during the project. Consideration of safety, weather or sub-contractor availability may necessitate working outside normal hours. Heavy or noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled.

4.8 Construction Traffic

This section describes the existing traffic in the area surrounding the site and provides a description of the local road network.

The impact of the generated traffic on the local road network during the construction of the proposed development is assessed and mitigation measures are proposed where necessary.

4.8.1 Existing Traffic Situation

4.8.1.1 General

The road system in the Rivers area, in which the site is located, is designed to cater for heavy traffic.

4.8.1.2 Local Road Network

The proposed development will be located at the Vistakon facility in the townland of Rivers near Castletroy. The site is adjacent to the Plassey Park Road. Construction access to the site will be from the Plassey Park Road via the existing entrance to the temporary car park at the Vistakon facility.

Construction traffic, likely to be generated during the construction of the proposed development, is described below:

Type of Construction Traffic

During the construction phase, three types of construction traffic will access the site.

- Heavy goods vehicles (HGV) traffic
- Workforce traffic
- General site traffic

HGV Traffic

The construction stage of the proposed development will involve HGV movements. HGV movements may include the following:

- delivery of road stone for the construction compound and for crane hardstanding.
- delivery and subsequent removal of plant and equipment to site for site compound, etc.
- geogrid material
- transformers
- cable
- sand
- ready-mix concrete
- formwork and reinforcing steel
- mobile cranes
- turbine components and transformer
- delivery of base rings.

These activities are outlined in more detail below. It should be noted that, in calculating traffic generation, account is taken of the return journey of the delivery.

It is unlikely that HGVs will access the site at night time. However this may be required in unusual circumstances (refer to **Section 4.7**).

The larger components of the wind turbine are likely to be delivered by sea to the Foynes Port, and subsequently transported by road to the Vistakon site (see **Section 4.9.2 Construction Traffic**).

The earthworks element of the construction will introduce some additional HGVs to the area.

General Plant and Equipment – Delivery and Removal

A range of plant and equipment is expected to be delivered to site near the commencement of the works and will be removed as soon as practical at the end of the activity for which the equipment is required.

Concrete

Up to approximately 440m³ of ready mix concrete may be required for the construction the turbine foundation.

Delivery of Turbine Components

Over-size load vehicles will be required for the delivery of the components of the turbine. The longest such element will be the turbine blades, of up to 40 metre length.

Delivery of Transformer

The transformer will also require delivery by HGV.

Holding Down Bolts

Additional deliveries of turbine components will include delivery of the hub and the holding down bolts.

Formwork and Reinforcing Steel

Formwork and reinforcing steel will be required for the concrete bases.

Mobile Crane Delivery and Removal

Mobile crane parts, including ballast which will be delivered and removed by HGVs.

Other Deliveries

Deliveries of road stone, cabling, geogrid and also of sand for the cable trenches will generate HGV traffic.

Workforce Traffic

The construction period will also generate demand in terms of construction workforce access. Throughout the construction, there will be some variation in the number of workers on site. It is estimated that up to 20 construction workers will be employed on site at any one time.

General Site Traffic

The construction stage will also generate site traffic in addition to HGV movements and workforce traffic. The general site traffic accounts for visitors and general service vehicles to the site.

4.8.1.3 Construction Traffic

4.8.1.4 Estimate of Traffic Generation During Construction

The construction phase will involve approximately 1000 HGV trips over a 6 month period. This will equate to an average of 6 HGV trips per day with a peak of between 30 and 40 trips during certain construction activities i.e. delivery of crushed stone and delivery of ready mix concrete.

It is estimated that construction staff will generate a peak of approximately 50 car/light goods vehicles (LGV) trips per day.

4.9 Potential Construction Phase Impacts

4.9.1 General

This section addresses potential construction phase impacts, and potential nuisance to the local community, including emissions to air such as dust, noise and vibration, construction traffic (including oversized deliveries and night time working) and poorly controlled construction waste. Surface water runoff from the site during periods of heavy rainfall, and leaks or spills from construction plant and equipment, have the potential to impact on the quality of soils, surface water and groundwater. These impacts are addressed in **Chapter 11 Soils, Geology, Surface Water and Groundwater**.

Potential construction phase impacts are also addressed in other chapters of this EIS. For example the construction phase noise and vibration impacts and construction phase impacts on air quality and climate are addressed in **Chapters 9 and 10 Noise and Vibration and Air Quality and Climate**, respectively. Potential impacts of construction on flora and fauna are addressed in **Chapter 7 Flora and Fauna**.

4.9.2 Construction Traffic

The annual average daily traffic (AADT) figure for the R445 (the old Dublin Road), which runs to the south of the National Technology Park, is approximately 17,000. The proposed construction traffic peak levels (staff plus 30-40 trucks), will equate to a less than one percent increase in traffic. Overall, the impact of construction traffic on the local road network will be very slight.

The most likely location from which the turbine components could be transported to the site is from Foynes Port, County Limerick. A brief summary of this route is outlined below. Prior to any development commencing on site, a full transportation plan will be prepared, and the schedules will be agreed with the relevant engineer in the Roads Section of Limerick County Council, and will include consultation with any other County Councils affected by the transport route.

Other possible locations, from which the turbine components could be transported, are:

1. *From Cork Harbour at Ringaskiddy,*
2. *From Dublin Port.*

Foynes Harbour to Turbine Site

From Foynes Port, the proposed route to the turbine site would be along the N69 until it meets the Limerick Southern Ring Road at the N69/N18 junction. From here, the route would continue eastwards along the N18 and the M7 until arriving at the M7/R445 interchange. From here the route would exit onto the old Dublin Road (R445) and run westward towards the Vistakon site. The route would turn off at Annacotty Roundabout onto Plassey Park Road where it would arrive at the Vistakon site. Based on a preliminary investigation of this route, it appears to be feasible, with the following points to note:

When exiting Foynes Port, it would be preferable to use the Port Access Road, which gives access to the N69 at a point which is east of the town of Foynes itself, negating the need to exit from the Port within the town centre. The junction of the Foynes Port Access Road and the N69 would likely require some localised works, entailing the temporary removal of some signage and possible some lighting columns, as it currently has a left-slip onto the N69 which would not be capable of accommodating the swing of the vehicles transporting the turbine blades without some localised adaptation works.

Some sections of the N69 have narrow width, an absence of hard shoulders, and some poor horizontal alignment, e.g. there are some poor bends/restricted widths at Barrigone, Boherboy, Glenamede, Kildimo and Ferrybridge. The N69 also passes through some villages along the route (Ferrybridge, Kildimo, Clarina (where there is a small roundabout)).

With regard to traffic management along the N69, the entire width of the N69 would theoretically be available under an appropriate traffic management plan.

However, the roundabout in Clarina may require some works to enable vehicle travel – this would entail the temporary removal of some bollards, landscaping, etc. A preliminary AutoTrack (a vehicle tracking software programme for vehicle swept path analysis) assessment for HGVs transporting 40m turbine blades was carried out for the roundabout at Clarina. The assessment indicated that routing via this junction is feasible, possibly subject to some localised works. Refer to **Figure 4.1**.

M7/R445 Interchange – The issue here would be the HGVs turning left at the roundabout to use the R445 old Dublin Road. Some works may be required here to enable the HGVs make this left-turn movement, perhaps affecting some services which may be present adjacent to the roundabout kerb. However, this could be avoided by the vehicles transporting the turbine components continuing to travel around the roundabout instead of turning left immediately. This will reduce the severity of the angle they will be approaching the exit onto the R445. This can be

seen on the preliminary vehicle tracking assessment undertaken, which shows the transporting vehicles routing around the interchange roundabout, and approaching the exit to the R445 at a better angle. Refer to **Figure 4.2**.

The route westwards along the R445 old Dublin Road is in good condition and has good width, so there will not be any issue.

The feasibility study indicated that access within the National Technology Park will not pose significant difficulties. The junction at the Annacotty Roundabout junction has been subject to a preliminary assessment using AutoTrack and appears to have a good enough standard/width, etc. to enable HGVs to turn into Plassey Park road. It may however require minor temporary widening to allow manoeuvring of the expected large oversized loads. Some street furniture and small signage may also require temporary removal. Refer to **Figure 4.3**.

The proposed access point from Plassey Park Road into the site itself has been assessed using AutoTrack, and no constraints were identified.

For road safety reasons there may be a requirement for temporary local road closures during transportation of abnormal loads to the site (e.g. the turbine rotors). Road closures, if required, will be of temporary and of short duration (refer also to **Section 4.10.6 Construction Traffic Mitigation Measures**).

No significant road works are predicted to be required to facilitate the delivery of turbine components to the site. Prior to construction, the selected turbine manufacturer will carry out a route assessment for the transportation of their particular components.

4.10 Construction Phase Mitigation Measures

4.10.1 General

Every reasonable effort will be made to ensure that any detrimental environmental effects will be minimised during the construction phase of this project. A construction environmental management plan will be prepared and implemented with the objective of keeping disruption and nuisance to a minimum. The plan will have regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, *Environmental Good Practice on Site*, CIRIA 2005.

4.10.2 Dust Minimisation

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with ambient conditions including rainfall, wind speed and wind direction. Refer to **Chapter 10 Air Quality and Climate** for an outline of the dust minimisation plan.

The dust minimisation plan will be reviewed at regular intervals during the construction phases to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust nuisance through the use of best practice and procedures.

4.10.3 Noise and Vibration

Construction noise will be kept to a minimum in accordance with BS 5228. Construction-phase noise impact is described in **Chapter 9 Noise and Vibration**, of this EIS.

It is anticipated that no significant vibration will be generated during the construction phases of the project.

4.10.4 Construction Waste Management

4.10.4.1 General

Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery and finally disposal to landfill.

This hierarchy will be implemented by identifying opportunities to firstly prevent waste from being produced, and secondly minimise the amount of waste produced. Where prevention and minimisation will not be feasible, ways to reuse or recycle waste will be sought, preferably on-site to avoid the impacts arising from transportation. If this is not feasible, opportunities to reuse or recycle the waste off-site will be investigated. If this is not feasible, then waste will be sent to an energy recovery facility, and only where there is no alternative, will waste be disposed of to landfill. To achieve this, existing waste management programmes and networks will be used such as the National Waste Prevention Programme (implemented by the Environmental Protection Agency) and material exchange networks, for example 'Freecycle'.

All waste removed from the site will be collected only by contractors with valid waste collection permits (under the Waste Management (Collection Permit) Regulations 2001 as amended). All facilities to which waste will be taken will be audited in advance, to ensure that they have appropriate waste licences or permits allowing them to accept the type of waste that is to be sent there (under the Waste Management Act 1996 as amended by the Protection of the Environment Act 2003, and the regulations thereunder). Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. Hazardous waste will be managed in accordance with the Waste Management (Hazardous Waste) Regulations 1998 and 2000.

4.10.4.2 Waste Arisings

In general construction waste materials may include general construction debris, scrap timber and steel, machinery oils and chemical cleaning solutions. In addition, the practice of excessive purchase of materials and equipment to allow for anticipated wastage will be avoided.

Typically, excavated material that is unsuitable for use as engineering backfill will be re-used on site as fill material. Soil which is not re-used will be disposed of to an appropriate permitted site. In the unlikely event of any evidence of soil contamination being found during work on site, the appropriate remediation measures will be employed. Any work of this nature would be carried out in consultation with, and with the approval of the Environmental Protection Agency and the Environmental Department of Limerick County Council.

4.10.4.3 Waste Management Plan for the Construction Phase

The Contractor will be required to develop, implement and maintain a Waste Management Plan during the construction works. A senior manager will be responsible for the waste management plan. The manager will be competent in waste management, and will receive training, where necessary, such as the CIF/FÁS Construction and Demolition Waste Management module.

The key principles underlying the plan will be to minimise waste generation and to segregate waste at source. The measures to achieve these aims include:

- Ordering of appropriate quantities of materials, with a just-in-time philosophy.
- Immediate and careful storage of materials delivered to the site.
- Storing materials which are vulnerable to damage by rain under cover and raised above the ground.
- Careful handling of materials, using appropriate equipment, to avoid undue damage.
- Designation of separate storage areas for different types of waste, in order to maximise the reuse and recycling potential of the waste.

The Waste Management Plan will outline how residual waste will be handled as follows:

- The identification of disposal sites.
- The identification of quantities to be excavated and disposed of and classification of this material.
- The identification of measures to prevent nuisance, etc.
- The identification of the amounts intended to be stored temporarily on site and the location of such storage.
- The contractor's approach to waste management.
- The names, roles, responsibilities, and authority of the key personnel involved in the waste management.

The Waste Management Plan will include documented procedures for dealing with waste management including liaison with third parties, statutory undertakers and other companies.

The Waste Management Plan will meet the requirements of the voluntary initiative by the construction industry. The National Construction and Demolition Waste Council (NCDWC) prepared these requirements. The NCDWC has been established by the Forum for the Construction Industry.

4.10.4.4 Site Tidiness

The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:

- A regular program of site tidying will be established to ensure a safe and orderly site.
- Scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind.
- Food waste will be strictly controlled on all parts of the site.
- Loaded lorries and skips will be covered.
- Surrounding roads used by trucks to access to and egress from the site will be inspected regularly and cleaned, using an approved mechanical road sweeper, when required.
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

4.10.5 Surface Water and Groundwater

The River Mulkear is located approximately 250m to the east of the site of the proposed wind turbine, and the River Shannon is located approximately 750m to the north. The Office of Public Works online flood hazard mapping (www.floodmaps.ie) indicates a history of flooding in the vicinity of the Vistakon facility. A flood protection earthen bund runs from the rear of Vistakon facility and follows the River Mulkear to its junction with the River Shannon.

A temporary interception drain will be put in place for the duration of the construction period in order to collect any surface water runoff from the site and to prevent any surface water runoff from entering the Mulkear River. The interception drain will be located between the construction site and the Mulkear River. Surface water runoff collected in the interception drain, and water which may require pumping from the excavation for the turbine foundation will undergo a silt removal process in order to meet the conditions of the Vistakon IPPC licence (refer to **Section 1.6.7**) prior to being discharged to the existing Vistakon surface water drainage network. Surface water from the Vistakon facility is discharged to the River Mulkear in compliance with the conditions of its IPPC licence.

The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off or groundwater. The Construction Industry Research and Information Association (CIRIA) in the UK has issued a guidance note on the control and management of water pollution from construction sites, *Control of Water Pollution from Construction Sites, guidance for consultants and contractors* (Masters-Williams et al 2001).

The guide is written for project promoters, design engineers and site and construction managers. It addresses the main causes of pollution of soil, groundwater and surface waters from construction sites and describes the protection measures required to prevent pollution of groundwater and surface waters and the emergency response procedures to be put in place so that any pollution, which occurs, can be remedied. The guide addresses developments on green field and

potentially contaminated brownfield sites. The construction management of the site will take account of the recommendations of the CIRIA guidance to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Site activities considered in the guidance note include the following:

- excavation
- earthmoving
- concreting operations

Additional specific guidance is provided in the CIRIA technical guidance on *Control of Water Pollution from Linear Construction Projects* (Murnane E, Heap A and Swain A 2006).

Surface run-off from wheel washing areas can contain of pollutants such as:

- detergents
- oil and fuel
- suspended solids
- grease
- antifreeze

Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters include:

- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded.
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site.
- In principle, soil excavation will be completed during dry periods and undertaken with backacters and dump trucks. Topsoil and subsoil will not be mixed together.
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access.
- Run-off will not be allowed to enter surface water drains, surface water or groundwater.
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land.
- Minimise the use of cleaning chemicals.
- Use trigger-operated spray guns, with automatic water-supply cut-off.
- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt.

- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.
- Use catchpots or silt traps on drains and ensure that they are in place during cleaning. Empty them at regular intervals.

In addition to the above construction mitigation measures, if flooding is predicted during the construction phase, construction activities will cease and the site will be prepared by the removal of any material which would pose a risk of contaminating the flood water. Construction would resume when the risk of flooding had passed. This will ensure that there will be no risk of pollution to the River Mulkear. In addition, there is a flood barrier along the entire bank of the Mulkear River in the vicinity of the site. Any run off from the site would be prevented by the flood barrier from entering the river. There is no potential for surface water runoff during construction to enter the Mulkear River. In a major flood, which overtopped the flood barrier, the river would be full of silt, so the contribution from the site would be insignificant.

4.10.6 Construction Traffic Mitigation Measures

- The construction management plan will address construction traffic management.
- In addition, prior to any development commencing on the site, a transportation plan will be prepared which will be agreed with Limerick County Council Roads Section Engineers. Any other county councils, affected by the transport route, will also be consulted. The detail of works to be undertaken on roads, if required to facilitate the transportation of the turbine and its components will be included in the Plan.
- Any road closures, if required, for the transportation of abnormal loads to the site will be of a short duration and will only be for the duration of the transportation of these components.
- Construction traffic will be temporary and of short duration.
- The Garda Síochána and local residents will be given advance notice of the above closures, should they be required.

4.11 Residual Impacts

It is anticipated that with proper management, there will be no significant environmental impacts as a result of the construction of the proposed development. Any impacts likely to occur will be of a temporary nature.

4.12 Commissioning

Following completion of construction and installation of equipment, and before operation commences, testing and commissioning will be undertaken. This will comprise:

- Installation compliance checks.
- Commissioning tests.
- Performance demonstration tests.

4.12.1 Installation compliance checks

This will be a process of systematically checking that all systems and equipment have been constructed, assembled, aligned and installed correctly, in accordance with the design specifications and drawings, and that all interconnecting pipe work, cabling and wiring has been installed in compliance with the design specifications and drawings.

4.12.2 Commissioning and Performance Demonstration tests

The wind energy system will be tested and verified, as being in accordance with the design and specifications. The control system and instrumentation will be tested to demonstrate that they are functioning correctly. Following these tests, each system will be checked to ensure that it is ready to be commissioned under operating conditions.

4.13 References

The Construction Industry Research and Information Association (CIRIA), (2005) *Environmental Good Practice on Site*, UK

The Construction Industry Research and Information Association (CIRIA), (2001) *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors*, UK.

Masters-Williams et al (2001) *Control of Water Pollution from Construction Sites, guidance for consultants and contractors*.

5 Planning and Policy

5.1 Introduction

This chapter outlines the statutory land use development and planning policy context of the proposed wind turbine at Vistakon. The proposed development is examined in the context of the policies and objectives of the documents below, which address energy policy guidance at European Union, national and local level.

International Commitments and Guidance

- *Kyoto Protocol to the United Nations Framework on Climate Change 1997*
- *Climate Change 2007: Mitigation of Climate Change, Intergovernmental Panel on Climate Change*

EU Directives and Policy Guidance

- *EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources*
- *EU COM (2007) 1 Final: An Energy Policy for Europe*

- *EU COM(2013) 169 Final: Green Paper: A 2030 framework for climate and energy policies*

Irish National Policy, Objectives and Guidance on Energy

- *National Development Plan 2007 to 2013*
- *Strategy for Renewable Energy: 2012 – 2020*
- *National Climate Change Strategy (2007 to 2012)*
- *Delivering a Sustainable Energy Future for Ireland – The Energy Policy Framework 2007 to 2020*
- *National Energy Efficiency Action Plan 2009*

Regional Planning Guidance

- *Mid West Regional Planning Guidelines 2010 to 2022*

Local Policy Guidance

- *Limerick County Development Plan 2010-2016*
- *Castletroy Local Area Plan 2009-2015*
- *Limerick 2030 – An Economic and Spatial Plan for Limerick (June 2013)*

5.2 International Commitments and Guidance

5.2.1 Kyoto Protocol to the United Nations Framework Convention on Climate Change (1997)

The Kyoto Protocol aimed to reduce worldwide greenhouse gas emissions to 5.2% below 1990 levels in the period 2008 to 2012. The Kyoto Protocol set specific emissions reduction targets for each industrialised nation, but excludes developing countries.

To meet their targets, most ratifying nations had to combine several strategies, such as:

- Place restrictions on their biggest polluters.
- Manage transportation to limit or reduce vehicle emissions.
- Make better use of renewable energy sources and displace the use of fossil fuels.

Conformance of the Project to Policy Objectives

The proposed Vistakon wind energy project will lead to a reduction in the emission of greenhouse gases (arising from the generation of electricity from fossil fuels), and will displace the use of fossil fuels.

5.2.2 Climate Change 2007: Mitigation of Climate Change

This report is the contribution from Working Group III towards the Intergovernmental Panel for Climate Change publication, the Fourth Assessment Report. It is designed to inform policy makers of the relative impacts of different

activities on climate change and to identify any activities that help reduce overall emissions. Displacement of power generation using fossil fuels by other methods of power generation is one of the activities identified in the report.

Conformance of the Project to Policy Objectives

The proposed Vistakon wind energy project will lead to a reduction in the generation of greenhouse gases (arising from the generation of electricity from fossil fuels), and will displace the use of fossil fuels.

5.3 European Union Directives and Policy Guidance

5.3.1 EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources

Directive 2009/28/EC on the promotion of the use of energy from renewable sources is part of a package of EU energy and climate change legislation which provides a legislative framework for EU targets for greenhouse gas emission savings. It encourages energy efficiency, energy consumption from renewable sources, the improvement of energy supply and the economic stimulation of the renewable energy sector in Europe.

This Directive establishes a common framework for the production and promotion of energy from renewable sources. Each member state has a target calculated according to the share of energy from renewable sources in its gross final consumption for 2020. This target is in line with the overall “20-20-20” goal for the Community, i.e. 20% reduction in greenhouse gas emissions, 20% improvement in energy efficiency and 20% increased share of renewables in the energy mix by 2020. The share of energy from renewable sources in the transport sector must amount to at least 10 % of final energy consumption in the sector by 2020.

The member states must establish national action plans which set the share of energy from renewable sources consumed in transport, the production of electricity and in heating, for 2020. These action plans must take into account the effects of other energy efficiency measures on final energy consumption (the higher the reduction in energy consumption, the less energy from renewable sources will be required to meet the target). These plans must also establish procedures for the reform of planning and pricing schemes and access to electricity networks, promoting energy from renewable sources.

Conformance of the Project to Policy Objectives

The proposed project will contribute to achieving Ireland’s 20-20-20 goal under the Directive by reducing greenhouse gas emissions and increasing the share of renewable energy in the energy mix.

5.3.2 EU COM (2007) 1 Final: An Energy Policy for Europe

The EU Commission issued a communication in early 2007 that outlined, for the first time, a comprehensive energy policy for Europe. The policy aims to develop long-term secure, sustainable and competitive energy for Europe, with the core energy objective being to reduce greenhouse gas emissions by 20% by 2020 (or 30% with international consensus). This deliberately draws the link between

greenhouse gas emissions and energy production. To achieve this objective, the Commission proposed further energy-related goals: improving energy efficiency by 20% and raising the share of renewable energy in the energy mix by 20%, all by 2020.

Conformance of the Project to Policy Objectives

The proposed project will contribute to achieving the goals of reducing greenhouse gas emissions and increasing the share of renewable energy in the energy mix.

5.3.3 EU COM (2013) 169 Final: Green Paper: A 2030 framework for climate and energy policies

The Green Paper is a consultation document to assist in the preparation of the policy framework for the period from 2020 to 2030. The Green Paper sets out the EU goals for climate and energy to be reached by 2030 and beyond. In section 1 the Green Paper summaries these goals:

“The framework should also take into account the longer term perspective which the Commission laid out in 2011 in the Roadmap for moving to a competitive low carbon economy in 2050, the Energy Roadmap 2050, and the Transport White Paper. The European Parliament has adopted resolutions on each of the Roadmaps¹. These Roadmaps were developed in line with the objective of reducing GHG emissions by 80 to 95% by 2050 compared to 1990 levels as part of necessary efforts by developed countries as a group. The scenarios in these Roadmaps suggested the following key findings:

- *By 2030 GHG emissions would need to be reduced by 40% in the EU to be on track to reach a GHG reduction of between 80-95% by 2050, consistent with the internationally agreed target to limit atmospheric warming to below 2°C.*
- *Higher shares of renewable energy, energy efficiency improvements and better and smarter energy infrastructure are "no regrets" options for transforming the EU's energy system.*
- *For renewables, the policy scenarios in the Energy Roadmap 2050 indicate a share of around 30% in 2030.*
- *Significant investments are needed to modernise the energy system, with or without decarbonisation, which will impact the energy prices in the period up to 2030.”*

In section 2 the Green Paper also presents a good summary of EU energy and climate change policies to 2020.

- “(1) an EU based target for GHG emission reductions of 20% relative to emissions in 1990;*
- (2) a 20% share for renewable energy sources in the energy consumed in the EU with specific target for the Member States;*
- (3) 20% savings in energy consumption compared to projections.”*

Conformance of the Project to Policy Objectives

The proposed project will contribute to achieving the goals of reducing greenhouse gas emissions and increasing the share of renewable energy in the energy mix.

5.4 Irish National Policy, Objectives and Guidance on Energy

5.4.1 Strategy for Renewable Energy: 2012 – 2020

In May 2012 the Department of Communications, Energy and Natural Resources published the strategy document Strategy for Renewable Energy: 2012 – 2020. In sections 1.1 and 1.2, the strategy recognises the crucial importance of renewable energy in achieving the Government's policy of reducing greenhouse gas emissions and reducing dependency on imported fossil fuels,:

"....Renewable energy, allied with energy efficiency, is crucial to our goals of secure sustainable and competitive energy supplies reducing dependency on expensive fossil imports and underpinning the move towards a low carbon economy. Energy Policy has a pivotal role to play in creating the conditions for job creation and a return to economic growth."

- 1.2 *The development of renewable energy is central to overall energy policy in Ireland. Renewable energy reduces dependence on fossil fuels, improves security of supply, and reduces greenhouse gas emissions creating environmental benefits while delivering green jobs to the economy, thus contributing to national competitiveness and the jobs and growth agenda. Climate change, energy security and competitiveness are inter-related challenges that will be addressed through the transforming of Ireland's economy from one based on a predominantly import based fossil fuel dependence to a more indigenous low carbon economy based around energy efficiency, renewable energy and smart networks."*

The development of renewable energy is necessary for Ireland to meet its obligations under EU energy policy:

- "1.10 The Government firmly believes that the development and deployment of Ireland's abundant indigenous renewable energy resources, both onshore and offshore, clearly stands on its own merits in terms of the contribution to the economy, to the growth and jobs agenda, to environmental sustainability and to diversity of energy supply. In addition, and in support of the Government's own energy policy objectives, Ireland is committed to delivering on its obligations under European Union Energy Policy which include the binding national target for renewable energy by 2020."*

The strategy sets out five strategic goals, the first of which relates to wind power. These goals are explained in section 2.

"Strategic Goals for Renewable Energy

- 2.1 *The Government's overarching strategic objective is to make renewable energy an increasingly significant component of Ireland's energy supply by 2020, so that at a minimum we achieve our legally binding 2020 target in the most cost efficient manner for consumers. Of critical importance is the role which the renewable energy sector plays in job creation and economic activity as part of the Government's action plan for jobs.*

2.2 *Underpinning the Government's energy and economic policy objectives are the following five Strategic Goals reflecting the key dimensions of the renewable energy challenge to 2020.*

2.3 ***Strategic Goal 1***
Progressively more renewable electricity from onshore and offshore wind power for the domestic and export markets."

Conformance of the Project to Policy Objectives

The proposed project will contribute to achieving the goals of producing more electricity from onshore wind and increasing the share of renewable energy in the energy mix.

5.4.2 National Renewable Energy Action Plan Ireland

Irish National Renewable Energy Action Plan was published by the Government in 2010. The Plan was submitted to the EU to fulfil a requirement under Article 4 of Directive 2009/28/EC on the promotion of the use of energy from renewable sources. The Plan sets out the actions to be taken to achieve Ireland's targets for 2020 under the Directive. Section 1 of the plan presents a summary of the Government's national renewable energy policy. Table 3 of the plan gives the national 2020 target and estimated trajectory of energy from renewable sources in heating and cooling, electricity and transport. In the Plan the Government has committed to the binding target, that by 2020 42.5% of Ireland's electricity will come from renewable sources.

Conformance of the Project to Policy Objectives

The proposed project will contribute to achieving the goals of reducing greenhouse gases and increasing the share of renewable energy in the energy mix to 42.5% by 2020.

5.4.3 National Development Plan 2007 to 2013

The National Development Plan sets out a programme of integrated investments that will underpin the Country's objective of growth that is economically, socially and environmentally sustainable. It follows on from the previous National Development Plan 2000 to 2006. However, the 2007 – 2013 plan has a greater focus on the necessary infrastructure which will be important in attracting investment and ensuring progress.

The NDP highlights that Ireland has significant renewable energy resources available but their large-scale exploitation continues to require support and intervention by policy makers because of the investment costs and risks entailed. This intervention is required across the three principal energy sectors: electricity, heat and transport and in the industrial, public, commercial and domestic sectors.

The 2020 target for the share of electricity produced from renewable energy sources and targets for renewable heat and transport sectors will be finalised in the context of the Energy Policy Framework and in the light of EU developments.

Conformance of the Project to Policy Objectives

The proposed project will increase the share of electricity produced from renewable energy resources, in line with the targets set out in the National Development Plan.

5.4.4 National Climate Change Strategy 2007 to 2012

The National Climate Change Strategy details the proposed measures to be taken by Ireland to limit the emissions of greenhouse gases such as carbon dioxide, methane, oxides of nitrogen, and certain fluorinated gases from all sectors of the economy to meet its 2008 to 2012 commitment. It also demonstrates how these measures position the nation for the post-2012 period, identifying the areas in which further measures are being researched and developed to enable the eventual 2020 commitment to be met.

The Strategy supports the production of energy from non-fossil fuel sources, displacing the carbon dioxide emissions associated with those sources.

Conformance of the Project to Policy Objectives

The proposed project will lead to a net reduction in greenhouse gas emissions, in line with the objectives of the Strategy.

5.4.5 Delivering a Sustainable Energy Future for Ireland: The Energy Policy Framework 2007 to 2020

The primary objective of the National Energy Policy is security of supply, environmental sustainability and economic competitiveness. The three key pillars of the plan are enhancing the security of energy supply, the environmental sustainability of energy supply and economic competitiveness. It is an objective of the Government to achieve 33% of the country's electricity consumption from renewable sources by 2020 with 15% the target for 2010. In this respect, Ireland set a target to increase the capacity of renewable energy based electricity generation capacity to at least 1,450 megawatts installed.

Conformance of the Project to Policy Objectives

The proposed project will contribute to the three key energy pillars of enhancing the security of energy supply, the environmental sustainability of energy supply and economic competitiveness.

5.4.6 National Energy Efficiency Action Plan, 2009

This policy document details the range of actions to which the Government is currently committed across all sectors of the economy. It includes reference to the implementation of the EU 'cap and trade' greenhouse gas emissions trading scheme in Ireland. The industrial sector accounts for approximately 37% of the National Allocation Plan for greenhouse gas emissions.

Conformance of the Project to Policy Objectives

The reduction in carbon emissions that will be associated with the proposed project is in line with the objectives of this Plan.

3.9.1 A Strategy for Growth: Medium-Term Economic Strategy 2014 – 2020

This strategic policy document sets out to build and sustain a competitive economy, with objectives of full employment, tackling household debt and mortgage arrears, providing opportunities for work, having well-managed public finances and a stable and effective banking system, protecting the vulnerable in society, eliminating poverty, and providing appropriate public services.

Conformance of the Project to Policy Objectives

The project will help to secure existing employment in Vistakon, and make the facility more competitive for future expansion and economic growth. This is in line with the objectives of the Strategy.

5.5 Regional Policy Guidance

5.5.1 Regional Planning Guidelines 2010 to 2022

The current Regional Planning Guidelines for the South-West Region were made by the South-West Regional Authority on 2010. The south-western region covers Clare, Limerick City and County and North Tipperary. The Regional Planning Guidelines address the key issues affecting the development of the region, such as population and settlement; economic and employment trends; industrial and commercial development; transportation; water supply and waste water facilities; energy and communications; education, healthcare, retail and community facilities; environmental protection. In addition, they have taken account of the changed global and national economic environment, new and updated planning and environmental policies and legislative requirements relating to strategic infrastructure, strategic environmental assessment, potential impacts on habitats, flood risk assessment etc.

The purpose and role of the Guidelines are explained thus in the Foreword:

“The Guidelines offer a long term strategic planning framework for the Mid-West Region and have been developed through a collaborative process involving elected representatives, Local Authorities and other public bodies in the region, private sector and civil society organisations and members of the public.

The Guidelines are set within the overall policy framework established by the National Spatial Strategy first adopted in 2002 and updated in 2010 and the National Development Plan 2007-2013. They also reflect other national social, economic and environmental policies which affect the Mid-West Region, as well as a range of existing regional strategies such as the regional Climate Change Strategy, the regional Waste Management Strategies and the County and City Development Board Strategies. The Guidelines set clear objectives and targets which will guide the preparation and reviews of City and County Development Plans in the Mid-West Region.

Chapter 2 of the Guidelines describes the Guidelines in context. Section 2.2.3 'Energy and Government' of Chapter 2 of the Guidelines states that:

“Renewable and sustainable energy lie at the heart of the Government’s environmental and economic policies. Accordingly, the Vision stated in the Guidelines proposes that; “the high potential of the Region for the provision of renewable energy including bio-energy and other green technologies including bio-technologies would be harnessed to the benefit of the economy and the environment alike.” and that “the Mid-West Region is particularly well-placed to make use of these policies with a wide range of renewable energy generating resources such as wind and wave power”

Chapter 3 of the Guidelines (Section 3.1.2) states that:

“County Limerick also has the potential to produce many forms of renewable energy, particularly tidal, wind and bio-energy. If this opportunity is properly availed of it can provide a significant contribution to the future development of the County.”

With regard to economic development, the Guidelines (Page 28 of Chapter 2) also state:

“The Shannon Development Knowledge Network (a cluster of five technology business parks linked with third level institutions in the Region) supports the development and growth of technology-driven enterprise, associated with linkages to third level colleges in the Mid-West including:

- *National Technology Park and the University of Limerick (UL),*
- *Tipperary Technology Park and Tipperary Institute,*
- *Ennis Information Age Park.*

These, together with the inputs of other educational institutions and locations, provide a strong base for new and emerging technologies.

Industrial employment trends have shown substantial growth over the past decade. However, according to the Forfás annual survey of employment in 2007, there was a decline in employment in all Foreign Owned industrial businesses in the Region from 18,509 jobs in 2002 to 17,333 jobs in 2008. Irish owned industries declined slightly from 11,026 to 10,957 in 2008.

According to the analysis by Forfás, employment growth in all sectors in the Mid-West was 34% from 1998 to 2007, compared to 40% nationally with a higher proportion of the Mid-West’s workforce employed in the manufacturing and industrial sector than any other region in the country (17.5% compared to 13.9% nationally). This makes the Mid-West Region more vulnerable to employment shocks in these sectors.

Over the period 2007/2008, the Region continued to attract investment in high growth potential sectors including Medical Devices, ICT Services and

broader Internationally Traded Services activities and recorded the highest number of Enterprise Ireland supported start ups of all regions in 2007. Recent events, including those in the manufacturing and construction sectors, have severe implications for future employment in the Region and the likely levels of unemployment that may arise.”

Economic Development, Section 2.7.2 of the Guidelines states:

“The key economic development issues relate to:

- the need to respond to the major employment losses associated with the downturn in the construction sector and job losses in major export-led enterprises;*
- the need to provide appropriate enterprise land with adequate water and wastewater services to accommodate those enterprise sectors in which the Region has competitive advantage;*
- the need to create a vibrant city centre with high levels of enterprise activity;*
 - the need to provide the infrastructure needed to attract investment into the Region;*
 - the need to create stronger linkages between Higher Education Institutes (HEIs), Research and Development (RandD) in the private sector and enterprise development;*
 - the need to develop a critical population and labour force mass by integrating the cities of Galway, Limerick and Cork and the corridors between them;*
 - The need to promote an additional corridor that has the same potential for economic development in the Limerick to Waterford corridor;*
 - the need to develop the tourism potential of the Region;*
 - The need to facilitate the development of enterprise in rural areas.”*

Section Chapter 4 Economic Development states:

“The ultimate economic development goal for the Mid-West Region is that it would contain a broad range and distribution of sustainable enterprises incorporating a wide range of activities utilising the Region’s particular strengths”

Section 2.7.5 of the Guidelines Conserving and Enhancing Environmental Qualities states that:

“The Region is well supplied with areas of high amenity. The principal issues regarding the conserving and enhancing of environmental qualities from a regional perspective include;

- *The development of well-based collaborative processes for managing natural resources that cross county and regional boundaries;*
- *Developing common approaches to managing key environmental assets including groundwater, surface water, Natura 2000 sites and other habitats as well as air quality while acknowledging the primary role of individual Local Authorities in this work;*
- *The protection and enhancement of water quality in line with the Water Framework Directive and River Basin Management Plans;*
- *Improvement of the quality of drinking water at certain locations;*
- *Maintenance of the quality of drinking water where it is satisfactory at present;*
- *Managing flood risk is also a key planning and development challenge, particularly as there area multiplicity of agencies managing the Shannon River System;*
- *Maintaining the architectural heritage and improving the design quality of new developments.”*

Conformance of the Project to Policy Objectives

The proposed project will be an individual turbine on an industrial premises. The proposed project will enhance the security, environmental sustainability and economic competitiveness of the energy supply to Vistakon. The project will help to safeguard the presence and potential future expansion of Vistakon in Castletroy, thus furthering the policies and objectives of the guidelines in relation to economic development and renewable energy.

5.6 Local Policy Guidance

The proposed turbine will be located on the Vistakon facility, which is located in County Limerick. The *Limerick County Development Plan 2010-2016*, the *Draft Limerick 2030 – An Economic and Spatial Plan for Limerick*, and the *Castletroy Local Area Plan 2009-2015* are the relevant statutory plans.

5.6.1 Limerick County Development Plan 2010-2016

5.6.1.1 Overall Economic Development Policy

Limerick County Council’s policies for economic development are based on the following principles:

“The overall goal of the Planning Authority is to ensure sustainable economic development. This means that land uses are facilitated to nurture economic enterprise and allow it to function and expand as may be

necessary, in such form and pattern that is sustainable in environmental, social and economic terms.

The Planning Authority's chief responsibilities in respect of economic development are:

A. To ensure that economic development is located and of a form that does not have adverse environmental impacts: this is achieved through policy and development management standards and guidelines;

B. To protect and facilitate through land use zoning, service priorities, and critical interventions, the range of land uses and developments required to sustain and improve the economy in real terms."

Limerick County Council's specific Policies on Employment and Economic activity are as follows (Chapter 5 of the Plan, Pages 4 and 5):

Policy ED P1: Adequate provision of serviced and zoned lands

Ensure that adequate provision is made in terms of objectives and measures, to contribute in an effective way to employment targets within the County. This will include making sure there is adequate quantity and range of serviced and zoned lands in appropriate locations.

Policy ED P2: Hierarchy of employment centres in concordance with settlement strategy

Complement the aims of the settlement strategy and hierarchy in a mutually reinforcing and sustainable manner through a hierarchy of employment centres established at Regional, County, and local centres.

Policy ED P3: Protect the County's resource base

Protect the County's resource base from inappropriate land uses, and promote practices to secure the long-term future of natural and cultural resources.

Policy ED P4: Recognise local economic activity

Recognise the contribution of home-based economic activity, small scale community enterprise, rural activities based on resources in situ, artisan workshops, local services, education and tourism and recreation projects and facilities to enhance local economies.

Policy ED P5: Retail development

Ensure that retail development, complies with the recommendations of the Joint Retail Strategy for the Mid West Region, 2010-2016 and any subsequent amendments thereof.

Policy ED P6: Tourism development

Facilitate measures to improve the tourism product of Limerick County in tandem with Shannon Development, the Shannon Regional Tourism Board, Fáilte Ireland and local development agencies.

Policy ED P7: Integrated planning of the Shannon estuary

Facilitate integrated planning to develop the capacity of the Shannon estuary as a prime transport and tourist asset and to protect all its other beneficial uses.

Policy ED P8: Infrastructural capacity

Improve infrastructural capacity, taking a strategic approach to ensure that infrastructure serves the requirements for economic development in a timely and cost effective manner.

5.6.1.2 Objectives by Industrial Sector

With regard to policies and specific objectives for the industrial sector, the County Development Plan states that for the **Secondary Sector: Industry and Enterprise** (Page 7 Chapter 5 of the Plan):

“Industry and enterprise together as sectors are crucial as drivers of economic growth. In this context, enterprise means small and medium scale businesses in light industry as well as in internationally traded services such as in software, telecommunications and financial services. These sectors play a leading role in improving Ireland’s versatility and technological advancement, giving it a greater competitive edge in international markets, and thereby creating revenue and employment.... It is reasonable to assume, for the purposes of this plan that provision will have to be made for 80% of the 20,500 projected new jobs in industry and enterprise: that is, up to 16,400 jobs will have to be provided for by 2022”. Refer to Page 7 of Chapter 5 of the Plan).

Policies relating to Industry and Enterprise are as follows:

Policy ED P9:

“Facilitation of range of sites for industry The Council shall facilitate and work pro-actively with development agencies to secure an adequate range of locations for both large scale and small-scale industrial development and for enterprise at key locations throughout the County in accordance with the settlement strategy.”

Policy ED P10:

“Ensuring no adverse environmental impacts The Council shall ensure that industry and enterprise are in an appropriate location and form for their

context, taking into account their likely impact on residential and other amenities, service and environmental carrying capacity.”

5.6.1.3 Policy Relating to Wind Energy

Limerick County Council’s wind energy strategy is contained in Chapter 8 of the Development Plan and is illustrated in Map 8.4 of the Plan which shows

“preferred areas, generally those with more stable mineral soils and closer to grid connections and outside designated sites, areas open to consideration, principally in the west and also areas which are not considered suitable for wind energy due to either scenic or ecological concerns” (Ch. 8 Page 33).

The Plan states that

“ecological issues are of huge concern in County Limerick with large areas of the southwest of the County designated as Special Protection Areas. The Council will seek to direct wind energy developments away from sensitive sites from both a visual and environmental perspective. The Council will be supportive of wind energy applications that take ecological concerns into account.”

The Development Plan contains a number of objectives relating to renewable energy, which are as follows:

“Objective IN O55: Support Renewable Energy Developments (Chapter 8 – Page 33)

“It is the objective of the Council to adopt a positive approach to renewable energy developments having regard to the following:

- a) the proper planning and sustainable development of the area;*
- b) the environmental and social impacts of the proposed development;*
- c) impact of the development on the landscape;*
- d) where impacts are inevitable, mitigation features have been taken into account or in the case of European conservation sites, the facilities will only be accepted if they comply with Article 6 of the Habitats Directive;*
- e) Protected areas – NHAs, SPAs and SACs, areas of archaeological potential and scenic importance, proximity to elements of the architectural heritage such as protected structures and architectural conservation areas, national monuments etc have been taken into account.”*

Objective IN O56: Siting of Renewable Energy Developments (Chapter 8 – Page 33)

“It is the objective of the Council to permit the siting of renewable energy developments in appropriate locations for each type of technology, bearing in mind the technology specific information required as detailed in Development Management guidelines Chapter 10.”

Objective IN O57: Pre-planning discussion (Chapter 8 – Page 33)

“It is the objective of the Council to facilitate early pre-planning discussion with providers of energy infrastructure and to support local community participation within this process.”

Objectives in the Plan which relate specifically to wind energy developments are as follows:**Objective IN O58: Siting of Wind Energy Developments:**

“(a) In considering the siting of renewable energy developments in terms of wind energy projects it is the objective of the Planning Authority to permit their siting in appropriate locations as identified in the Landscape Characterisation of the County and Wind Energy Strategy where judged to be in compliance with proper planning and sustainable development with the Development Guidelines for wind farms. These are drawn from the Department of Environment’s ‘Wind Energy Development Guidelines’ (DEHLG 2006) and the Planning Authority shall have regard to these in assessing planning applications.

(b) Surface drainage associated with access roads has to avoid raising the hydrographic peak in downstream rivers after rain events, and has to avoid reducing the water storage abilities of peatland areas and to have in place during the lifetime of the wind farm a storm water flow attenuation system to achieve no net increase in surface water run off to a 1:100 year storm event capacity.

(c) Areas open for consideration for wind energy applications shall be treated on their merits with the onus on the developer to demonstrate why the development should be granted permission. This category has been applied to areas with limited capacity to absorb wind development but which are sensitive enough to require a site by site and cumulative effects appraisal to ascertain the suitability of the area for development.”

(Chapter 8 – Page 34)

Objective IN O59: Individual Wind Turbines (Chapter 8 – Page 33):

“The Council will consider applications for individual wind turbines in areas designated not suitable for wind energy on Map 8.4 on industrial or education zoned lands and which are related to an existing development primarily to serve the energy needs of the applicant. Such applications will need to demonstrate that they will not detract from the amenity value of nearby residential areas and will be subject, where necessary, to the

provisions of Article 6 of the Habitats Directive which may require appropriate assessment of such developments. Such applications will also be subject to normal planning criteria.”

Conformance of the Project to Development Plan Policy Objectives

The proposed wind turbine is in conformance with the Limerick County Development Plan’s policies and objectives on wind energy projects, as follows:

- An assessment of the potential impacts of the proposed wind turbine on ecology in the vicinity of the site was undertaken during the preparation of the EIS. This is included as **Chapter 7 Flora and Fauna** of the EIS). In addition, screening for the requirement for an Appropriate Assessment was undertaken by Moore Group under Article 6 of the European Union Habitats Directive. The Screening for Appropriate Assessment report is included as **Appendix C** of the EIS.
- The environmental, residential amenity and social impacts of the proposed development are assessed in the various relevant chapters of the EIS.
- Impacts of the proposed turbine on the landscape are assessed in **Chapter 8 Landscape and Visual** of the EIS.
- Pre-planning discussions were held with the relevant planning authorities.

In relation to the siting of wind energy developments (see Objective IN 058 above), the area in which the Vistakon site is located is indicated on Map 8.4 of the Plan as “an area unsuitable for wind energy development.” However, the Plan indicates that the classification of areas regarding their suitability for renewable energy development “is in general form” and states that “in the absence of some forms of renewable energy such as small-scale hydro-schemes, the areas of the County that may be suitable can only be indicated in general form (Page 31 Section 8.5.4).”

- In relation to individual turbines, the proposed turbine is “related to an existing development primarily to serve the energy needs of the applicant” (see Objective IN 059 above).
- The proposed project will be in compliance with proper planning and sustainable development of the local area and will comply with the Department of Environment’s ‘Wind Energy Development Guidelines’ (DEHLG 2006).

5.6.1.4 Policy Relating to the Landscape

The Development Plan identifies ten different landscape areas in County Limerick, as shown on Map 7.4 of the Plan. The proposed development is located in the landscape character area ‘Shannon Integrated Coastal Management Zone’.

Objective EH O12: Shannon Coastal Zone Landscape Character Area

This objective states that:

“(g) this area is considered as being unsuitable for wind energy except for the townlands indicated in table 9.1 in Chapter 9” of the Plan, which are open for consideration for this form of development, subject to appropriate

assessment of wind energy development in this area on the adjacent European sites.

(h) Where wind farms are permitted it is recommended that single lines of equally spaced turbines shall be considered, in order to limit the visual and landscape impact."

The location of the proposed wind turbine does not lie within any of the townlands indicated in Table 9.1 of the Plan, mentioned above. The proposed development will comprise a single turbine, not a wind farm.

5.6.2 Castletroy Local Area Plan 2009-2015

The renewable energy development policy of the Castletroy Local Area Plan (LAP 2009-2015 is contained section 5.11 of the LAP. Section 5.11 of the LAP states that

"Limerick County Council will support renewable energy projects that can reasonably be provided. The Council also recognises that renewable energy provides an opportunity for the matching of local energy needs to local energy sources, and has the potential for local employment creation, economic development and for increasing local competitiveness".

Policy E1 Renewable Energy of the LAP (Page 64) is as follows:

POLICY E1: Renewable Energy

"The provision of renewable energy schemes, particularly from wind, solar and biomass resources, will be encouraged by the Council. Proposals will be considered against the following criteria, according to the scale and nature of the scheme:

- a) The proposed development would not have a detrimental effect on the environment and character of the Plan area, including visual impact and generation of emissions;*
- b) The development is located and designed in a manner which would be sensitive to the character of any buildings or landscapes affected;*
- c) The location of the scheme does not impinge on transport routes; and*
- d) The scheme does not cause unreasonable adverse effect on existing dwellings and business premises.*

Adequate supporting information, which assesses the extent of possible environmental effects and how they can be satisfactorily mitigated, will be required to accompany any planning application for this form of development.

Domestic scale Renewable Energy proposals will be encouraged by the Council where appropriate".

Enterprise and Employment

Objectives in the Local Area Plan in relation to economic development include the following

Objective 3: A Strong Local Economy

- *To promote Castletroy as a strategic location for Industry, first class educational facilities and high quality living environments to ensure the areas competitiveness;*
- *To designate sufficient zoned areas for commercial, retail and employment uses;*
- *To designate suitable areas zoned to encourage economic development providing a range of retailing and service opportunities for residents in the area;*
- *To encourage the regeneration of the District centre to support existing local businesses;*
- *To facilitate the provision of improved public transport infrastructure in order to provide better transportation for commuters and visitors; and*
- *To encourage the role of Castletroy as a local service centre for the surrounding area."*

Conformance of the Project to the Policies and Objectives of the Limerick County Development Plan and the Castletroy Local Area Plan.

The proposed wind turbine will be in conformance with the Castletroy Local Area Plan's policies and objectives, as follows:

- It is a renewable energy project,
- It will not have a detrimental effect on the environment and character of the Plan area,
- It will help to preserve local employment by securing jobs at Vistakon.
- It will improve the competitiveness of the Vistakon plant within the Johnson & Johnson group and relative to other manufactures of contact lenses.
- It will support the economic development of the area, by increasing the ability of Vistakon to attract further projects and investment within Johnson & Johnson.

5.6.3 Draft Limerick 2030 – An Economic and Spatial Plan for Limerick (June 2013)

This is the first economic and spatial plan for Limerick and sets a framework for public sector action and private sector investment until 2030. The Plan is published

as a draft document for public consultation and it is intended to incorporate the Plan into the Limerick City and County Development Plans.

The draft Plan comprises an economic strategy which identifies how Limerick can take advantage of economic opportunities to build a stronger local economy through the creation of employment and investment. It also includes a Spatial Plan, the main focus of which is to revitalise and redevelop Limerick City centre. The third element of the Plan is a marketing plan which aims to change perceptions of Limerick.

The objectives of the Economic Strategy are:

“Position Limerick as a competitive knowledge economy, known for its skills base excellence in high tech sectors;

- 1. Develop an outstanding environment for starting and growing new businesses;*
- 2. Create the conditions for long-term economic growth;*
- 3. Create a vibrant City Centre economy with a new mix of economic uses and a strong educational presence; and*
- 4. Maximise the local employment impact from development/regeneration”.*

The objectives of the Spatial Strategy are:

- 1. “To establish a 21st Century City Centre economy capable of competing with other European cities and leading the wider City, Metropolitan Area and City-Region economy;*
- 2. To reposition the City Centre as the premier regional shopping destination;*
- 3. To establish a unique tourism offer that takes full advantage of the City Centre’s special heritage and environmental characteristics;*
- 4. To make the City Centre once again a desirable place to live by improving the quality of the housing offer in the City Centre;*
- 5. To create a high quality and safe urban environment attractive to investors, employers, residents and tourists which generates a sense of pride in the City;*
- 6. To build upon the City Centre’s rich historic character by fully capturing this rich heritage, protecting and enhancing it where appropriate, and complementing it with world class design for any new development;*
- 7. To create quality strategic gateways to the City Centre, thereby making it a welcoming experience for visitors; and*
- 8. To attract and retain young people by providing learning opportunities through the co-operation of the University of Limerick, Limerick Institute of Technology, and Mary Immaculate College, in providing teaching and residential accommodation in the heart of the City Centre.”*

Conformance of the Project to the Objectives of the draft Limerick 2030 Spatial and Economic Plan

- It will help to preserve local employment by securing jobs at Vistakon.
- It will be a symbol of green sustainability.
- It will support the economic development of the area,
- It will create a strategic landmark and gateway on the eastern approaches to the City, visible from the M7 motorway.

6 Human Beings

6.1 Introduction

This chapter addresses impacts of the proposed wind energy project on human beings.

The proposed development has the potential to affect human beings in several ways. The potential impacts on human beings from construction activities, visual effects, built and natural heritage, and air, noise and vibration are dealt with in the specific chapters in this EIS dedicated to those topics. In this chapter, issues such as social and economic activity are examined.

6.1.1 Introduction

The current socio-economic status in the areas close to the proposed development was reviewed. Baseline information with respect to the demographic and employment characteristics of the resident population within the catchment area was sourced from the 2002, 2006 and 2011 Censuses. The data included information on population, number of persons at work and unemployment profile. Information was also sourced from the following documents/websites:

- *Limerick County Development Plan 2010-2016*
- *Castletroy Local Area Plan 2009-2015*
- Central Statistics Office (CSO) *National Quarterly Household Statistics* available on the CSO website (www.cso.ie)
- The Department of Education and Sciences website (www.education.ie)
- Shannon Development website (www.shannondevelopment.ie)

6.1.2 Existing Environment

A description of the existing environment in the study area is provided in the following subsections.

The Vistakon facility is located within the National Technology Park. The Park has approximately 80 high-technology and knowledge-based companies and

employees over 3,000 skilled people. The Vistakon facility has approximately 1,000 employees. The nearest facility Ophtecs is located approximately 200m west of the proposed location of the wind turbine – this is in the ownership of Vistakon.

6.1.2.1 Residences

The nearest residences to the site of the proposed development are located in excess of 500m to the northeast and southeast of the site.

6.1.2.2 Schools and Colleges

The University of Limerick and its campus are located approximately 1km northwest of the Vistakon facility.

Primary schools in the area include Scoil Moin a Lin, Castletroy, which is located southwest of the University of Limerick and Milford Grange National School located just southeast of the University of Limerick.

Post primary schools in the area include Castletroy College, Newtown, which is located approximately 1km to the south of the Vistakon facility.

6.1.2.3 Health, Social, and Community Facilities

Local area facilities include the local health centre at Annacotty, and Milford Hospice and day care centre, located near the University of Limerick.

6.1.2.4 Heritage and Amenity

Heritage

Archaeological, architectural and cultural heritage are discussed in **Chapter 13, Archaeological, Architectural and Cultural Heritage**. Nature Conservation Areas are discussed in **Chapter 7, Flora and Fauna**.

The geology of the area is discussed in **Chapter 11** of this EIS, *Soils, Geology, Surface Water, and Groundwater*.

Designated views and prospects, scenic routes and protected views, designated in the County Development Plans for Limerick, Clare and North Tipperary are discussed in **Chapter 8** of this EIS, *Landscape and Visual*.

Local Amenity

From a local amenity viewpoint, the Plassey Park Road runs along the southern boundary of the University of Limerick providing the main vehicular link between the education / research campus and the technology / industry campus. In 2008, approximately 1.2kms of the Plassey Park Road was reconstructed to provide new footpaths, cycleways, public lighting, road markings and signage.

Local sports facilities include the sports facilities at the University of Limerick, Milford and Monaleen GAA Clubs, UL Bohemians RFC and Castletroy Golf Course. The River Shannon to the north and the River Mulkear to the east are popular locations for angling. There is a riverside walkway along the River Shannon and River Mulkear in the vicinity of the Vistakon plant.

The waymarked way, the Lough Derg Way, is located approximately 1km to the north west of the Vistakon site.

6.1.2.5 Economic Activity

CSO statistics (CSO website accessed in December 2013) show that the main economic sectors in Limerick County are professional services, commerce and trade, and manufacturing industries. The remaining sectors include agriculture, forestry and fishing, building and construction, transport and communications, public administration.

Tourism

According to the Shannon Development's Annual Report 2011, *"there was positive news on the tourism front, with tourism business reporting a return to growth during the year. Shannon Heritage, a tourism subsidiary company of Shannon Development, reported a 5% increase in visitor numbers, a growth figure that was echoed generally by the Region's tourism industry."* The report also states that there are 25,000 people employed in 1,000 tourism businesses in the Shannon Region.

The *Mid West Regional Planning Guidelines* (Section 2.4.3 Tourism) states that *"Tourism plays a significant role in the economy of the Mid-West. The Region contains a number of key tourism zones, including several attractions of national and international significance"*

The Regional Planning Guidelines also state that *"The location of existing tourist attractions of national and international significance are poorly distributed throughout the Region with the focus predominantly to the west of the Shannon, i.e. Cliffs of Moher, Bunratty Castle and Folk Park, Burren, Lough Derg, West Clare coast, as mentioned above. The southern and eastern peripheries of the Region by contrast are poorly represented. As a result, diversification and regeneration of the rural economy in these areas has suffered."*

Fáilte Ireland's publication *Guidelines on the Treatment of Tourism in an Environmental Impact Statement* (2011) was consulted in the preparation of the EIS.

Business and Technology Premises

Shannon Development plans to expand the National Technology Park, in the general area of the Vistakon facility. Shannon Development's strategy for this area is to have a single large strategic site, to the southwest of Vistakon, and small to medium scale business and technology units, comprising a mix of third generation offices and advanced manufacturing, to the north and northwest.

The whole thrust of the National Technology Park's development has been to harness the technology resources on the site, and particularly those at the University of Limerick, towards the needs of enterprise and development (Shannon Development website, accessed Dec. 2013).

6.1.3 Recent Trends in Population

The Central Statistics Office Census online population data for Limerick County and the Castletroy is provided in the following **Table 6.2**. The table outlines the population changes between 2002, 2006 and 2011. The population of the area increased substantially between 2006 and 2011.

Table 6.2 Population Change between 2002 and 2006

Geographic Area	2002	2006	2011	Change from 2006-2011
Limerick City	54,023	59,790	56,779	-3,011
Limerick County	121,281	124,265	134,527	+ 10,262
Castletroy	8,979	10,601	-	+ 1,622 (2002-2006)

Source CSO website - Census 2002, 2006 and 2011

The Castletroy LAP (Page 11) states that “at current estimates, the population of Castletroy will reach approximately 14,000 persons by 2015 and 15,145 persons by 2018.

6.1.3.1 Household Size

CSO figures show that the average household size for Limerick City and for Limerick County in 2011 stood at 2.5 and 2.8 persons per household, respectively.

6.1.4 Trends in Employment

6.1.4.1 Quarterly National Household Survey

The CSO Quarterly National Household Survey, Quarter 2 of 2013 states that 1,869,900 persons were in employment in the State in the second quarter of 2013, an annual increase of 33,800 or 1.8%. This compares with an annual increase of 1.1% in the previous quarter, and a decrease of 1.3%% in the year to Q2 2012.

The survey states that unemployment decreased by 22,200 (-6.9%), in the year to Q2 2013, bringing the total number of persons unemployed in the State to 300,700. The survey also states that this is the fourth quarter in succession where unemployment has declined on an annual basis.

In the Midwest region, in which the Vistakon plant is located, in the second quarter of 2013, there were 150,900 persons in employment and 2,620 unemployed. This is an unemployment rate of 14.8%. This is higher than the rate for the State as a whole (13.9%). However, the unemployment rate in the second quarter of 2012 was 16.1% so there was an improvement in the year to the second quarter of 2013.

6.2 Evaluation of Impacts and Mitigation Measures

6.2.1 Introduction

Impacts on humans as a result of the proposed development have been considered in detail in other chapters of this EIS, as follows:

Chapter 4 *Construction Activities*

Chapter 8 *Landscape and Visual*

Chapter 9 *Noise and Vibration*

Chapter 10 *Air Quality and Climate*

Chapter 12 *Material Assets*

In this chapter, socio-economic impacts of the proposed development on human beings are evaluated in the following sections.

6.2.2 'Do nothing' impacts

Based on past trends and the policies of the Limerick County Development Plan 2010 and the Castletroy LAP, it can be expected that economic development will continue in the Castletroy area and will take place regardless of whether the wind energy project is built or not.

However, cost competitiveness of the Vistakon facility and future investment in the facility could be negatively affected if the project does not go ahead.

With ever increasing focus on sustainable manufacturing, companies are choosing locations where renewable energy resources are available.

6.2.3 Residential Amenity Impacts

6.2.3.1 Residential Amenity During Construction

There may be some minor temporary disruption to the residents in the vicinity of the site due to traffic, noise and dust during the construction phase. **Chapters 4, 9, and 10** respectively of this EIS have addressed these issues, and the measures, which will be put in place, to minimise this disruption.

6.2.3.2 Residential Amenity During Operation of the Facility

The proposed wind turbine will be located adjacent to the existing Vistakon facility.

The impacts of the proposed turbine due to construction activities and noise are discussed in **Chapters 4 and 9** of this EIS, respectively. The impact on landscape is assessed in **Chapter 8** of this EIS.

Shadow Flicker

Wind turbines, like other tall structures, can cast long shadows when the sun is low in the sky. The effect, known as shadow flicker, occurs where the blades of a wind

turbine cast a shadow over a window in a nearby building and the rotation of the blades causes the shadow to flick on and off. This effect lasts only for a short period and happens only in certain specific combined circumstances.

Shadow flicker may occur under certain combinations of geographical position and time of day, when the sun passes behind the blades of a wind turbine and casts a shadow over the neighbouring properties. As the blades rotate, the shadow flicks on and off and an effect known as shadow flicker occurs. The effect occurs inside buildings, where the flicker generally appears through a narrow window opening. The likelihood and duration of the effect depends upon a number of variable factors as follows:

- Direction of the property relative to the turbine. In Ireland, only properties within $\sim 130^\circ$ either side of north, relative to the turbine, can be affected as turbines do not cast long shadows on their southern side.
- Location of windows on affected receptors.
- Distance from turbine. The further the observer is from the turbine, the less pronounced the effect is.
- Wind speed and direction. The wind speed at the turbine will need to be sufficient for the blades to rotate. Further, the shape of the shadow will be determined by the position of the sun relative to the blades (which will be rotated to face the wind).
- Turbine height and rotor diameter.
- Time of year and day (the height of the sun in the sky).
- Weather conditions (cloud cover reduces the risk of shadow flicker).
- Existing physical screening between the turbine and the receptor.

A shadow flicker assessment has been completed, assessing the impact of the proposed wind turbine. The assessment is included as **Appendix F** to this EIS.

Assessment Methodology

A turbine with a hub height of 80m and a rotor tip height of 120m was considered in the analysis.

The shadow flicker calculations have been undertaken using the EMD WindPRO 2.9 modelling software.

The model makes the following simplifications:

- There are clear skies every day of the year.
- The rotors are always rotating.
- The sun can be represented as a single point.
- There are no obstacles other than terrain.
- The turbine rotors are always perpendicular to the direction of the line of sight from the specified location to the sun.

Shadow flicker has been calculated at a height of two metres to represent ground floor windows.

The receptors are simulated as mounted horizontal plates representing the worst case scenario (glass-house) while real windows would be facing towards a particular, selective direction.

The Department of the Environment, Heritage and Local Government (DoEHLG) *Wind Energy Planning Guidelines* recommends that shadow flicker at neighbouring offices and dwellings within 500m of a wind turbine should not exceed 30 hours per year and 30 minutes per day. In compliance with these guidelines, calculation of shadow flicker was carried out for the receptors within 500m of the proposed wind turbines. The guidelines also state:

At distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. Where shadow flicker could be a problem, developers should provide calculations to quantify the effect and where appropriate take measures to prevent or ameliorate the potential effect, such as by turning off a particular turbine at certain times.

In compliance with this guidance, the calculation of shadow flicker has been focussed on effects for the areas which are within 10 rotor diameters (800m) of the turbine and potential receptors of shadow flicker from the proposed turbine, located within 800m of the proposed turbine are included in the assessment. Structures were selected based on their susceptibility to shadow flicker to some extent. The locations of these receptors are indicated in Figure 1 of the report of the shadow flicker assessment (**Appendix F**).

Cumulative Shadow Flicker Analysis

The IWEA Best Practice Guidelines 2012 state:

"It is important to determine if there are other existing and/or permitted but not constructed wind farms in the vicinity of the proposed development which could contribute towards a cumulative shadow flicker impact on any receptors. Any such wind farm developments within 2km of the proposed development should be considered in a separate cumulative shadow flicker assessment."

Consultation of Limerick City and County Council online planning files indicate that there are no existing or permitted wind farm developments within 2km of the proposed development.

Assessment Findings

The assessment identifies that with the application of a conservative 'grey sky' factor of 40%, the Department of the Environment, Heritage and Local Government guidelines are not exceeded at any sensitive receptors not in the ownership of the applicant.

However, the Department has issued a draft update to the guidelines, for public comment. These draft guidelines indicate that any potential shadow flicker effects experienced at sensitive receptors are considered unacceptable. Vistakon will incorporate a shadow flicker control module in the turbine, to allow the turbine to be switched off for the duration of predicted impacts, and to ensure that best practice in the operation of the turbine is achieved.

6.2.3.3 Health and Safety

Health and safety is addressed in **Chapters 3 and 4** *Site and Scheme Description* and *Construction Activities*.

There will be no residual health and safety impact.

6.2.4 Recreational Amenity Impacts

There will be no recreational amenity impacts as a result of the proposed wind turbine. The proposed development will not have an impact on angling in the area.

6.2.5 Community Facilities

There will be no impact on community facilities as a result of the proposed development.

6.2.6 Economic Activity

6.2.6.1 Land Use

No economic activity will be displaced by constructing the proposed wind turbine. Construction the wind turbine on the site will not impact negatively on the future development of Shannon Development's strategic site on the west site of Plassey Park Road or on the Shannon Development lands to the north.

6.2.6.2 Agriculture

There will be no impact on agricultural activities as a result of the proposed wind turbine.

6.2.6.3 Tourism

In 2008, Fáilte Ireland published a report of survey of visitor attitudes to wind farms *Visitor Attitudes on the Environment – Wind Farms (2008)*. The report states that almost half of the tourists interviewed during the survey had seen at least one wind farm during their holiday. Most felt that the presence of wind farms did not detract from the quality of their sightseeing, with the largest proportion (45%) saying that the presence of the wind farm had a positive impact on their enjoyment of sightseeing, with 15% claiming that they had a negative impact.

In 2011, Visit Scotland (www.visitscotland.org) commissioned omnibus research to learn more about consumer attitudes to wind farms and their effect on tourism. 83% stated their decision would not be affected by the presence of a wind farm, with 17% claiming that it would affect their choices over which area to visit while on a Scottish holiday.

The visual impact of the development on tourist routes and amenities is assessed in **Chapter 8** *Landscape and Visual Assessment* of this EIS. Overall, the wind turbine will be a positive visual feature in the area. It will be a landmark structure which will identify the eastern gateway to Limerick and which will also carry a message of renewable and sustainable energy.

The proposed development will not have an impact on angling in the area. Property Values

Property values are addressed in **Chapter 12 Material Assets**.

6.2.6.4 Construction Phase Economic Impact

The construction of the turbine will cost circa €7 million. There will be a maximum number of 20 jobs created during construction. There will also be a number of indirect jobs, created in the off-site construction services providers and material suppliers. These jobs will be a beneficial economic impact of the proposed development.

6.2.6.5 Operational Phase Economic Benefit

The proposed wind energy project will generate annual expenditure on maintenance, security, insurance and various other services, which will be from local or indigenous suppliers where possible. The additional rates for the wind turbine will be a benefit to the economy.

The wind turbine will help secure the existing employment in Vistakon.

6.3 Mitigation Measures

The health and safety features incorporated into the design of the proposed facility are outlined in **Chapter 3 Proposed Site and Project Description**. The Health and Safety policy, procedures and work practices of the proposed development will be in conformance with all relevant health and safety legislation both during the construction and operational stages of the wind turbine. The proposed development will be designed and constructed to best industry standards, with an emphasis being placed on the health and safety of employees, local residents and the community at large. The technology to be employed in the proposed development is well understood and has been used successfully in equivalent projects internationally, with no implications for health and safety. To minimise the risk that the proposed development will cause nuisance, comprehensive mitigation measures will be implemented. These mitigation measures will reduce any negative impacts of the proposed development on the residential amenity of the local area. Refer to **Chapters 4, 8, 9, 10, 12 and 13** of this EIS for further details of mitigation measures.

Vistakon will incorporate a shadow flicker control module in the turbine, to allow the turbine to be switched off for the duration of predicted impacts, and to ensure that best practice in the operation of the turbine is achieved.

6.4 Residual Impacts

The proposed mitigation measures will minimise nuisance to local residents and inconvenience to the local residents during construction and operation of the facility. There will be a residual visual impact on the immediate area and the surrounding area.

The wind turbine project will help to reduce electricity costs and thereby secure the existing jobs at Vistakon. By increasing the competitiveness of the plant, it will make

it more likely for Vistakon to win future projects and investment from Johnson and Johnson. The jobs created during construction will have a positive economic impact in the local area.

6.5 References

Central Statistics Office (2002) *Census of Population*

Central Statistics Office (2006) *Census of Population*

Central Statistics Office (2011) *Census of Population*

Central Statistics Office website www.cso.ie

Central Statistics Office (2013) *National Quarterly Household Statistics*

Department of Education website www.education.ie

Fáilte Ireland (2011) *Guidelines on the Treatment of Tourism in Environmental Impact Statements*

Limerick County Council (2011) *Castletroy Local Area Plan*

Limerick County Council (2010) *Limerick County Development Plan 2010-2016*

Shannon Development Annual Report 2011 (www.shannondevelopment.ie)

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7 Flora and Fauna

7.1 Introduction

This chapter provides an assessment of the potential impacts of the proposed wind turbine on the flora and fauna at the site of the Vistakon facility at the National Technology Park, Rivers, County Limerick. The ecological impact assessment was prepared by Moore Group, Environmental Services. As part of the ecological assessment, a bat survey of the site was undertaken by Aardwolf Wildlife Surveys.

The proposed construction works, the operational phase and their potential impacts on existing habitats and species are addressed, including the impacts on rare or protected habitats and species in the study area. This chapter described the existing environment at the site of the proposed development and identifies areas of semi-natural habitats of high ecological value, and designated nature conservation areas and Natura 2000 Sites in the vicinity of the proposed development.

7.2 Methodology

7.2.1 Introduction

This ecological assessment is undertaken in compliance with the European Communities (Environmental Impact Assessment) Regulations 1989, as amended, and follows *Guidelines on the Information to be contained in Environmental Impact Statements* (Environmental Protection Agency, 2002). The aims of the ecological impact assessment are to:

- Establish baseline ecological data in the area of the proposed development,
- Determine the ecological value of each plant, animal or habitat,
- Assess the impact of the proposed development on any ecological features of value,
- Recommend mitigation measures to reduce or prevent the above impacts,
- Identify any residual impacts after mitigation, and
- Form the basis for screening to determine the need for an appropriate assessment.

The assessment of the likely impacts of the proposed development on ecological resources has regard to the following policy documents and legislation:

- *Wildlife Act, 1976 and Wildlife (Amendment) Act, 2000*
- *EU Habitats Directive 92/43/EEC*
- *EU Birds Directive 79/409/EEC*
- *European Communities (Natural Habitats) Regulations 1997 (as amended 2005).*
- *Flora (Protection) Order, 1999.*

The assessment was carried out in three stages, firstly through desktop assessment to determine existing records in relation to habitats and species present in the study area.

The second phase of the assessment involved a site visit to establish the existing environment in the area of the proposed development.

The final part of the assessment involved an evaluation of the proposed development area and determination of the potential impacts of the proposed development on the flora and fauna of the area. This part of the assessment formed the basis for a screening report to determine if an appropriate assessment was required, and is based on the following guidelines and publications:

- *Handbook for Phase 1 habitat survey* (JNCC, 1990, Rev. 2003; 2007)
- *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011)
- *EPA Advice Notes on Current Practice* (EPA, 2003)
- *Assessment of plans and projects significantly affecting Natura 2000 sites* (EC, 2002)
- *Managing Natura 2000 Sites* (EC, 2000) *Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC* (EC, 2007)
- *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities* (DEHLG, Rev. Feb. 2010)
- *Castletroy Local Area Plan 2009-2015* (Limerick County Council, adopted July 2009)

7.2.2 Bat Survey

A desktop survey and field survey of bats at the site was undertaken on the 15th August 2011 by Aardwolf Wildlife Surveys. The report of the survey is appended to this EIS (**Appendix E**).

Wind turbines are a known risk to bats (Arnett *et al.* 2008, Baerwald *et al.* 2008, Cryan and Brown 2007, Johnson *et al.* 2003, Johnson and Strickland 2004, Zagamajster *et al.* 2007) and the *EUROBATS Secretariat* has published guidelines on bats and wind farm projects (Rodrigues *et al.* 2008) to ensure bats are considered as part of development proposals.

The Irish Government has yet to produce national guidelines as has been done in the UK and Northern Ireland. At the time of undertaking the 2011 bat survey, Bat Conservation Ireland had drafted initial bat survey and mitigation guidelines for wind turbine developments. Bat Conservation Ireland subsequently published *Wind Turbine/Wind Farm Development Bat Survey Guidelines in December 2012 (Version 2.8)* following discussions with the Irish Wind Energy Association, Bord Gáis Energy, Forestry Service, Department of Agriculture, Food and the Marine, Bird Watch Ireland and other interested parties.

The bat surveys were undertaken at the optimal time for activity surveys, as outlined in the Bat Conservation Ireland Guidelines, and as there are no impacts predicted on winter hibernation roosts, the surveys completed are sufficient to provide a robust record of baseline bat activity at the site, as required in the Guidelines.

7.2.2.1 Desk Study

The desk study included research on the National Parks and Wildlife Service metadata website, the BirdWatch Ireland website and a literature review of published information on flora and fauna occurring in the development area.

7.2.2.2 Field Study

The site was visited on the 3rd of August 2011 with the aim of gathering information on terrestrial habitats present at the wind turbine location, approach tracks, compound area and associated infrastructure. Areas which were highlighted during the desktop assessment were investigated in closer detail. Habitats in the proposed development areas were classified according to the Heritage Council publication “*A Guide to Habitats in Ireland*” (Fossitt 2000). This publication sets out a standard scheme for identifying, describing and classifying wildlife habitats in Ireland. This form of classification uses codes to classify different habitats based on the plant species present. Species recorded in this report are given in both their Latin and English names. Latin names for plant species follow the nomenclature of “*An Irish Flora*” (Webb, Parnell and Doogue 1996). The habitats are shown on **Figure 7.3** and listed in **Table 7.1**

Sights and signs of mammals and invertebrates were surveyed while walking the various habitats which lie within the survey area. Representative photographs of the areas assessed are presented in **Appendix D** of the EIS.

Scoping and Consultation

The Development Applications Unit of the Department of Arts, Heritage and the Gaeltacht was sent a scoping letter during the feasibility study of the project in July 2010. The following response was received from the Department in August 2010:

“The Department recommends that, as well as standard ecological issues covered by EIA, the proposed environmental assessment looks at bird and bat collision risk and at mitigation to ensure no pollution of nearby watercourses.”

The National Parks and Wildlife Service Local Conservation Ranger for Limerick City and East Limerick was contacted by phone and topics including water quality and protected species were discussed. John Lusby of Bird Watch Ireland was contacted by email with regard to owls in the study area.

Appropriate Assessment

Article 6 of the EU Habitats Directive 92/43/EEC requires plans and projects to be subject to Habitats Directive Assessment (also known as Appropriate Assessment) if the plan or project is not directly connected with or necessary to the management of a Natura 2000 site (which includes SACs and SPAs) but which has the potential to have implications for a site’s conservation objectives. These implications can be significant effects either individually or in combination with other plans or projects.

Appropriate Assessment (AA) screening was undertaken for the project and the screening report is presented as **Appendix C**.

7.3 Existing Environment

7.3.1 Designated Conservation Areas

The Mulkear River flows at a distance of approximately 250m to the north of the turbine site location. It is designated as part of the Lower River Shannon cSAC (Site Code 0002165). The main channel of the River Shannon is located approximately 750m to the northwest. The site, a candidate SAC, is selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the EU Habitats Directive. The site is also selected for floating river vegetation, Molinia meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, Salicornia mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays, all habitats listed on Annex I of the EU Habitats Directive. The cSAC is also selected for the following species listed on Annex II of the same directive, Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter. Refer to the Site Synopsis in **Appendix B** of the EIS. **Figure 7.1** shows the study area.

The project site is located within 15km of the following Natura 2000 sites:

- Slievefelim to Silvermines Mountains SPA (004165); 9.4km to the east,
- River Shannon and River Fergus Estuaries SPA (004077); 9km to the west,
- Glenomra Wood cSAC (001013); 9km to the northwest,
- Clare Glen cSAC (000930); 9.8km to the northeast,
- Glenstal Wood cSAC (001432); 10.4km to the east.

These sites are addressed in the Appropriate Assessment screening report appended to the EIS as **Appendix C**.

The project site is also located within 15km of the following proposed Natural Heritage Areas (pNHAs):

- 000433 Castleconnell (Domestic Dwelling, Occupied)
- 000930 Clare Glen
- 000028 Cloonlara House
- 002048 Fergus Estuary and Inner Shannon, North Shore
- 001013 Glenomra Wood
- 001432 Glenstal Wood
- 000435 Inner Shannon Estuary, South Shore
- 002001 Knockalisheen Marsh

7.3.2 Non-designated Areas

7.3.2.1 Habitats

Seven main habitat types were identified during fieldwork in August 2011. These habitats and their classification codes are listed below in **Table 7.1**. The predominant habitats recorded at the site of the proposed development are bare ground, wet grassland, scrub and mixed broadleaved woodland and treelines. The scrub and grassland areas merge and diverge randomly and so the predominant habitats are best presented on the Google Earth aerial photograph with the main features identified, see **Figure 7.3**.

Table 7.1 Habitat types according to Fossitt (2000)

Habitat	Habitat Category	Habitat Type
(G) Grassland	(GA) Improved grassland	(GA2) Amenity grassland
	(GS) Semi-natural grassland	(GS4) Wet grassland
(W) Woodland and scrub	(WD) Modified Woodland	(WD1) Mixed broadleaved woodland
(W) Woodland and scrub	(WS) Scrub	(WS1) Scrub
	(WL) Linear woodland	(WL2) Treelines
(E) Exposed Rock and Disturbed Ground	(ED) Disturbed Ground	(ED2) Spoil and bare ground
(B) Cultivated and Built Land	(BC) Cultivated Land	(BC4) Flower beds and borders

(BC4) Flower beds and borders/(GA2) Amenity grassland

The Vistakon facility is located in the National Technology Park at Rivers, County Limerick and the boundaries of industrial facilities are maintained with amenity grassland and borders of mixed ornamental species.

(ED2) Spoil and bare ground

Access to the proposed turbine area is comprised of an area of hardstanding currently used as a temporary car park for the Vistakon Facility. The car park was recently constructed and the previous topsoil layer mounded toward the centre of the site. Flora was sparse in the used car park area but the verges showed a similar species composition as the central mound described below.

(GS1) Wet grassland/(WS1) Scrub

The mound is densely colonised by Rye grass (*Lolium* spp.), Cocks foot (*Dactylus glomerata*), Yorkshire fog, (*Holcus lanatus*), Meadow grasses (*Poa* spp), False Oat-grass (*Arrhenatherum elatius*), Timothy (*Phleum pratense*) and Hard Rush (*Juncus inflexus*). Common herbaceous species include clovers (*Trifolium repens* and *Trifolium pratense*), Stitchwort (*Stellaria* spp.), Spear thistle (*Cirsium vulgare*), Yarrow (*Achillea millefolium*), Great Willowherb (*Epilobium hirsutum*), Nettle (*Urtica dioica*), Meadow vetchling (*Lathyrus pratensis*), Dandelion (*Taraxacum*

spp.), Creeping buttercup (*Ranunculus repens*) and Common Fleabane (*Pulicaria dysinterica*). Goat willow (*Salix caprea*) and Osier (*Salix viminalis*) were also common on the mound and in the treelines and adjacent fields.

The footprint of the turbine will extend into the adjacent wet grassland to the west of the car park. The plant species occurring in the adjacent field areas includes Rye grass (*Lolium* spp.), Cocks foot (*Dactylus glomerata*), Yorkshire fog, (*Holcus lanatus*), Meadow grasses (*Poa* spp), False Oat-grass (*Arrhenatherum elatius*), Timothy (*Phleum pratense*), Soft Rush (*Juncus effuses*) and Hard Rush (*Juncus inflexus*). The fields reflect a semi-natural state with tall herb growth and dense rush growth. Herb species includes Horsetail (*Equisetum arvense*), Birds foot trefoil (*Lotus corniculatus*), White clover (*Trifolium repens*), Red clover (*Trifolium pratense*), Selfheal (*Prunella vulgaris*), Oxeye daisy (*Leucanthemum vulgare*), Tufted vetch (*Vicia cracca*), Knapweed (*Centaurea nigra*), Purple loosertrife (*Lythrum salicaria*), Marsh Woundwort (*Stachys paulistris*), Spear thistle (*Cirsium vulgare*) and Square-stalked St John's-wort (*Hypericum tetrapterum*). Cleavers (*Galium aparine*) and Bramble (*Rubus fruticosus* agg.) were recorded near treelines in scrub areas along with Knapweed and Oak and Ash saplings.

(WD1) Mixed broadleaved woodland and (WL2) Treelines

The treelines to the front and west of the Vistakon facility are comprised of Oak (*Quercus petraea*), Ash (*Fraxinus excelsior*), Alder (*Alnus glutinosa*), Willow (*Salix* spp.), Silver Birch (*Betula pendula*) and Scots Pine (*Pinus sylvestris*) with an understorey of Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*). The treelines to the west of the Vistakon facility have merged to form a band of woodland with trees up to 30m in height in places.

The trees surrounding the western boundary of the development area and those closer to the Mulkear River are comprised more predominantly of Willow species.

7.3.2.2 Fauna

Birds

The birds recorded reflected a mixed grassland woodland representation. A list of bird species recorded at the site is shown in **Table 7.2** below. Species of conservation concern are noted in accordance with BirdWatch Ireland's 'Birds of Conservation Concern Ireland' (BoCCI), which lists threatened species using colour codes. Red List bird species are of high conservation concern, while Amber List birds are of medium conservation concern or of concern in a European population context. Green List Species are all other regularly occurring species in Ireland whose conservation status is presently considered favourable. All species are protected under the Wild life Act 1976 and Wild life Amendment Act 2000.

Table 7.2 Bird species observed during the site visit

Bird species	Scientific name	BoCCI Status
Sparrow	<i>Passer domesticus</i>	Green List
Great Tit	<i>Parus major</i>	Green List
Chaffinch	<i>Fringilla coelebs</i>	Green List
Goldfinch	<i>Carduelis carduelis</i>	Green List
Blackbird	<i>Turdus merula</i>	Green List
Magpie	<i>Pica pica</i>	Green List
Wood pigeon	<i>Columba palumbus</i>	Green List
Swallow	<i>Hirundo rustica</i>	Amber List
Mute Swan	<i>Cygnus olor</i>	Amber List

The majority of bird species recorded was woodland and pasture species listed as not considered to be of conservation concern. Overall, bird numbers in the survey area were low. Swallow was the most frequently recorded species. The presence of Mute Swan on the Mulkear River is discussed in more detail under impacts in **Section 7.4**. The Mulkear River is not listed as an important site for waterbirds (Crowe, 2005). However, Kingfisher (*Alcedo atthis*) has been recorded in the Mulkear catchment and is listed on Annex I of the EU Birds Directive. None were recorded during fieldwork, and would not be expected given the distance from the river channel (250m) and more favourable habitats upstream.

The Local Conservation Ranger suggested the potential for owls on or near the site. However, BirdWatch Ireland has no records of active sites for either Barn or Long-eared Owl within the proximity of the proposed development. There is a record of a traditional Barn Owl nest site at Castletroy, but it has not been occupied for at least 6 + years.

Mammals

Otter

Otters (*Lutra lutra*) along with their breeding and resting places, are protected under the provisions of the Wildlife Act, 1976, as amended by the Wildlife (Amendment) Act, 2000. Otters have additional protection because of their inclusion in Annex II and Annex IV of the Habitats Directive.

There were no signs of otter, holts, spraints or prints in the study area. However, it is possible that otters roam throughout the study area and would forage in riparian areas. Otters have been recorded recently by the Mulkear LIFE Project further upstream (<http://www.mulkearlifeproject.com/>).

Badger

Badgers (*Meles meles*) are protected under the Wildlife Act 1976. There were no signs of badger or badger setts in the study area.

Bats

All bats (and their roosting places) are protected under the Natural Habitats Regulations and the Wildlife Acts (1976, 2000).

Of the ten recorded bat species in Ireland, eight have been recorded within a 10km radius of the study site including; common *Pipistrellus pipistrellus* and soprano *P. pygmaeus* pipistrelle, brown long-eared *Plecotus auritus*, Leisler's *Nyctalus leisleri*, Daubenton's *Myotis daubentonii*, Natterer's *M. nattereri*, whiskered/Brandt's *M. Mystacinus*, Brandt's bat *M. brandtii* and lesser horseshoe *Rhinolophus hipposideros* bats. The remaining Irish bat species: Nathusius' pipistrelle *P. nathusii* is not expected to occur on-site due to the absence of favourable habitats (deciduous woodlands and large lakes). Roosts of three species; soprano pipistrelle, brown long-eared and lesser horseshoe bats are known within 10km of the site, the nearest (pipistrelle) being 6km northwest.

During the on-site bat detection survey, foraging bat species detected were Common Pipistrelle in the tall ash treelines on-site, and Soprano Pipistrelle in the shelter of willow scrub. Leisler's bat was detected flying high over the study site on three occasions but this may have been the same individual. Daubenton's bat was present on the nearby Mulkear River but was not detected on-site.

All but one of the bat species confirmed or expected on-site are low fliers, and as a result, are considered to be at low risk from the proposed development. Only Leisler's bat is a high flier and hence may come into conflict with turbines, however, there is currently no evidence of Leisler's bat mortality due to wind turbines in Ireland.

Refer to **Appendix E Bat Survey and Assessment Report** for further details.

Fish

Salmon

The Atlantic Salmon (*Salmo salar*) is listed in Annexes II and V of the European Union's Habitats Directive as a species of European importance. Salmon are listed as a qualifying interest in the Mulkear River as part of the Lower River Shannon SAC. The Mulkear LIFE Project will target areas where Atlantic Salmon habitat has been impacted by drainage and other negative land management practices. As part of the Mulkear LIFE Project, river habitat will be enhanced by applying proven instream restoration techniques to recreate habitat complexity. At the closest point, the site is 250m from the Mulkear River and 750m from the River Shannon.

Lamprey Species

Three lamprey species occur in Ireland: Sea lamprey, (*Petromyzon marinus*), River lamprey, (*Lampetra fluviatilis*) and Brook lamprey, (*Lampetra planeri*). All three species are listed under Annex II of the EU Habitats Directive (Directive 92/43/EEC), thereby requiring member states to designate Special Areas of Conservation (SACs) for their protection. All three species are listed as qualifying interests in the Mulkear River as part of the Lower River Shannon SAC. The weir at Annacotty is a migration barrier that prevents lamprey from accessing the rest of the river, however modifications to the weir have allowed some lamprey to ascend and access the upper watershed. The Mulkear LIFE Project aims to find a

permanent solution to lamprey passage at the weir and monitor lamprey movements throughout the catchment by radio-tracking, snorkelling and electrofishing surveys. At the closest point, the site is 250m from the Mulkear River and 750m from the River Shannon.

Site Evaluation and Conservation Status

The main habitat of conservation concern at the site of the proposed wind turbine is the treelines. The existing treelines are well established and present a notable list of native broadleaved species. These are important for biodiversity, insects, birds and bats.

Access to the turbine footprint area has been modified through development of the existing car park area which is of low ecological value. The adjacent wet grassland presents a moderately high value environment in terms of its natural state and importance for insects.

The value of the site with regard to bats is described in the attached bat assessment (**Appendix E**) and is outlined above.

There were no rare or protected species of flora under the footprint of the proposed development. The nearest area of conservation concern is that of the Mulkear River. It is designated for Salmon, Otter, and Lamprey species.

On the Mulkear River, a tributary of the lower River Shannon, adult sea lamprey are not normally seen over spawning beds until mid-May (Igoe et al., 2004). Commencement of spawning at this time has also been reported for sea lamprey in the lower Shannon main river channel at Plassey, upstream of Limerick city, in the Kilmastulla River, a tributary of the lower River Shannon and in the River Suir. Although the spawning period may span several months, most of the adults have left the spawning beds by early August.

The 2002 spawning period for lamprey on the Mulkear River was longer than that normally observed for most years. Sea Lamprey appeared over the spawning beds in mid-May 2002. Spawning activity peaked from mid-June to mid-July. However, a small number of individuals were still observed over the spawning grounds in early October. The main spawning site for Sea Lamprey on the Mulkear River is immediately downstream of Annacotty Weir (Igoe et al., 2004).

7.4 Predicted Impacts

7.4.1 Direct Impacts

7.4.1.1 Habitats and Flora

There are no rare or protected flora or fauna under the footprint of the proposed development. There will be a minor negative local impact on flora as a result of clearance of the recolonised earth mound to the centre of the site and the removal of a relatively small portion of wet grassland.

A short length of the treeline to the west of the turbine will be required to be removed partly to accommodate the turbine hardstand area. This will result in the

removal of circa 100m of mixed Ash and Willow treeline of high ecological value in a local context. This constitutes a local moderate negative impact.

The impact would be mitigated by the removal of vegetation outside the bird breeding season and the employment of bat mitigation measures outlined in **Section 7.5.1.3 Specific Mitigation - Bats**, and also in the bat assessment (**Appendix E**).

7.4.1.2 Fauna

Birds

In assessing the effects of the proposed wind turbine development on birds, there are three main potential impacts to consider (Percival 2007):

- Direct habitat loss resulting from the proposed development.
- Collision with turbines.
- Disturbance (construction and operational phases).

Construction phase

Impacts on breeding birds within the site during construction are likely to result from a combination of direct habitat loss and disturbance. Some direct habitat loss will occur through the construction of the turbine. Disturbance from construction noise is likely to have a short-term negative impact on birds in the immediate area of the site works.

Mitigation measures to minimise habitat loss and disturbance during construction are outlined in **Section 7.5**.

Operation phase

Birds

During the operational phase, there may be disturbance to breeding birds within the site of the proposed wind turbine by either the presence of or noise from the turbine, although this is likely to decrease over time with habituation (Crockford 1992).

There is not likely to be significant disturbance to farmland species during construction or operation of the wind turbine. Studies have shown that farmland birds do not appear to avoid operational wind turbines (Devereux *et al.*, 2008). With a hub height of up to 80m and a blade length of up to 40m there will be a clearance of 40m, allowing adequate room for treeline nesting and foraging birds.

There is a potential risk of birds colliding with wind turbines. However, studies to date indicate that the collision risk for birds is not likely to cause a threat to local bird populations. (Percival 2000, Percival 2005)

The potential for impact on owls is considered low given the rarity of records for the study area.

With regard to Mute Swans on the Mulkear River, it is likely that they commute to and from the main River Shannon channel upstream to the Mulkear River. The stretch of the Mulkear River directly northeast of the Vistakon facility comprises a section of shallow rapids making it unsuitable for swans to land.

The main channel of the River Shannon is located circa 750m to the northwest, at which point the river flows in a northeast-southwest direction. The main concern with regard to mute swans landing on the Mulkear River would be those approaching from the southwest. However, there is sufficient distance from this flight line to the proposed turbine to rule out potential collision. Refer to **Figure 7.4**.

Bats

The planned turbine development is to be sited within an area of mainly agricultural grassland currently over-flown by Leisler's bat. The hedgerow boundaries are currently in use by at least two bat species while the nearby river is frequented by a fourth species. Although, to date, there are no published results of a study of bat mortality from Irish wind turbines, considering recent research from mainland Europe and North America, there is an increasing amount of detailed published evidence that wind turbines cause bat fatalities. However, many of these foreign turbine/bat mortality studies are at wind farms, with multiple turbines, sited along known bat migration routes where many hundreds or even thousands of bats commute seasonally resulting in numerous deaths and injuries. There is currently no evidence that mortality of bats on the same scale occurs here. Also, although it is known that Nathusius' pipistrelle migrates from Scandinavia to Scotland and to the north of Ireland and back again (Russ et al 2001) apart from this species, there is currently no evidence that internal or external bat migration routes of other bat species exist elsewhere in Ireland as no research has been undertaken. Nevertheless, risks to bats from wind turbines have to be acknowledged and it is possible that some bat mortality may occur due to the planned development therefore mitigation measures are recommended to reduce the likelihood of such fatalities.

7.4.2 Indirect Impacts

7.4.2.1 Water Quality

There is no potential for surface water runoff during construction to enter the Mulkear River, due to the presence of the existing flood barrier which runs along the entire bank of the Mulkear River in the vicinity of the site, and also due to the construction mitigation measures described **Section 4.10.5 Surface Water and Groundwater** which will be implemented to prevent run off from the site during construction from entering the Mulkear River.

In the event of a major flood overtopping the flood barrier, the river would be full of silt, so the contribution from the site would be insignificant.

7.4.2.2 Aquatic Fauna

Noise and vibration from the proposed piling for the turbine foundation has the potential to have an indirect effect on the designated Salmonid and Lamprey species in the Mulkear River.

Noise and vibration from pile driving within a given water body can impact on Salmonid and Lamprey species by causing damage to sensory organs, mortality or loss of habitat due to disturbance. However, studies on the hearing ability of

lamprey (Popper, A. 2005) have shown that they are fundamentally “primitive” species with poorly developed hearing systems.

Pile driving can give rise to a range of frequencies of vibration. Low frequency, high amplitude vibrations transmit furthest. High frequency vibrations are naturally attenuated closer to the source than low frequency vibrations.

The vibrations that will be generated by the piling planned for the foundation of the proposed turbine will be high frequency vibrations. No pile driving will take place in the Mulkear River. No vibration impacts are predicted at locations 250m from the turbine, such as at the Mulkear River.

No adverse impact on Salmonid or Lamprey species are therefore predicted arising from the vibration associated with the construction of the wind turbine base.

7.5 Mitigation

7.5.1 Mitigation - Direct Impacts

7.5.1.1 General

Standard mitigation measures, as would apply to any large-scale development, will be adopted in the site clearance and construction of the turbine. These will include limiting the disturbance of trees and vegetation to outside the breeding season so as to reduce impacts on breeding bird species, and preventing pollution and sedimentation entering watercourses.

Specific mitigation measures, to avoid and reduce potential impacts on Flora and Fauna are proposed in the following sections.

7.5.1.2 Specific Mitigation - Birds

Potential impacts on nesting birds will be avoided by restricting vegetation cutting to outside the breeding season of March 1st to August 31st.

7.5.1.3 Specific Mitigation - Bats

The following specific measures will be implemented to protect bats on-site.

Buffer Zone

To ensure a safe distance from the turbine for low-flying bats along hedgerows, a vegetation-free buffer zone of 50m minimum from the nearest vegetation to the turbine rotors will be cleared to reduce the risk of collision and/or barotrauma to species that mainly fly low along hedgerows, tree lines and forest edge such as lesser horseshoe, brown long-eared and pipistrelle bats. (Refer also to the mitigation measures, regarding the timing of vegetation removal, outlined under the following heading *Retention and Removal of Trees*).

Retention and Removal of Trees

Outside of the buffer zone, trees and treelines should be retained where possible. Retained trees shall be protected from root damage by machinery by an exclusion zone of at least 7 metres or equivalent to canopy height. Such protected trees shall be fenced off by adequate temporary fencing prior to other works commencing.

Mature trees, which are to be removed, shall ideally be felled in the period late August to late October, or early November, in order to avoid the disturbance of any roosting bats as per *National Roads Authority* guidelines (NRA 2006a and 2006b). Tree felling shall be completed by Mid-November at the latest because bats roosting in trees are very vulnerable to disturbance during their hibernation period (November – April). Ivy-covered trees, once felled, shall be left intact on-site for 24 hours prior to disposal to allow any bats beneath the foliage to escape overnight.

Lighting Restrictions

In general, artificial light creates a barrier to bats so lighting shall be avoided where possible. Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) shall be used to prevent overspill. This shall be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

Leisler's Bat

No mitigation measures with respect to Leisler's Bat are required or proposed. There is currently no evidence of Leisler's bat mortality due to wind turbines in Ireland, and no published results of bat/turbine interaction at Irish wind turbine sites (refer also to **Section 7.6 Residual Impacts**).

7.5.2 Mitigation - Indirect Impacts

The proposed turbine will be located 250m distant from the Mulkear River. Mitigation measures include the existing flood barrier which runs along the entire bank of the Mulkear River in the vicinity of the site to its junction with the River Shannon, and the construction mitigation measures described **Section 4.10.5 Surface Water and Groundwater** which will be implemented to prevent run off from the site during construction from entering the Mulkear River. In addition, good construction management practices will be implemented as outlined **Chapter 4 Construction Activities** and **Chapter 10 Soils, Geology, Surface Water and Groundwater** of the EIS.

The distance of 250m from the River Mulkear to the proposed location of piling works and the use of piling methodology which will not emit low frequency vibrations will ensure there will be no risk of impact to Lamprey species in the River Mulkear (refer to **Section 7.4.2.2 Aquatic Fauna**).

7.6 Residual Impacts

Appropriate assessment screening has found that there will be no impact on the integrity of the adjacent Lower River Shannon cSAC from the construction or operation of the proposed wind turbine.

There will be no impact on other designated sites within 15km of the proposed development, given the distance from the development and the lack of biological connectivity.

The impact on local bat populations from the construction of the proposed development will be minor due to the implementation of the 50m vegetation free buffer zone (refer to **Section 7.5.1.3**). All bat species confirmed or expected on or near the study site are expected to persist.

All but one of the bat species confirmed or expected on site are low fliers, and as a result, are considered to be at low risk from the proposed development. Only Leisler's bat is of concern as it is a high flyer and hence may come into conflict with turbines. However, there is currently no evidence of Leisler's bat mortality due to wind turbines in Ireland. To date, there are no published results of bat/turbine interaction at Irish wind turbine sites and those undertaken abroad are mainly of wind farms, with multiple turbines, sited along known bat migration routes which are currently unknown in Ireland (refer to **Appendix E** Bat Survey and Assessment Report). The adjudged worst case scenario is that the turbine may cause injury or death to a few individual specimens of Leisler's bat over time, but the Favourable Conservation Status of the species should not be affected.

Once the proposed mitigation measures have been employed to avoid predicted impacts, there will be no significant impact on flora and fauna in the vicinity of the proposed wind turbine.

7.7 Monitoring

As no research currently exists on bats and wind farms in Ireland, the planned development could provide an opportunity to gain baseline data on bat/turbine interaction and Vistakon will facilitate the monitoring of the site as part of a potential future wind turbine bat mortality study.

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8 Landscape and Visual

8.1 Introduction

This chapter of the EIS examines the predicted impacts of the proposed wind turbine at Vistakon, Rivers, County Limerick under the heading of Landscape and Visual. The chapter initially sets out the methodology followed (**Section 8.2**), then examines the existing environment (**Section 8.3**), proceeds to examine the likely significant landscape and visual aspects associated with both the construction and operational phases of the proposed development (**Section 8.4**), details the measures proposed to mitigate the likely significant impacts of the proposed wind turbine development (**Section 8.5**) then describes the residual impacts (**Section 8.6**) and finishes with the conclusion (**Section 8.7**).

8.2 Methodology

This assessment has been prepared in accordance with the recommendations of the Environmental Protection Agency - *Guidelines on the Information to be contained in Environmental Impact Statements* (EPA, 2002) and *Advice Notes on Current Practice in the preparation of Environmental Impact Statements* (EPA 2003). In keeping with these guidelines, this assessment provides a description of the existing landscape context and a description of the proposed wind turbine development in terms of its landscape and visual context and outlines the various associated landscape and visual effects. These impacts and effects are considered with regard to the vulnerability of the landscape to change and to the location of visual receptors relative to the proposed wind turbine development. In this way the impact of the proposed wind turbine development on the existing context is appraised and significant impacts to either the landscape character or visual amenity identified.

Landscape Impacts

Landscape has two separate but closely related aspects. The first is visual impact, i.e. the extent to which a new structure in the landscape can be seen. The second is landscape character impact, i.e. effects on the fabric or structure of the landscape. Landscape character is derived from the appearance of the land and sea, and takes account of natural and man-made features such as topography, landform, vegetation, land use and built environment and their interaction to create specific patterns that are distinctive to particular localities.

A Zone of Theoretical Visibility Map was prepared based on the Department of the Environment, Heritage and Local Government's '*Wind Farm Planning Guidelines*' (2006). The map is referred to throughout the assessment and is illustrated in **Figure 8.0.1**. The ZTV map illustrates a study area extending to 20km around the site and highlights the areas where the proposed turbine will theoretically be visible from. This ZTV map does not take into consideration vegetation cover, changing weather conditions or the mitigating effect of distance and therefore illustrates the worst case scenario of visibility. The relevant Landscape Planning designations within the study area, as outlined in the *Limerick County Development Plan 2010-2016*, *Clare County Development Plan 2011-2017*, *Limerick City Development Plan 2010-2016*, *Castletroy Local Area Plan 2009-2015* and *North Tipperary County Development Plan 2010-2016* have been illustrated on **Figure 8.0.1**.

Landscape planning designations, including National and County designations or listings are considered and assessed for impacts, where appropriate. All such landscapes are assessed for direct and indirect landscape impacts.

Visual Impacts

Visual impacts are categorised under 'Visual Intrusion' and 'Visual Obstruction' where:

- 'Visual Intrusion' is an impact on a view without blocking;
- 'Visual Obstruction' is an impact on a view involving blocking thereof.

With a wind turbine development visual intrusion is more common. In reporting on visual impact, three basic assessments are used:

- Construction Impacts: considers the impacts including the active construction of the wind turbine up to completion of the works;
- Operational Impacts: considers the impact after completion of construction.
- Residual Impacts: considers any alteration of operational impact due to mitigation during the 25 year period that the wind turbine will be in operation before decommissioning.

Cumulative impact is also considered where appropriate. 'Static' cumulative impact is considered from the photomontage (Viewshed Reference Point) locations. This is where the receptor is located in one viewing position and looks at the view around them and can view several wind turbine developments. 'Sequential' cumulative impact is considered from the roads. This is where more than a wind turbine development would be seen whilst travelling along a length of road, but not necessarily together in one view. As a worst-case scenario, the cumulative impact assessment in this chapter assumes that all built and permitted wind turbine developments, within 20kms of the proposed development, are built and operating in the landscape.

Other significant landmark features have been noted in the immediate setting, such as the O2 telecommunications mast, located in the National Technology Park. The cumulative impacts of the proposed wind turbine and these existing man-made features will increase the overall landscape visual impact.

In this assessment, the term 'receptors' mean viewers within the general environment, as well as residential properties. Although the Zone of Theoretical Visibility extends to 20km from the site of the proposed turbine, the residential assessment is largely focussed on the 5-6km around the site where significant impacts are potentially likely to occur.

The extent to which additional illumination will be visible in the night landscape is also taken into account.

Sixteen photomontages were prepared at specific key locations surrounding the site. These photomontage viewpoints have been chosen to reflect a range of distances, directions and receptor types. The locations of the viewpoints are indicated on **Figure 8.0** as 'VRPs' (Vantage Reference Points).

Significance Criteria

The significance criteria, as set out in the EPA guidelines, have been used for the purpose of this assessment. The significance of landscapes is considered against their designation (national, county, local, etc.). Where not designated, landscapes are considered as being of local significance. Views from properties are all considered on an equal basis without varying degrees of significance.

Table 8.1 Landscape and Visual Impact Assessment Criteria

Significance Level	Criteria
Profound	An impact which obliterates sensitive characteristics
Significant	An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends.
Slight	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.
Imperceptible	An impact capable of measurement but without noticeable consequences.

As per the EPA Guidelines, impacts can be considered to be Negative, Neutral or Positive in effect. Impacts are considered where they may be direct, indirect and/or cumulative as appropriate. Impact duration is considered as being Temporary (for up to one year), Short-term (from 1 to 7 years), Medium-term (7 to 15 years), Long-term (from 15 to 60 years) or Permanent (in excess of 60 years).

The study was carried out between the spring and summer of 2011. There were no limitations or constraints in carrying out the assessment.

8.3 Receiving Environment

This section describes the existing site context in terms of landscape character, land use and landscape planning designations.

8.3.1 Existing Environment

Site Context

The Vistakon site is located to the eastern edge of the National Technology Park in Rivers, County Limerick. This ‘Science and Technology’ Park is a 263 hectare managed parkland site and is located some 5km to the east of Limerick City. Refer to **Figure 8.0**. The R445 is located immediately south of the National Technology Park; where it links with the M7 some 2km east of the Park’s main entrance at Annacotty Roundabout.

The National Technology Park lies to the south of the River Shannon and west of its tributary, the Mulkear River. The built development within the National Technology Park is largely concentrated to the west where it merges with the University of Limerick and suburban developments of Castletroy. In recent years, the University has also developed north of the Shannon and includes a mixed

development of student residences, academic buildings and a sports facility which is currently under construction.

The National Technology Park includes a number of large and small scale manufacturing and office facilities including Vistakon, Cook Medical and O2. The Vistakon building is one of the larger industrial buildings measuring approximately 280m long, 150m wide and 12m high, located at the eastern side of the park.

The topography of the site and wider landscape is generally flat, gently undulating to higher ground at Monaleen to the south and to the north of the River Shannon. The lands to the east of the River Mulkear rise gently eastwards and are largely rural in character. The Slieve Felim and Cratloe/Woodcock Hills lie 8km and 5km to the east and north, respectively.

The R445 with its associated 'ribbon' development generates a strong physical boundary to the south of the National Technology Park. The Limerick City suburbs of Annacotty and Monaleen, dominate the landscape to the south of this route and rise gently southwards. The M7 (Cork-Dublin route) is located further south of the aforementioned suburban estates and forms an edge to the low-lying Shannon River valley.

There are a number of key vantage points surrounding Limerick City and its environs. These particular view points encapsulate the character of the low-lying City setting with its prominent built features or landmarks such as notable church spires including St. John's Cathedral, St. Mary's Church of Ireland and St. Alphonsis' Redemptorist Church. The riverside City also includes more recent landmarks including the Clarion Hotel, Thomond Park and Riverpoint development, all of which contribute to the visual diversity and interest of the City's skyline.

Landscape Character

The landscape character of the study area and its vicinity is described in the Limerick County Development Plan as 'Shannon Integrated Coastal Management Zone' and while the Plan does not designate any specific visual landscape status to the area, the area can be considered to be part of a distinctive section of the Lower River Shannon, characterised by the riparian vegetation, islands and fast flowing sections of river.

The River Shannon corridor, to the north, is notable for extensive, large trees (principally willow and alder) which line its banks and cover the islands which have formed from a build-up of silt within the river channel.

The landscape character of the site and surrounding landscape can be described as flat, edge of city, industrial and suburban landscape.

Site Description

The circa 15.5 hectare Vistakon manufacturing facility is comprised of a large industrial unit (approximately 38,000sq.m.) with associated car-parking and green spaces. Vehicular access to the site is via the main entrance immediately south of the facility on Plassey Park Road.

The Vistakon site is relatively flat where ground levels of approximately 10.5m AOD are noted. The current facility has opportunity for future development/expansion to the north-west of the existing facility. Lands immediately to the south and east of the site are also currently unoccupied.

Vistakon is located immediately to the east of Plassey Park Road and to the west of the UL Bohemian Rugby Grounds adjacent the River Mulcair. Residential development largely comprises compact 'ribbon development' located immediately to the south east of the Vistakon site; namely along Mulcair Drive and Mount Shannon Road. Refer to **Figure 8.0** for detailed location.

The current facility is largely enclosed. A substantial field boundary/hedgerow is located along the south-eastern edge of the site of the existing facility. This hedgerow is largely comprised of Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*) and Ash (*Fraxinus excelsior*) and is further reinforced by specimen tree planting within the Vistakon site.

A mixed woodland, approximately 12metres wide, defines the Vistakon site's boundary to the east where it adjoins UL Bohemian Rugby Grounds. It is likely that this planting (largely Oak (*Quercus petraea*), Willow (*Salix cinerea*) and Ash (*Fraxinus excelsior*)) was carried out in connection with the construction of the facility. Today it aids in screening the existing facility from the adjoining playing fields. A similar woodland mix has also been planted to the north of the Vistakon facility. Immediately north of this woodland, there is a temporary car-parking facility. This is accessed via a construction traffic access route from Plassey Park Road to the north-west of the Vistakon site.

To the north-west of this temporary carpark, there is a small enclosed field (of approx 1.8ha) with some naturalised Willow (*Salix cinerea*). This small field is enclosed to the north and northwest by a hedgerow with a number substantial tree species including Oak (*Quercus petraea*) and Ash (*Fraxinus excelsior*). This field is more 'open' along Plassey Park Road as the vegetation along the existing drainage ditch is less dense than the aforementioned hedgerows.

A substantial mixed woodland with some ornamental edge species is present along the western edge/roadside margin at Plassey Park Road which provides screening for the road user to the existing facility. This planting mix includes a number of substantial Oak trees; along with Alder (*Alnus glutinosa*), Willow (*Salix cinerea*) and Dogwood (*Cornus alba*).

8.3.2 Site Significance

The National Technology Park was developed as Ireland's first Science and Technology Park in 1984 and since its inception it has become hugely important focal point in the south-west for high technology and knowledge based companies. The Park provides a base for over employment 80 businesses which, in turn, employ some 3,000 people.

The University of Limerick adjoins the National Technology Park to the west as noted in **Section 8.3.1**. Shannon Development continues to promote associations between the National Technology Park's client firms and the adjoining third level facility.

The site falls within the *Limerick County Development Plan 2010-2016* and the *Castletroy Local Area Plan 2009-2015*. Although the site lands are located outside

the statutory control of the adjoining local authorities, namely Clare County Council, Limerick City Council and North Tipperary County Council, the *Clare County Development Plan 2011-2017*, the *Limerick City Development Plan 2010-2016* and the *North Tipperary County Development Plan 2010-2016* have been referred to in terms of landscape and visual impacts on the environment.

The National Technology Park lands are zoned 'Enterprise and Employment' in the Castletroy Local Area Plan 2009-2015. The lands immediately to the west of the Technology Park at the University of Limerick are designated 'Education and Active Open Space' while the remaining lands adjoining the 'Technology Park' include the following zoning designations, 'Existing Residential', 'Retail/Commercial/Community' and 'Neighbourhood Parkland/Open Space Recreational/Existing and Proposed'.

8.3.3 Design Guidance & Planning Context

The Department of the Environment, Heritage and Local Government design guidelines *Wind Energy Planning Guidelines 2006* offer guidance on the siting and design of wind turbines for urban and industrial areas, similar to that of the proposed Vistakon site.

Location	"A wind energy development can be placed sufficiently close to the structures concerned in order to establish a visual relationship but sufficiently distant to ensure a certain autonomy. The wind energy development should appear as a distinct and discrete entity."
Spatial context	"determined by the spatial extent and height of the existing structures making up the urban and/or industrial context." "thematic association is created with the existing structures in terms of technological image."
Layout	"a single line or staggered line will most likely be the preferred approach. In the case of an extensive urban and/or industrial complex a slightly deeper plan might be acceptable."
Height	"tall turbines could create a dramatic contrast with existing structures"
Cumulative effect	"In urban areas there is little or no tolerance of more than one wind energy development due to the likely sense of clutter and possible feeling of dominance."

It is considered that the proposed Vistakon wind turbine is designed and located in accordance with the guidance above.

8.3.4 Designated Scenic Landscape

The Limerick County Development Plan 2010-2016 includes a broad-based landscape character assessment plan. As noted above in **Section 8.3.2**, the proposed development site is located within the Landscape Character Area; 'Shannon Integrated Coastal Management Zone'. Protected Views and Prospects, designated in the Plan, are noted below in **Section 8.3.4**.

Although the aforementioned plan does not designate any specific visual – landscape status to the area of the proposed development, the area is, however part of a distinctive section of the Lower River Shannon in its course from Lough Derg to Limerick City, characterised by the riparian vegetation, islands and fast flowing sections of water.

There are no designated scenic landscapes areas within the environs of Limerick City, County Clare and North Tipperary as referenced in their respective Development Plans as noted above. However, a number of scenic routes/ prospects, designated in the Plans are listed in **Table 8.2** below.

8.3.5 Designated Scenic Routes/ Views and Prospects

A number of designated routes which could potentially have views of the proposed wind turbine development are listed below in **Table 8.2**; (Note: All designated scenic routes/views and prospected are graphically represented on **Figure 8.0**).

Table 8.2 Designated Scenic Routes/Views and Prospects

Limerick County Development Plan 2010-2016			
Views and Prospects: Reference	Name	Distance	Comment
N/A	Clare Glens	11km east	The Clare Glens lie within the Agricultural Lowlands'. This includes a looped walkway along a steep-sided gorge; offering high landscape and amenity value. Given that the trails are largely edged with naturalised vegetation, there are no views to the site.
N/A	Lough Gur	18km south	Lough Gur has been included as its own Landscape Character Area. It is 'perhaps the most significant archaeological site in the County.....It is the objective of the Council to: (a) Safeguard the visual amenity of the are and to have regard to the views and prospects in and out of Lough Gur'. (EH011) There are no views to the site.
N/A	Tory Hill	18.5km south-west	Tory Hill has been included as its own Landscape Character Area. It is 'an isolated locally prominent hill within is within 2km of the town of Croom. It is an important feature in the surrounding countryside as it is a limestone hill with deposits of gravel which have been left since the last ice age....It is an objective of the Council that there is a presumption against development in this location' (EH 015). There are no views to the site.
Clare County Development Plan 2011-2017			
Scenic Routes:	Name	Distance	Comment
Ref: 22	From Brickhill Bridge north east to road junction at Reaskcamoge	15km, north-west	There are no views of the site from this route given the intervening land form and roadside vegetation. Open views of the Shannon Estuary are possible when viewing westwards.

Ref: 23	Road from Cratloe north-east through Gallows Hill to Glennagross	15km, north-west	There are no views of the site from this route given the intervening land form and roadside vegetation. Open views of the Shannon Estuary are possible when viewing westwards.
Ref: 25	Views in and out of Doon Lough	17km, north-west	There are no views of the site from this route given the intervening landform and roadside vegetation. Framed views of Doon Lough are possible from this scenic route.
Ref: 26	Between Broadford and O' Briensbridge	8.5km north (nearest point)	There are no views of the site from this route giving the intervening landform and roadside vegetation. Open views of Slieve Bearnagh, Glenvagaliagh Mountain and Lackareagh Mountain are possible from this route.
Ref: 27	R463 from O' Briensbridge through Killaloe to outside Ogonnolloe	17km, north-east (nearest point)	High Landscape Value. Offering views towards Lough Derg and surrounding valley. There are no views of the site from this route.
North Tipperary County Development Plan 2010-2016			
Protected Views	Name	Distance	Comment
Ref: V01	Views west and sections of the road to the east of the R494 road from Ballina to Portroe	18km, north-east.	High Landscape Value. Offering views towards Lough Derg and surrounding valley. There are no views of the site from this route.
Ref: V12	Views north and south on sections of the R503 from Newport to Ballycahill	18km, east.	Open views towards River Shannon Valley. At a number of locations along the route, long range views of the site may be possible.
Ref: V14	View west on the Cork Road approach to Newport	12km, east.	There are no views of the site from this route given the intervening landform and roadside vegetation

The *Limerick City Development Plan 2010-2016* does not include a specific list of protected views or prospects or scenic routes. The Plan does however note that the *'the amenity view types and prospects which are particularly relevant to Limerick City and shall be considered in the assessment of development proposals are as follows:*

- *Linear views of Landmark Buildings, the City Walls and City Skyline*
- *River Prospects*
- *Approach Road Views'*

'Policy LBR.5: It is the policy of Limerick City Council to protect the intrinsic character and scale of the City and the City skyline.

Policy LBR.6: It is the policy of Limerick City Council to protect key views and vistas and the visual prominence of important city landscape and townscape features such as areas of woodland, important tree groupings, and areas of special architectural or heritage value.'

8.3.6 Other Designations

A Special Area of Conservation (Site Code: 002165) - Lower River Shannon) is located north of the site. There are Natural Heritage Areas (NHAs) and Special Protection Areas in the wider area.. These have been referenced in detailed in **Chapter 7 Flora and Fauna**.

An ‘Architectural Conservation Area’ (ACA) is designated ‘in and around the University (Limerick) Campus....to secure the appreciation of the setting of the existing protected structures and the buildings of high architectural quality constructed since the University’s foundation’. The Castletroy Local Area Plan (CLAP), 2009 identifies a number of objectives associated with the ACA; including ‘safeguard views out from, or in towards, the University’s principal buildings’.

A number of ‘key’ protected structures and recorded monuments (listed in Castletroy LAP 2009, the Limerick City Dev. Plan 2011 and the Limerick County Development Plan 2010-2016 within an approximate 5km radius of the site, and which are of architectural and visual importance both locally and at a city level. include those are noted in **Tables 8.3** and **8.4** below.

The spires of a number of the larger churches within the City create clear visual landmarks from a number of key vantage points around the City. These landmark churches include St. Alphonsis’ Redemptorist Church, St. Mary’s Church of Ireland and St. John’s Cathedral, all of which have been noted below in **Tables 8.3** and **8.4**.

For a comprehensive list of all recorded monuments and protected structures, refer to **Chapter 13 Archaeology, Architecture and Cultural Assessment**.

Table 8.3 Key Recorded Monuments

Key Recorded Monuments				
Location/Reference	Document Reference	Reference:	Title/Location	Description
710m NW of site	Castletroy LAP 2009	LI006-017001	Castletroy Castle, Castletroy	Medieval Castle
Ref. 7, Figure No. 8.0 (7.0km SW of the site)	Limerick City Dev. Plan 2011	21521011	St. Alphonsis Redemptorist Church, South Circular Road.	Limestone Church with spire.
Ref. 3, Figure No. 8.0 (5.5km SW of the site)	Limerick City Dev. Plan 2011	2150814	St. Mary’s Church of Ireland, Athlunkard Street.	Limestone Church with tower.
Ref. 4, Figure No. 8.0 (6.0km SW of the site)	Limerick City Dev. Plan 2011	21518042	St. John’s Roman Catholic Church, Cathedral Place	Limestone cathedral with spire.

Table 8.4 Key Protected Structures

Key Protected Structures			
Location/Reference	Document Reference	Title/Location	Description
710m NW of site	Castletroy LAP 2009 (Ref 1) and Limerick Co. Dev. Plan 2010	Castletroy Castle, Castletroy	Medieval Castle
2.75km W of site	Castletroy LAP 2009 (Ref 1) and Limerick Co. Dev. Plan 2010	Plassey Bridge, Sreelane	Bridge, known locally as 'Black Bridge'
2.75km W of site	Castletroy LAP 2009 (Ref 1) and Limerick Co. Dev. Plan 2010	Plassey Mill, Sreelane	Industrial Mill in ruins
2.0km W of site	Castletroy LAP 2009 (Ref 1) and Limerick Co. Dev. Plan 2010	Plassey House, Sreelane	Country House
Ref. 3, Figure No. 8.0 (5.5km SW of the site)	Limerick City Dev. Plan 2011 (Ref 009)	St. Mary's Church of Ireland, Athlunkard Street.	Limestone Church
Ref. 4, Figure No. 8.0 (6.0km SW of the site)	Limerick City Dev. Plan 2011 (Ref 025)	St. John's Roman Catholic Church, Cathedral Place	Limestone Church with spire.
Ref. 7, Figure No. 8.0 (7.0km SW of the site)	Limerick City Dev. Plan 2011 (ref 039)	St. Alphonsis Redemptorist Church, South Circular Road.	Limestone Church with spire.

8.3.7 Recreation and Amenity Landscapes

The proposed site has no direct bearing on any areas of amenity or recreation. There are however amenity facilities nearby:

- Riverside walkway along the River Shannon and the River Mulkear. These rivers are also popular locations for anglers.
- University of Limerick and UL Bohemians Rugby Grounds – incorporating sporting grounds and zones for passive recreation.
- Designated waymarked ways, including Lough Derg Way, a portion of which is located approximately 1km to the north east of the Vistakon site. Other waymarked ways which are distant from the site include the East Clare Way, the Slieve Felim Way and the Clare Glens.

8.3.8 Zone of Theoretical Visibility

A key element of any appraisal of a proposed wind turbine development is an assessment of the visual impact. This is greatly aided by the production of a Zone of Theoretical Visibility Map. This map is based on the Ordnance Survey 1:50,000 Discovery Series mapping used in conjunction with ArcGIS Spatial Analyst software for a radius of 20km.

The map (**Figure 8.0.1**) indicates all locations where the wind turbine will be theoretically visible in the landscape. The assessment is based on topography only and excludes buildings and vegetation. Accordingly, screening influences associated with land use and land cover are excluded and there may be small exceptions locally across this plan however it is intended to illustrate the broad pattern of theoretical visibility across the area. The map illustrates the extent of the visibility at the base of the proposed wind turbine, at the hub (80m) and at half the blade height in addition to the hub height (100m), in accordance with the DOEHLG Wind Planning Guidelines (Appendix 1, page 80 -84 inclusive).

The site of the proposed turbine is located in Rivers and is low-lying, approximately 10.5m O.D., which results in the site being visible over a wide area, particularly from localised highpoints in the wider context of the River Shannon Valley. The primary views of the site include Knockaunnamoughilly, Woodcock Hill, Slievebearnagh and Cappakea in County Clare; Keeper Hill and Slieve Felim in County Tipperary and Luddenmore and Knockseefin in County Limerick.

8.4 Characteristics of Proposed Development

8.4.1 Description

A full description of the proposed development is given in **Chapter 3 'Site and Scheme Description'**. The proposed development comprises one wind turbine with a hub height of up to 80m, rotor radius of up to 40m and a tip height of up to 120m.

Once installed, the physical scale and movement of the turbine will give rise to significant change in the immediate landscape. The turbine has been located to work with site constraints, minimise visual and other environmental impacts, as well as maximising the wind potential.

The turbine will be painted in an off-white or grey colour with a matt finish. This is the usual colour and finish recommended for Irish wind farms as under typical Irish skies, these colours look attractive on bright sunny days; and they blend in effectively under cloudy skies.

The turbine will be of a typical modern design which shall incorporate a tubular steel tower and three rotating blades. The foundations for the turbine are described in **Section 4.5.6**.

Other elements which will have a landscape and visual impact but to a lesser degree include:

- Night lighting for aviation, which will consist of a medium intensity white flashing light at the top of the turbine hub.
- For some turbine models there is an external transformer with typical dimensions of 1m wide by 2 to 3m long by 2m high (approximately). If external it will be located close to the turbine. Other turbines include these within the turbine shaft. Given the scale and context of the turbine any visual impacts arising from an external transformer will be minimal.
- Cabling (electrical and fibre-optic) will be underground connecting into existing 38Kv electrical substation and networks.

- Access track – the Vistakon turbine will utilise the existing temporary car-park on site along with an additional track which will be finished in stone or gravel. The track will be used by construction vehicles and will be retained throughout the lifetime of the wind project for use by maintenance vehicles.
- Temporary construction compound.

8.4.2 Do Nothing Scenario

In the event of this development not proceeding, the site will continue to remain as an industrial/light manufacturing site. The lands may none the less be directly impacted in the future by further expansion or industrial redevelopment of the site.

In the wider context, the overall character of the area will remain and be reinforced as a built development expands within the business park setting.

8.5 Impacts of Development

8.5.1 Landscape Impacts

Construction Impacts

In general, the construction impacts on landscape will vary depending on location from imperceptible to moderate and will be temporary, negative and localised in nature. The base of the turbine will generally be well screened from the immediate surrounding landscape due to the topography of the area. Excavation will be required for the foundations of the turbine and also for underground cabling (electrical and fibre-optic) linking into the existing electrical substation on site. The installation of the tower, nacelle/hub and blades will require large lifting cranes. This operation will be of a short duration over approximately one week.

Operational Impact – General

The impact of a wind turbine or turbines within the landscape very much depends on by whom and how they are experienced. This is influenced by whether the wind turbines are experienced from residences or roads and by local people or visitors. For the latter, the presence of the wind turbine come as a surprise, if not expected, and if perceived as being an unlikely feature of the type of landscape anticipated, even if it is also considered of interest. The impact of wind turbines also depends on how they are encountered; for example, arriving close to them on foot when exposure to wind can also be appreciated or seeing them in short glimpses whilst travelling along a main road where the experience is affected by the vehicle's speed and direction of movement.

Wind turbines can be perceived as either being majestic or dominating depending on where it is seen from and the viewers' perception. They are often perceived as being positive within the landscape, interesting in their own right due to their sleek and simplistic appearance. Some people find them negative or unattractive. Additionally, rather than being just static objects, the movement of the wind turbine blades can attract attention.

Once a wind turbine has been installed, the physical presence of the turbine and the movement of blades can give rise to significant changes in the local visual environment (within 2km). By their nature, wind turbines are very visible elements in the landscape; they must be sited in areas of relatively high wind resource potential, which often inevitably implies locations of higher elevation and visibility.

Within close proximity to wind turbines, it is likely that the structures will be considered as being dominating. However, from mid-ground or distant views, the turbines will be less dominating. From many vantage points they will be screened by intervening vegetation, topography and/or built development. From other vantage points the full size of the turbine will be visible. This may be perceived by people as being majestic due to their scale and simple form and association with a clean, renewable energy source. It is acknowledged that other people will dislike their form or the change that they create to the existing landscape.

The visibility of turbines will vary throughout the day, weather conditions and season due to the level of the intensity of light. Turbines will be more visible in the early morning and evening when light shines directly upon the structure. Additionally, the backdrop to the structure will also affect the visual contrast. Where the structures are located against the sky they, due to the off-white colour will blend into the horizon especially when there is haze or cloud. When the structures are viewed against land, the colour contrast increases the visual prominence of the structure. The visual effect is also affected by the orientation of the viewpoint to the wind tower, as the turbine blades will be more visible when viewed straight on.

During the operation stage, landscape and visual impacts mainly arise from the physical built presence of the turbine and the movement of the blades. The impacts will be long term (25 years) and for the purposes of this assessment have deemed to be neutral during this stage as only a single turbine is proposed in the context of a large manufacturing facility, although this is highly subjective dependant on the receptors opinion or perception of wind turbines. The impacts could equally be considered to be negative or positive. During the hours of darkness the proposed turbine will have a light which will be a medium intensity white flashing light.

Operational Impact – Proposed Turbine

The proposed wind turbine has been sized and located in a position that attempts to balance the environmental impacts with operations of the site and maximising the wind energy potential. The turbine will be painted off-white or light grey, with a matt or semi-matt finish. This is the usual finish that is recommended by most guidelines for wind turbines in a northern European context. Under typical Irish skies, these colours can look attractive on a sunny day; but more importantly, they blend in effectively with the more usual cloudy skies. This particularly applies to distant views, with the turbine being most visible during clear weather conditions.

The wind turbine will be visible over a wide area of the immediate surrounding landscape. Depending on the viewing location the impact will vary from imperceptible to significant due to the scale and type of development proposed. A comprehensive series of viewshed reference points (VRPs) have been prepared to illustrate the levels of landscape impact.

It is accepted that the proposed wind turbine would be a significant visual focal point in close range views. However, the turbine will not be dominant in the landscape

over a wide area. Beyond 1 to 2km, the visual presence of the wind turbine will reduce in the landscape. This is clearly evident in the range of photomontage views from around the site and city.

There is a permitted windfarm at Castlewaller approximately 10km to the east on the Slieve Felim Mountains within North Tipperary.

The cumulative landscape and visual impact arising from some or all of these turbines will have an imperceptible to slight effect on the visual and landscape character of the area. For some, the impact will be viewed as negative, but for many others the impact will be positive in nature.

8.5.2 Visual Impacts of the Development

8.5.2.1 Viewpoint Assessment

Various vantage points in the surrounding landscape were identified as suitable viewshed reference points (VRP) for illustrating the level of visual impact. These are listed in **Table 8.5** below. The table includes the name, location, distance from the wind turbine and level of impact during construction and operational phases.

For the location of the VRPs, please refer to **Figure 8.0**. For individual VPR references please refer to **Figures 8.1.1 – 8.16.3** inclusive.

The recommendations of the Department of Environment Heritage and Local Government (DoEHLG), *Wind Farm Planning Guidelines* (2006) have been taken on board when preparing each VPR. For each VPR, the existing view, wireframe and proposed view is illustrated. The existing and proposed view will be illustrated with a 50mm lens; the wireframe will be shown with a 24mm lens to aid in illustrating the wider context.

Table 8.5 VRP (Viewshed Reference Points)

VRP	VRP location	Figure	Description and nature of existing views	Distance (km) to proposed turbine from VRP	Visual Impact - Vistakon		
					Construction	Operational	Cumulative
01	R445/M7 Dublin Road Interchange	8.1.1, 8.1.2 & 8.1.3	Elevated view westward from upper level of M7/R445 Interchange.	2.2km	Slight, temporary impact during installation of the turbine.	Moderate impact with turbine visible with context of the eastern edge of Limerick with a mixture of vegetation and built development.	No cumulative impact with Castlewaller Windfarm; Castlewaller is located approximately 13.5km to the north-east of the Vistakon site.
02	Dublin Road (R445) at Mulkear River	8.2.1, 8.2.2 & 8.2.3	Elevated north-westward view (over properties along Mulkear Drive) from Dublin Road at Mulkear River Bridge Crossing.	1.2km	Slight, temporary impact during installation of the turbine.	Moderate impact at the bridge crossing of the Mulkear river, where there is a break in the road side vegetation allowing views towards the proposed turbine.	No cumulative impact with Castlewaller Windfarm; Castlewaller is located approximately 13.5km to the north-east of the Vistakon site.
03	N24/Railway crossing at Ballysimon	8.3.1, 8.3.2 & 8.3.3	Long range open view from N24/Railway Crossing with farmland in the foreground and residential developments of Newcastle and Monaleen on the skyline.	3.5km	Slight, temporary impact, during installation of the turbine	Slight impact with turbine partially visible behind the ridgeline at Monaleen/ Annacotty.	No cumulative impact with Castlewaller Windfarm; Castlewaller is located approximately 13.5km to the north-east of the Vistakon site.
04	Annacotty Roundabout (R445)	8.4.1, 8.4.2 & 8.4.3	Road level views northwards to National Technology Park.	0.5km	Slight, temporary impact during installation of the turbine.	Moderate impact with turbine visible at the entrance to the National Technology Park.	No cumulative impact with Castlewaller Windfarm; Castlewaller is located approximately 13.5km

VRP	VRP location	Figure	Description and nature of existing views	Distance (km) to proposed turbine from VRP	Visual Impact - Vistakon		
					Construction	Operational	Cumulative
							to the north-east of the Vistakon site.
05	Monaleen Road	8.5.1, 8.5.2 & 8.5.3	View north-eastwards from Monaleen Road. Suburban, primarily residential, landscape in the foreground with views of the Slievebearnagh and Knockaunnamoughilly Hills in the distance	2.3km	Slight, temporary impact during installation of the turbine.	Moderate impact with turbine visible above intervening trees and vegetation and visible against skyline and hills in distance.	Slight impact given the long range distance from the turbines.
06	Dublin Road (R445) at Groody Hill	8.6.1, 8.6.2 & 8.6.3	Road level view north-eastwards from Groody Hill incorporating mixed roadside development	2.6km	Imperceptible, temporary impact during installation of the turbine.	Slight/imperceptible impact with upper section of blade of turbine visible.	No cumulative impact with Castlewaller Windfarm given that the windfarm is being obscured by existing vegetation.
07	M20/R926 Interchange	8.7.1, 8.7.2 & 8.7.3	Long range open view from M20/R926 interchange north-eastwards. The M20 dominates the view in the foreground.	8.5km	Imperceptible, temporary impact during installation of the turbine.	Slight impact with turbine visible against skyline at Monaleen/ Annacotty.	No cumulative impact with Castlewaller Windfarm given that the windfarm is being obscured by existing vegetation.
08	N18/ West of Limerick	8.8.1, 8.8.2 & 8.8.3	Long range easterly view from the N18. Thomond Park Rugby Grounds is visible on the skyline in the centre of the view.	12.5km	Imperceptible impact during installation of turbine.	Slight impact with turbine visible at skyline with the Slieve Felim Mountains forming the backdrop.	No cumulative impact with Castlewaller Windfarm given that the windfarm is being obscured by existing vegetation.

VRP	VRP location	Figure	Description and nature of existing views	Distance (km) to proposed turbine from VRP	Visual Impact - Vistakon		
					Construction	Operational	Cumulative
09	Northern bank of River Shannon, NW of the site.	8.9.1, 8.9.2 & 8.9.3	View south-eastwards towards the site with riparian woodland of the River Shannon dominating the middle ground.	0.65km	Slight, temporary impact, during installation of turbine	Moderate impact as full height of turbine will be visible; the VRP shows that the view will be somewhat filtered given the screening properties of the existing vegetation; however, open views to the turbines will be possible at this location. The impact on this particular view will be somewhat reduced in the summer months given leaf cover on mature trees.	No cumulative impact with Castlewaller Windfarm given the angle of VRP
10	Long Pavement, Moyross	8.10.1, 8.10.2 & 8.10.3	Panoramic view south-westwards across Limerick City and environs.	7.0km	Imperceptible impact due to intervening distance, topography and vegetation.	Slight impact with turbine visible above distant treeline at Castletroy.	No cumulative impact with Castlewaller Windfarm given the angle of VRP
11	Bridge over N18, East of N18/N69 Interchange	8.11.1, 8.11.2 & 8.11.3	Panoramic view north-eastwards across Limerick City and environs.	9.0km	Imperceptible impact due to intervening distance, topography and vegetation.	Slight impact with upper part of turbine visible above distant treeline at Castletroy.	No cumulative impact with Castlewaller Windfarm given that the windfarm is being obscured by existing vegetation.
12	Mulcair Drive, Annacotty	8.12.1, 8.12.2 & 8.12.3	Cluster of detached residential properties to the south east of the Vistakon and NTP site. Mixture of	0.79km	Slight, temporary impact, during installation of turbine with craneage visible	Moderate impact with upper part of turbine visible to northwest from properties and	No cumulative impact with Castlewaller Windfarm given the angle of VRP

VRP	VRP location	Figure	Description and nature of existing views	Distance (km) to proposed turbine from VRP	Visual Impact - Vistakon		
					Construction	Operational	Cumulative
			single storey and dormer dwellings, primarily facing east and west.		above intervening trees and hedgerows.	through gaps between buildings.	
13	Mulcair Drive East, Annacotty	8.13.1, 8.13.2 & 8.13.3	Cluster of detached residential properties to the south east of the Vistakon and NTP site. Mixture of single storey and dormer dwellings, primarily facing east and west.	0.69km	Slight, temporary impact, during installation of turbine with crane visible above intervening trees and hedgerows.	Moderate impact with upper part of turbine visible to northwest from properties and through gaps between buildings.	No cumulative impact with Castlewaller Windfarm given the angle of VRP
14	Mulcair Drive North, Annacotty	8.14.1, 8.14.2 & 8.14.3	Northern end of Mulcair Drive at the entrance to UL Bohs Rugby Club car park. View towards Vistakon site which is substantially screened by boundary planting and hedgerows	0.6km	Moderate, temporary impact with crane visible above intervening trees and hedgerows.	Significant impact with much of the proposed turbine visible above the existing trees.	No cumulative impact with Castlewaller Windfarm given the angle of VRP
15	Mulcair Drive West, Annacotty	8.15.1, 8.15.2 & 8.15.3	Cluster of detached residential properties to the south east of the Vistakon and NTP site. Mixture of single storey and dormer dwellings, primarily facing east and west.	0.7km	Slight, temporary impact, during installation of turbine with crane visible above intervening trees and hedgerows.	Moderate impact with upper part of turbine visible to northwest from properties and through gaps between buildings.	No cumulative impact with Castlewaller Windfarm given the angle of VRP
16	Mountshannon Road, Annacotty	8.15.1, 8.15.2 & 8.15.3	Intermittent views across flat agricultural landscape towards the NTP site. Some built elements of the NTP are visible through and/or above the intervening hedgerows.	0.85km	Slight, temporary impact, during installation of turbine with crane visible above intervening trees and hedgerows.	Moderate impact with upper part of turbine visible above intervening hedgerows.	No cumulative impact with Castlewaller Windfarm given the angle of VRP

8.5.2.2 Settlements

Many of the visual impacts upon surrounding settlements area are well illustrated in the photomontages, and described in **Table 8.5** above.

As a general note however, the key suburban areas in close proximity to the site include Castletroy, Annacotty and Monaleen. There will certainly be views, many of these quite open, to the proposed turbine from these suburban locations.

'Ribbon' type resident developments in Lisnagry, Mount Shannon (along Mount Shannon Road) and Rivers will certainly have open views to the proposed turbine; however some areas will be screened by existing residential boundary planting and the proximity of adjoining built development.

Further from the site, other suburban developments in Limerick City and City environs including Dooradoyle, Singland will have more distant views towards to the proposed turbine.

Immediately north of the site, in County Clare, open views to the proposed turbine will be possible from Garraun. Views will also be possible from limited locations in Parteen and Athlunkard; however the turbine will form part of the Limerick City environs.

8.5.2.3 Designated Scenic Routes and Roads Views and Prospects

There are a number of designated scenic routes within the 20km radius of influence which will have varying levels of visual impact:

- **Views and Prospects (Limerick): Clare Glens**

Generally, there will be no views from this scenic route to the proposed turbine given that the route will be screened by roadside vegetation and the intervening localised rise in topography. They are limited views of Limerick City at a number of locations along this route, however given that the route is some 10.0km at its nearest point from the proposed development and the fact that the development will be part of built development of the City and its environs, the impact will only be imperceptible.

There will be no cumulative visual impact with Castlewaller windfarm development.

- **Views and Prospects (Limerick): Lough Gur**

There will be no views of the proposed development from Lough Gur given the intervening ridgeline at Luddenmore and as such there will be no visual impact on the same. Refer to Figure 8.0. There will be no cumulative visual impact with Castlewaller windfarm development.

- **Views and Prospects (Limerick): Tory Hill**

There will be no views of the proposed turbine from Tory Hill and as such there will be no impact on the same. Refer to **Figure 8.0**. There will be no cumulative visual impact with Castlewaller windfarm development.

- **Scenic Route (Clare, Ref 22): Local road Brickhill Bridge to Reaskcamoge**

There will be no views of the proposed turbine given the intervening ridgeline of Woodcock Hill and as such there will be no impact on this scenic route. Refer to Figure 8.0. There will be no cumulative visual impact with Castlewaller windfarm development.

- **Scenic Route (Clare, Ref 23): Local road Gallows Hill to Glennagross**

There will be no views of the proposed turbine given the intervening ridgeline of Woodcock Hill and as such there will be no impact on this scenic route. Refer to **Figure 8.0**. There will be no cumulative visual impact with Castlewaller windfarm development.

- **Scenic Route (Clare, Ref 25): Views in and out of Doon Lough**

There will be no views of the proposed turbine given the distance from the site, roadside vegetation and intervening ridgeline of Knockaunnamoughilly and as such there will be no impact on this scenic route. Refer to **Figure 8.0**.

- **Scenic Route (Clare, Ref 26): Route from Broadford to O' Briens Bridge**

There will be no views of the proposed turbine given the intervening ridgeline of Cappakea and rising lands immediately north of the Mulkear River and as such there will be no impact on this scenic route. Refer to **Figure 8.0**. There will be no cumulative visual impact with Castlewaller windfarm development.

- **Scenic Route (Clare, Ref 27): R463 from O' Briensbridge to Ogonnolloe**

There will be no views of the proposed turbine given the distance from the site, roadside vegetation and the intervening rising lands immediately north of the Mulkear River and as such there will be no impact on this scenic route. Refer to **Figure 8.0**. There will be no cumulative visual impact with Castlewaller windfarm development.

- **Scenic Route (Tipperary, Ref V01): R494 Ballina to Portroe**

There will be no views to the proposed turbine given the intervening rising lands, roadside vegetation and distance from the site and as such there will be no impact on this scenic route. Refer to **Figure 8.0**.

- **Scenic Route (Tipperary, Ref V12): R503 Newport to Ballycahill**

There may be some limited views of the proposed turbine from this route where open views to Limerick City and environs are possible resulting in a imperceptible to slight impact given the distance of approximately 11.0km at its nearest point from the proposed development and the fact that the development will be part of built development of the City and its environs.

Cumulatively, visual impacts will vary from slight to moderate. Refer to **Figure 8.0**.

- **Scenic Route (Tipperary, Ref V14): Cork Road approach to Newport**

There will be no views of the proposed wind turbine as localised land forms, particularly close to Murroe, will screen the route from the proposed development. There will be no cumulative visual impact with Castlewaller windfarm development.

8.5.2.4 Designated Scenic Landscapes

As noted previously, there are no designated scenic landscapes within the 20km study area.

8.5.2.5 Other Designations

There will be little or no impact on the 'Architectural Conservation Area' located in Castletroy / Dromroe; however there will be occasional views of the proposed turbine from the outer eastern edge of this designated zone. The building form along this eastern

zone of the 'Architectural Conservation Area' includes 'Hamilton House' and the 'University Business Complex' which tend to have a westerly orientation and would be similar in character to the building units associated with the National Technology Park. Where views to the turbine are possible (i.e. from the east facing façade) the impact would vary between moderate and significant. There will be no views to Castlewaller Windfarm from this location and as such there would be no cumulative impact.

As noted in the 'Cultural Heritage Assessment', there is little or no impact on protected structures and recorded monuments within close proximity to the proposed wind turbine. Refer to **Section 13.5.2, Cultural Heritage Assessment** for details.

As noted previously, the low-lying riverside City of Limerick includes a number of landmark features; some constructed in the last decade including the Clarion Hotel, Riverpoint and Thomond Park. Other key landmark features on the City skyline include more historic features (or protected structures) which are largely the church spires of St. John's Cathedral, St. Mary's Church of Ireland and St. Alphonsis' Redemptorist Church. All of these features, whether old or new help to define the city, and in effect creates its own 'identity'/'sense of place'. The proposed turbine will create a landmark in its own right and will certainly create a significant visual impact over a wide area. To some, the image of the turbine will be deemed as negative, however to others, it will be seen as a positive impact on the local landscape and will certainly suggest or deliver the message that the City is striving for alternative or renewable sources of energy, is aiming to reducing the local carbon footprint and is seeking a 'greener' environment.

In the wider context, the turbines proposed in Castlewaller, will be visible from the City and the environs and as a result will give rise to perceived changes in the landscape. Again, this could be seen as either being positive or negative depending on the observer.

8.5.2.6 Recreational Areas

The river bank walks along the River Shannon and the River Mulkear will be largely screened from views of the turbine given the riparian woodland enveloping the river's edge and islands. Where openings appear, particularly in winter, views of the turbine are likely and which will result in slight to moderate impact. As walkers and cyclists will be travelling at a slower speed than motorists, oblique as well as directional views may be possible of the turbine and therefore impacts will vary considerably. There will be no views to Castlewaller Windfarm from this location and as such there will be no cumulative impact.

As a general note, the designated walking routes further from the site; i.e. Slieve Felim Way, East Clare Way and the Clare Glens will result in an imperceptible to slight impact where views are possible to the site.

The Lough Derg Way, adjacent to the Errina Canal is largely enclosed by riparian planting and as such only limited views to the proposed development will be possible. Where views of the site are possible, it will result in a slight to moderate impact depending on the nature of the view; decreasing in impact as one is further removed from the site. Where views of both the proposed site and Castlewaller windfarm development are possible, the cumulative impact will slightly increase.

There will be limited views of the development from the University of Limerick, but where views are possible, the impact is likely to range from slight to moderate. There will be no views of Castlewaller Windfarm from this location and as such there would be no cumulative impact.

8.5.3 Impact on Landscape Character

The proposed wind turbine will be located within the 'Shannon Integrated Coastal Management Zone' Landscape Character area. As stated previously, Limerick County Development Plan 2010-2016 notes that 'this zone comprises a large area of northern County Limerick and is bounded on one side by the Shannon Estuary while its southern boundary is defined by the gradually rising ground, which leads onto the agricultural zone and the western hills to the south west.'

The Castletroy Local Area Plan (CLAP) 2009 further notes that urban structure of Castletroy has undergone major changes in terms of development in recent times. 'Castletroy North' is described as follows: *'The major inter-related land uses of the University and the National Technological Park (Plassey Park) dominate the northern half of the plan area. There are also areas of residential development, community and sports facilities and hotels as well as a number of neighbourhood centre type developments offering retail and other services to the local working and resident population. The sporting and recreational facilities of the University are open to public use and so act as an important amenity to the local area.'*

Locally the mixture of light industrial and retail developments, undeveloped land banks, housing, infrastructure, University lands, community and sporting facilities define the overall character of the local area. The informal and mixed nature of the landscape creates a context that helps to visually absorb and assimilate the turbine into the landscape. The turbine, is however a new 'entity' in the landscape and will result in a moderate to significant impact or change in its local setting. There will be a slight increase in the overall cumulative impact where views of Castlewaller are possible from the local landscape.

8.6 Mitigation Measures

As with any similar development some degree of impact is inevitable, and wherever possible, measures have been proposed to mitigate the potential 'negative' nature of these impacts.

Existing tracks will be utilised wherever possible to minimise unnecessary physical disruption of the site.

General construction mitigation measures will include that site machinery will operate within the proposed construction compounds and storage areas will be located so as to avoid impacting further on existing trees or visually on roads and nearby properties. The construction compound will be fully re-instated at the end of the construction contract.

The three-bladed turbine will be of a grey/ off white colour which will be the least prominent against the principle colour of the backdrop of the sky.

8.7 Residual Impacts

Due to the visual nature and scale of wind turbine, it is inevitable that residual visual impacts will remain, particularly from the closest surrounding areas.

Given the nature of the development, the landscape and visual mitigation was considered in order to minimise negative impacts and create a simple clean image within the surrounding landscape. Therefore the residual impacts remain at the same significance level as assessed for the operational phase.

Given the mixed use character of the landscape, it can accommodate the proposed development in its own right. Overtime, the perception of the impact often lessens as the new development becomes more familiar and part of the overall 'normal' views.

As mentioned earlier, the wind turbine is likely to be seen as one of the key elements of the landscape and the Limerick City skyline. For some, this may be a negative impact on the local landscape; however, for others the wind turbine will represent a positive element with the landscape and visual environment.

Overall, the wind turbine will be a positive visual feature in the area. It will be a landmark structure which will identify the eastern gateway to Limerick and which will also carry a message of renewable and sustainable energy.

8.8 References

The following publications have been referenced in the Landscape and Visual Impact Assessment:

- Limerick County Council (2010) *Limerick County Development Plan 2010-2016*
- Limerick County Council (2009) *Castletroy Local Area Plan 2009-2015*
- Clare County Council (2011) *Clare County Development Plan 2011-2017*
- North Tipperary County Council (2010) *North Tipperary County Development Plan 2010-2016*
- Limerick City Council (2010) *Limerick City Development Plan 2010-2016*
- Environmental Protection Agency (2002) *Guidelines on the Information to be contained in Environmental Impact Statements*, EPA Johnstown Castle.
- Department of Environment and Local Government (2000) *Landscape and Landscape Assessment, Consultation Draft of Guidelines for Planning Authorities*
- Department of Environment, Heritage and Local Government (2006) *Wind Farm Planning Guidelines*
- Scottish Natural Heritage (2002) *Visual Assessment of Wind farms: Best Practice*
- Ordnance Survey of Ireland Discovery Series 1:50,000 mapping.
- SEI and IWES (2008) *Best Practice Guidelines for the Irish Wind Energy Industry*
- The Landscape Institute (2002) *Institute of Environmental Management and Assessment Guidelines for Landscape and Visual Impact Assessment (2nd Edition)* Spon Press, 2002.

9 Noise and Vibration

9.1 Introduction

This chapter assesses the environmental noise and vibration impact of a proposed wind turbine at Vistakon (Ireland) located on land adjacent to the northwest boundary of its existing manufacturing facility, at the National Technology Park, County Limerick. The impact of the proposed wind turbine has been assessed in accordance with criteria outlined in the EPA Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3) (EPA, 2011).

Compliance with IPPC noise limits is assessed based on the cumulative impact of wind turbine noise and existing facility noise.

9.2 Methodology

An environmental noise survey was undertaken in order to quantify the existing noise environment. The survey was conducted in general accordance with *ISO 1996: Acoustics – Description, measurement and assessment of environmental noise (Part 1 and Part 2)* (ISO, 2003 and 2007). Specific details are set out below.

Cognisance was also given to the following documentation.

- Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), EPA 2012
- *BS 5228 Code of Practice for Noise and Vibration Control on Construction and Open Sites (Part 1 and Part 2)* (BSI, 2009)
- *BS 8233 Sound Insulation and Noise Reduction for Buildings – Code of Practice* (BSI, 1999)
- *Targeted Review in relation to Noise, Proximity and Shadow Flicker – December 11th 2013, for Proposed Revision to Wind Energy Development Guidelines 2006* (Department of Environment, Community and Local Government 2013)

In addition, reference is made to the results of annual environmental noise surveys which have been carried out by Vistakon in compliance with the requirements of the IPPC Licence for the existing facility (Register Reference P0818-02).

9.2.1 Monitoring Methodology

9.2.1.1 Monitoring Procedure

Given the location of the site and the nature of the proposed development, it was determined that unattended continuous noise measurements would be taken at the closest inhabited noise sensitive receptor (AN-7, refer to **Figure 9.1**). This location is residential in nature and is considered to be a sensitive receptor due to its proximity to the Vistakon site (refer to **Figures 9.1 and 9.2**).

Continuous noise measurements were logged at 10 minute intervals for a period of approximately one week in August 2011. This logging occurred during both day-time and night-time monitoring periods, which are defined as follows in the IPPC Licence:

- Day-time Monitoring: 08:00 to 22:00 hours.

- Night-time Monitoring: 22:00 to 08:00 hours.

The survey was carried out over a one week period in order to obtain a typical snapshot of the existing background noise climate. The primary purpose was to ensure that the proposed noise criteria associated with the development are commensurate with the prevailing environment.

Following completion of the survey, the logged data was downloaded onto a computer and specialised software was then used to analyse the data. The presence of a tonal or impulsive component was also assessed. The noise levels recorded are discussed in **Section 9.3**.

In addition to the data gathered during the continuous noise monitoring, noise data from compliance monitoring at the site was also considered and incorporated into the assessment. Compliance monitoring takes place annually at six locations (AN-1 to AN-6 inclusive) (Refer to **Figure 9.1**). Information on the data recorded is discussed in **Section 9.3.2.2**.

9.2.1.2 Meteorological Conditions

Weather conditions were mixed over the course of the week, with some dry spells and some wetter periods. Wind speeds varied from 1.5 – 9.3 metres per second (m/s) over the course of the week with windier conditions experienced predominantly between the 10th and 14th August (5.1 m/s to 9.3 m/s).

9.2.1.3 Instrumentation

A Brüel and Kjær 2250 Light Class 1 Sound Level Meter was utilised to carry out the noise assessment. This meter complies with the International Electrotechnical Commission (IEC) Specification for Sound Level Meters: IEC 61672-1:2002 (IEC, 2002).

The noise meter was calibrated before and after monitoring using a Brüel and Kjær 4231 Acoustic Calibrator. A windshield and raincover was used to provide the microphone with effective wind and rain protection.

9.2.1.4 Measurement Parameters

The following parameters were recorded and reported:

- L_{Aeq} – this is the continuous steady sound level during the sample period and effectively represents an average value.
- L_{A10} – this is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.
- L_{A90} – this is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The “A” suffix denotes the fact that the sound levels have been “A-weighted” in order to account for the non-linear nature of human hearing. The L_{A90} parameter represents the steady component of the measured noise. It is relatively unaffected by intermittent interfering noise, and is used to describe the existing background noise. It is also used for the measurement of the steady component of wind turbine noise, and for evaluation of

compliance with limit values. For wind turbine noise, the L_{A90} value is typically 2 dB lower than the L_{Aeq} value.

9.2.2 Modelling Methodology

9.2.2.1 Noise Propagation Model

Calculations have been completed using SoundPLAN modelling software, Version 7.0. The following input data was used to develop the noise model:

- Details of ground topography and ground conditions.
- Noise data from wind turbine to be used.
- Location and height of the nearest sensitive receptors and boundary locations.

Noise predictions were made using this software according to guidelines specified in ISO 9613-2: Attenuation of Sound Propagation Outdoors: General Method of Calculation (ISO, 1996).

The final wind turbine type has not yet been selected. This assessment assumes that a turbine of 3MW will be installed, and uses noise emission data for the Enercon E-82 3MW wind turbine for quantitative modelling purposes. The noise impact of alternative wind turbines, with the same sound power emissions would be similar. The noise impact predictions presented in the report can readily be extrapolated for other turbine manufacturers' noise emission data, should this be required.

It is proposed to install one wind turbine with a power rating of up to 3MW, a hub height of up to 80m. The proposed wind turbine location was inserted into the computer noise model at the co-ordinates indicated in **Table 9.1**. As mentioned previously, calculations in this report are based on data for an Enercon E-82, the noise emission data for which is also presented in **Table 9.1**.

The predicted noise level is a function of the sound power emission from the turbine. The E-82 turbine has a maximum sound power output of 106 dB(A) L_{WA} at a wind speed of 10m/s (measured at 10m height). Other manufacturers' models of a similar power rating, representing best available technology, are expected to have similar sound power emissions. The calculated noise levels at the nearest houses can be readily scaled up or down from the predicted values, if the sound power emission of the turbine selected deviates from the value used in the noise model.

Table 9.1 Details of location of wind turbine and sound power emissions used in noise modelling

Site	Easting				Northing		
Vistakon (Ireland)	163345				158173		
Sound Power Emissions for Enercon E-82, hub height 80m							
Sound Power, L _{WA}	98	102	105	106	106	106	dB(A)
Windspeed, z=10m	5	6	7	8	9	10	m/s

All receptors were modelled at a height of 4 metres even if the receiver is a one-storey property, in accordance with the EPA guidance (EPA, 2011).

9.2.2.2 Noise Propagation Factors

The computer noise model allows for the reduction of sound due to distance, and allows for ground absorption and atmospheric absorption. The lands in the region are acoustically sound absorbing, and a conservative sound absorption factor of 0.5 was assigned in the model, as recommended in the EPA guidance note (EPA, 2011).

The propagation of sound from a wind turbine is a function of meteorological conditions. The manufacturer's guaranteed sound power emissions are measured downwind of the turbine, and consequently represent downwind propagation. The noise model carries out the noise calculations on the basis of downwind noise propagation.

9.2.3 Wind Turbine Noise Assessment Criteria

As outlined previously, the noise impact is assessed with reference to the *EPA Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3)* (EPA, 2011).

The EPA guidance note proposes noise limits for day-time and night-time periods of 55 dB(A) and 45 dB(A) L_{Aeq} respectively. These are cumulative noise limits representing the sum of the existing industrial noise and the additional wind turbine noise.

Essentially, the EPA view is that where wind turbines are erected on existing IPPC sites, the additional noise emissions must be accommodated within the existing EPA guideline noise limits for noise sensitive locations. The following are the IPPC Noise limits for the Vistakon site. Refer to **Figure 9.1** for the locations where the IPPC limits apply.

Table 9.2: Vistakon IPPC Licence Limits

Location	Reference	Daytime dB(A) L_{Aeq} (30 minutes)	Night-time dB(A) L_{Aeq} (30 minutes)
AN1 (site boundary)	163743E 158106N	61	61
AN2 (site boundary)	163881E 157950N	55	49
AN3 (site boundary)	163737E 157843N	55	45
AN4 (site boundary)	163609E 157879N	55	45
Noise sensitive locations		55	45

The EPA guidance note also states that wind turbine noise should not exceed 45dB(A) L_{Aeq} at any time, and should not contain any significant tonal components.

Taking account of the guidelines, the following criteria were used in this assessment:

Night-time

- At night-time the wind turbine noise at any noise sensitive receptor should not exceed 45 dB(A) L_{Aeq} , and;
- The cumulative wind turbine and industrial noise at any noise sensitive receptor should not exceed 45 dB(A) L_{Aeq}
- The cumulative wind turbine and industrial noise should comply with the IPPC Licence limits at the boundary locations.

Daytime

- During the daytime, the wind turbine noise at any noise sensitive receptor should not exceed 45 dB(A) L_{Aeq} and;
- The cumulative wind turbine and industrial noise level at any noise sensitive receptor should not exceed 55 dB(A) L_{Aeq} .
- The cumulative wind turbine and industrial noise should comply with the IPPC Licence limits at the boundary locations

It was also deemed appropriate to apply significance criteria through consideration of predicted changes in noise level due to the proposed development. This was done by calculating the change in L_{Aeq} and categorising the significance (refer to **Table 9.3**).

Table 9.3 Changes in Noise Level – Significance Criteria

Change in Sound Level (dB)	Subjective Reaction	Significance Level
<3	Inaudible	Imperceptible
4-5	Perceptible	Slight
6-10	Up to doubling of loudness	Moderate
11-15 >16	Over a doubling of loudness	Significant Profound

Source: Based on a number of noise documents including EPA Guidelines, BS4142 and PPG24

The Department of Environment, Community and Local Government has issued a draft Targeted Review of the Wind Energy Development Guidelines 2006, in relation to Noise, Proximity and Shadow Flicker. The draft document was issued for consultation purposes, on 11 December 2013. It proposes a noise limit of 40dBA for noise attributable to wind turbines, as experienced at sensitive properties. Because this proposed limit is more onerous than the EPA limits, it has also been considered in this assessment.

9.3 Description of Baseline Noise Environment

9.3.1 Site Location

The Vistakon facility lies within the National Technology Park which comprises 263 hectares of parkland situated on the R445, 5 km east of Limerick City. The Technology Park is bounded by the Rivers Mulkear, Shannon and Groody on the eastern, northern and western sides, respectively, and by the R445 on the southern side. The nearest facility is the Ophtecs building which is located approximately 200 metres west of the proposed location of the wind turbine.

The Vistakon facility is bounded to the east by a number of playing fields, and to the west by Plassey Park Road. The northern and southern boundaries comprise undeveloped land, which is part of the National Technology Park, and is currently in agricultural use. There are residential areas at the southeastern boundary and to the northeast of the Vistakon site. The main noise sources in the area are local traffic, distant traffic and industrial plant noise.

9.3.2 Noise Surveys

Unattended continuous noise monitoring was carried out over a one week period in August 2011 at the nearest inhabited noise sensitive receptor (Noise Monitoring Location AN-7). In addition, Vistakon (Ireland) carry out day-time and night-time annual noise surveys at six locations (AN-1 to AN-6 inclusive). The results from both survey types are discussed in the following sections.

9.3.2.1 Unattended Continuous Monitoring

The continuous noise monitoring took place from 9th – 16th August, 2011 inclusive. Data was logged at 10 minute intervals for the duration of the monitoring period and is summarised in **Table 9.4** (Daytime) and **Table 9.5** (Night-time). A plot of the data recorded is presented in **Figure 9.2**.

The objective of the survey was to determine the existing background noise level, and to determine if a correlation between background noise and wind speed could be established. In a rural area, with little man-made noise, this correlation can generally be established. However in the area of the Vistakon facility, with several industrial operations in the vicinity, establishing a correlation is not straightforward, as in addition to the background noise generated by the wind, the industrial component of the noise varies with wind direction, wind speed, and variations in the atmospheric temperature gradients.

Table 9.4 Summary of Day-time Noise Monitoring Data Recorded at AN-7

Date	LAeq		LA10		LA90	
	Max	Min	Max	Min	Max	Min
09/08/2011	45.3	39.9	46.3	40.8	42.7	38.8
10/08/2011	47.3	40.6	49.6	41.6	43.7	39.4
11/08/2011	50.3	40.8	48.0	41.6	43.4	39.9
12/08/2011	46.5	40.8	48.6	41.6	44.3	39.6
13/08/2011	47.3	41.1	49.5	42.2	44.9	39.8
14/08/2011	46.7	40.1	49.2	41.1	43.6	39.0
15/08/2011	45.0	38.9	46.8	39.8	43.3	37.6
16/08/2011	45.4	43.2	46.2	44.2	44.3	41.8

Table 9.5 Summary of Night-time Noise Monitoring Data Recorded at AN-7

Date	LAeq		LA10		LA90	
	Max	Min	Max	Min	Max	Min
09/08/2011	45.1	37.1	46.4	37.8	43.7	35.7
10/08/2011	44.8	39.2	45.7	40.4	42.3	37.6
11/08/2011	42.5	37.3	43.4	37.9	41.2	36.4
12/08/2011	42.2	37.9	43.5	38.9	40.3	36.7
13/08/2011	42.5	38.7	43.0	39.6	40.1	37.6
14/08/2011	43.0	38.3	44.1	39.0	41.5	37.6
15/08/2011	45.0	37.2	45.8	38.1	43.9	35.7

From visits to site to install the monitor and change the battery it is concluded that the noise environment in the vicinity of this location is typical of a rural environment in proximity to an urban centre with industrial activity. The primary noise sources are traffic noise along the R445 and along the Plassey Road. A gentle constant industrial fan noise is audible from the Vistakon facility in the distance. However, it is not a dominant noise source and it does not contain any audible variations or tonal components.

The mean background noise level during the daytime and night-time was 43 dB(A) L_{Aeq} , and 40 dB(A) L_{Aeq} respectively.

A scatter plot, which was prepared to plot the background noise against wind speeds in the vicinity of the site, is shown in **Figure 9.3**. From analysis of the data there is no correlation between background noise and windspeed. As outlined previously, it is difficult to establish such a correlation in an industrial area. Wind speed data was obtained from Met Éireann for Shannon Airport and was measured at a height of 10 metres.

9.3.2.2 Annual Noise Monitoring

As discussed in **Section 9.2.1.1**, annual noise monitoring is carried out at six locations in compliance with the IPPC licence for the facility. Four of these locations are on-site (AN-1 to AN-4 inclusive). AN-5 is located to the north-east of the facility at the entrance gate of a farm approximately 100m east of the Mulkear River. AN-6 is located to the south-east of the facility, at the end of residential cul de sac, on the lands of Bohemians Rugby grounds.

Data from three recent noise surveys (i.e. 2010, 2011 and 2013) are presented in **Table 9.6** (Daytime) and **Table 9.7** (Night-time) respectively. Monitoring locations are depicted on **Figure 9.1**.

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Table 9.6 Day-time Noise Monitoring at Vistakon, 2010, 2011 and 2013

LOCATION	2010		
	L _{Aeq}	L _{A10}	L _{A90}
AN-1	59.9	60.5	58.7
AN-2	50.8	51.9	49.3
AN-3	52.7	50.4	46.6
AN-4	54.4	76.8	45.9
AN-5	52.6	71.5	39.9
AN-6	49	49.1	44.2
LOCATION	2011		
	L _{Aeq}	L _{A10}	L _{A90}
AN-1	59.4	59.9	57.8
AN-2	54.1	53.9	48.4
AN-3	56.1	55.9	51.3
AN-4	54.5	57.0	50.4
AN-5	53.5	76.1	43.5
AN-6	51.1	52.6	49.0
LOCATION	2013		
	L _{Aeq}	L _{A10}	L _{A90}
AN-1	60.5	60.8	59.4
AN-2	54.2	54.5	49.3
AN-3	48.0	66.9	46.8
AN-4	54.0	57.4	47.8
AN-5	53.4	57.1	41.2
AN-6	46.4	48.1	44.6

Table 9.7 Night-time Noise Monitoring at Vistakon, 2010, 2011 and 2013

LOCATION	2010		
	L _{Aeq}	L _{A10}	L _{A90}
AN-1	60.5	68.4	59.9
AN-2	47.8	48.5	46.8
AN-3	48.0	53.5	47.3
AN-4	45.3	45.8	43.8
AN-5	50.7	48.5	41.9
AN-6	44.0	45.0	42.6
LOCATION	2011		
	L _{Aeq}	L _{A10}	L _{A90}
AN-1	58.6	59.8	57.2
AN-2	50.4	51.5	48.0
AN-3	50.3	52.1	47.3
AN-4	47.5	63.5	45.4
AN-5	50.0	47.3	43.4
AN-6	45.6	46.7	43.1
LOCATION	2013		
	L _{Aeq}	L _{A10}	L _{A90}
AN-1	58.4	59.1	57.6
AN-2	48.0	49.7	46.8
AN-3	43.4	44.8	43.3
AN-4	51.6	52.8	47.6
AN-5	52.9	46.0	37.9
AN-6	39.9	42.0	39.9

The day-time and night-time noise environment at the facility (AN-1 to AN-4) comprises traffic on the Plassey Road, traffic accessing and egressing the facility and plant operations, namely pumps and fans. Offsite, at locations AN-5 and AN-6, traffic is also the dominant noise source, particularly at AN-5. Plant operations are audible at AN-6 only but are not the dominant noise source.

9.4 Noise and Vibration Impact Assessment

9.4.1 Construction Phase

The construction works required for preparation of the foundations, hard standings, site roads, and erection of the turbine are relatively minor. Construction sites of this nature may have daily average total sound power emissions of 115 dB(A) L_{WA}. The resulting noise levels at the nearest houses would be less than 40 dB(A) L_{Aeq}. For short duration construction projects, a noise limit of 70 dB(A) is typically applied at the nearest sensitive receptor, and in this context, the impact of the construction works will be negligible.

Some piling work may be required for the foundation of the turbine, and this will be managed to minimise the temporary noise and vibration impacts arising from this work.

9.4.2 Operational Phase

9.4.2.1 Predicted Wind Turbine Noise Levels

Predicted noise levels at the noise sensitive and boundary locations are presented in **Table 9.8** for wind speeds in the range 5 to 10m/s.

In general, at the wind speed of 5m/s, the predicted noise levels are approximately 7 dB lower than at 10m/s. At a wind speed of 6m/s the noise levels are approximately 3 dB lower. At 8m/s the noise levels reach the maximum values, and remain unchanged up to 10m/s. All predicted levels are in compliance with the EPA wind turbine limit of 45dB L_{Aeq} at the nearest sensitive receptors. A noise contour graphic for wind speed of 10m/s is provided in **Figure 9.4**.

Table 9.8 Predicted wind turbine noise levels as a function of windspeed (at $z=10m$). Based on a sound power emission curve for Enercon E-82, 80m hub height

Key Noise Sensitive Locations	Wind Turbine Noise as Function of Wind Speed, L_{Aeq} dB(A), at 4m height, receptor downwind of turbine					
	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s ¹
AN1	35	39	42	43	43	43
AN2	29	33	36	37	37	37
AN3	17	21	23	24	24	24
AN4	36	40	43	44	44	44
NSR1	30	34	37	38	38	38
NSR2	30	34	37	38	38	38
NSR3	29	33	36	37	37	37
NSR4	29	33	36	37	37	37
NSR5	28	32	35	36	36	36
NSR6	28	32	35	36	36	36
NSR7	29	33	36	37	37	37
NSR8	29	33	36	37	37	37
NSR9	29	33	36	37	37	37
NSR10	28	33	35	36	36	36
NSR11	28	32	35	36	36	36
NSR12	29	33	35	37	37	37
NSR13	28	32	35	36	36	36
NSR14	28	32	35	36	36	36
NSR15	28	32	35	36	36	36
NSR16	28	32	34	36	36	36
NSR17	27	31	34	35	35	35
NSR18	28	31	35	36	36	36
NSR19	27	31	33	34	34	34
NSR20	27	31	34	35	35	35
NSR21	28	32	35	36	36	36
NSR22	28	32	35	36	36	36

Key Noise Sensitive Locations	Wind Turbine Noise as Function of Wind Speed, L_{Aeq} , dB(A), at 4m height, receptor downwind of turbine					
	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s ¹
NSR23	28	32	34	35	35	35
NSR24	28	32	35	36	36	36
NSR25	28	32	35	36	36	36
NSR26	28	32	35	36	36	36

9.4.2.2 Comparison with EPA IPPC Licence Limits, and Draft Proposed Planning Guideline Limits

The potential audibility of the wind turbine noise outdoors during daytime will depend on its level relative to the existing background noise. The noise output of the wind turbines increases with wind speed, and for the Enercon E-82, reaches a sound power output of 106 dB(A) L_{WA} at a wind speed of 8m/s.

The background noise levels were established from data recorded at the nearest monitoring point to the receiver as part of the unattended monitoring or the annual compliance monitoring. The long-term monitoring data was used for all sensitive receptors as the levels were recorded over a one week period. Short-term compliance monitoring was used at the boundary locations.

All predicted cumulative noise levels are in compliance with the relevant daytime and night time IPPC Licence limit values, refer to **Tables 9.9** and **9.10**. Also, the wind turbine noise does not exceed the 45dB L_{Aeq} limit at any time at sensitive receptors, or contain any significant tonal components. Based on the significance criteria outlined in **Table 9.3**, the impact of the proposed wind turbine on the existing noise environment will be imperceptible.

All predicted noise levels at sensitive receptors are also below the draft proposed planning guideline limits of 40dB(A), and therefore the proposed wind turbine will be in compliance with those limits.

It is recommended that the above conclusions be reviewed when the final wind turbine model is selected.

Table 9.9 Predicted total daytime noise levels based on a sound power emission of 106 dB(A) L_{WA} for an Enercon E-82, 80m hub height, wind speed 10m/s (at $z=10m$).

Noise Sensitive and Boundary Locations	Highest Vistakon Wind Turbine Noise ¹ L_{Aeq} dB(A)	Existing Noise, Daytime dB(A)	Wind Turbine and Existing Industrial Noise (Daytime) L_{Aeq} dB(A)	IPPC Licence Limit L_{Aeq} dB(A)	Change in Noise Level dB(A)
AN1	43	60	60	61	0
AN2	37	53	53	55	0
AN3	24	55	55	55	0
AN4	44	54	54	55	0
NSR1	38	43	44	55	1
NSR2	38	43	44	55	1
NSR3	37	43	44	55	1
NSR4	37	43	44	55	1
NSR5	36	43	44	55	1
NSR6	36	43	44	55	1
NSR7	37	43	44	55	1
NSR8	37	43	44	55	1
NSR9	37	43	44	55	1
NSR10	36	43	44	55	1
NSR11	36	43	44	55	1
NSR12	37	43	44	55	1
NSR13	36	43	44	55	1
NSR14	36	43	44	55	1
NSR15	36	43	44	55	1
NSR16	36	43	44	55	1
NSR17	35	43	44	55	1
NSR18	36	43	44	55	1
NSR19	34	43	44	55	1
NSR20	35	43	44	55	1
NSR21	36	43	44	55	1
NSR22	36	43	44	55	1
NSR23	36	43	44	55	1
NSR24	36	43	44	55	1
NSR25	36	43	44	55	1
NSR26	36	43	44	55	1

¹ Calculated noise from the wind turbine at Vistakon, receptors downwind of the wind turbine

Table 9.10 Predicted total night-time noise levels based on a sound power emission of 106 dB(A) LWA for an Enercon E-82, 80m hub height, wind speed 10m/s (at z=10m).

Noise Sensitive and Boundary Locations	Highest Vistakon Wind Turbine Noise ¹ L _{Aeq} dB(A)	Existing Noise, Nighttime dB(A)	Wind Turbine and Existing Industrial Noise (Nighttime)L _{Aeq} dB(A)	IPPC Licence Limit L _{Aeq} dB(A)	Change in Noise Level dB(A)
AN1	43	60	60	61	0
AN2	37	49	49	49	0
AN3	24	49	49	45	0
AN4	44	47	49	45	2
NSR1	38	40	42	45	2
NSR2	38	40	42	45	2
NSR3	37	40	42	45	2
NSR4	37	40	42	45	2
NSR5	36	40	41	45	1
NSR6	36	40	41	45	1
NSR7	37	40	42	45	2
NSR8	37	40	42	45	2
NSR9	37	40	42	45	2
NSR10	36	40	41	45	1
NSR11	36	40	41	45	1
NSR12	37	40	42	45	2
NSR13	36	40	41	45	1
NSR14	36	40	41	45	1
NSR15	36	40	41	45	1
NSR16	36	40	41	45	1
NSR17	35	40	41	45	1
NSR18	36	40	41	45	1
NSR19	34	40	41	45	1
NSR20	35	40	41	45	1
NSR21	36	40	41	45	1
NSR22	36	40	41	45	1
NSR23	36	40	42	45	2
NSR24	36	40	41	45	1
NSR25	36	40	41	45	1
NSR26	36	40	41	45	1

¹ Calculated noise from the wind turbines at Vistakon, receptors downwind of the wind turbine

9.4.2.3 Tonality, Impulsiveness and Amplitude Modulation

The potential intrusiveness and audibility of a sound depends on the level of the sound relative to background noise levels in the locality, and also on the nature of the sound, i.e. tonality, impulsiveness, modulation. If the sound from a wind turbine has these noticeable characteristics, a correction is applied to the calculated or measured noise levels. In addition, under EPA guidelines, tonal noise is not permitted at night time.

For modern wind turbines, tonal and impulsive noise is controlled to extremely low levels. For the Enercon E-82 turbine, which is indicative of the type proposed, the tonal audibility is guaranteed to be less than 2 dB over the operating range, in the vicinity of the turbine.

Amplitude modulation refers to a rhythmic character to the noise, which on occasions is audible at the rotation frequency of the turbine blade in the immediate vicinity of individual wind turbines, or close to large wind farms. The noise sensitive locations in the vicinity of Vistakon are in excess of 500m from the proposed wind turbine. There is no potential for noticeable amplitude modulation effects.

9.4.2.4 Infrasound

The EPA wind turbine guidance states *there is a common misconception that there is a significant component of low frequency noise but this is not the case. As distances increases from a noise source, the noise spectrum becomes more biased towards the low frequencies. This is caused by greater attenuation of middle to high frequencies by atmospheric effects, with reduced attenuation of low frequencies.*

Infrasound is high level sound at frequencies below 20 Hz. This was a prominent feature of passive yaw "downwind" turbines where the blades were positioned downwind of the tower which resulted in a characteristic "thump" as each blade passed through the wake caused by the turbine tower. With modern active yaw turbines (i.e. the blades are upwind of the tower and the turbine is turned to face into the wind by a wind direction sensor on the nacelle activating a yaw motor) this is no longer a significant feature.

On this basis, no significant off-site infrasound impacts are envisaged.

9.4.2.5 Vibration

The wind turbine will be fitted with anti-vibration sensors, which will detect any imbalance caused by the icing of the blades. For operational and safety reasons, the sensors will cause the turbine to wait until the blades have been de-iced prior to beginning operation.

On this basis, no off-site operational vibration effects are envisaged.

9.5 Mitigation Measures

Whilst the construction phase is not expected to give rise to significant noise and vibration impacts, as a matter of good practice, reference will be made to BS5228 (BSI, 2009) which offers detailed guidance on the control of noise and vibration from demolition and construction activities.

As all predicted levels comply with the relevant limits, no mitigation measures are proposed for the operational phase of the development. However, design measures to minimise the noise impact include selection of a wind turbine with low sound power

emissions, and location of the wind turbine to ensure a distance in excess of 500m to the nearest noise sensitive location.

9.6 Residual Impact

For a wind turbine with characteristics similar to the Enercon E-82, the residual noise impact is predicted to comply with the IPPC Licence limit values, and the limit for wind turbine noise.

In terms of audible perceived noise, and taking account of the masking effects of background noise, the impact is expected to be negligible at the nearest noise sensitive locations to Vistakon.

No significant vibration impacts are predicted arising from either the construction or operation of the proposed development.

9.7 References

British Standards Institution (BSI), 1997. *BS 4142: Method for Rating Industrial Noise affecting mixed residential and industrial areas*. BSI, London, England.

BSI, 1999. *BS 8233: Sound Insulation and Noise Reduction for Buildings – Code of Practice*. BSI, London, England.

BSI, 2009. *BS 5228: Code of Practice for Noise and Vibration Control on Construction and Open Sites (Part 1 and Part 2)*. BSI, London, England.

Department of Environment Heritage and Local Government (DoEHLG), 2006. *Wind Farm Planning Guidelines*. The Stationery Office, Dublin, Ireland. [also 2013 – proposed revision to the Planning Guidelines – draft for comment]

Environmental Protection Agency (EPA), 2003. *Environmental Noise Survey Guidance Document*. EPA, Johnstown Castle, Wexford, Ireland.

EPA, 2011. *Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3)*. EPA, Johnstown Castle, Wexford, Ireland.

International Electrotechnical Commission (IEC), 2002. *Specification for Sound Level Meters: IEC 61672-1:2002*. IEC, Geneva, Switzerland.

International Organisation for Standardisation (ISO), 1996. *ISO 9613-2: Attenuation of Sound Propagation Outdoors: General Method of Calculation*. ISO, Geneva, Switzerland.

ISO, 2003 and 2007. *ISO 1996: Acoustics – Description, measurement and assessment of environmental noise (Part 1 and Part 2)*. ISO, Geneva, Switzerland.

Office of the Deputy Prime Minister (ODPM), 2004. *UK Planning Policy Guidance 24: Planning and Noise*. ODPM, London, England

10 Air Quality and Climate

10.1 Introduction

In this chapter the likely impact of the proposed wind turbine on air quality and climate is described. Good-practice mitigation measures are proposed to avoid any significant dust or nuisance during the construction of the turbine, and the beneficial impacts on air quality and climate arising from reduced dependency on fossil fuels is considered.

10.2 Methodology

Vistakon operates under an Integrated Pollution Prevention and Control (IPPC) licence (Reg. No. P0818-02), which includes conditions relating to emissions to air. The IPPC licence, and Annual Environmental Report 2012 for Vistakon were reviewed, and Environmental Protection Agency data on air quality was compiled.

Typical construction activities associated with the construction of a wind turbine were reviewed, with particular reference to potential impacts on air quality.

The potential beneficial impacts on air quality and climate of displacing power generated using fossil fuels were considered.

10.3 Existing Environment

Vistakon is located approximately 5km east of Limerick City, in a zone referred to by the Environmental Protection Agency as Zone D – Rural Ireland. Air quality is measured by monitoring the levels of various pollutants. This monitoring checks whether air quality meets standards that are considered adequate for the protection of human health and environment. The EPA reports that air quality in this zone is ‘Good’, with reference to the parameters PM₁₀, nitrogen oxides, sulphur dioxide, carbon monoxide and metals.

The Vistakon Annual Environmental Report (AER) for 2012 states that there is one licensed emission point (with limits) to the atmosphere from the Regenerative Thermal Oxidiser at the Vistakon facility. This emission point is continuously monitored for Total Organic Carbon and bi-annual samples are taken for Nitrogen Oxides and Carbon Monoxide.

The AER states that the site was compliant in 2012 with its IPPC Licence conditions.

Under the Kyoto Protocol to the UN Framework Convention on Climate Change, and a subsequent European Union burden sharing agreement, Ireland is committed to limiting its increases in national emissions of named greenhouse gases. Energy use and production account for about 80% of EU emissions of greenhouse gases. The most important greenhouse gas is carbon dioxide, and it is widely accepted that controlling and reducing the emission of carbon dioxide to the atmosphere will reduce the risk of adverse climate change.

10.4 Predicted Impacts

10.4.1 Emissions to the Atmosphere

Electricity generation by wind turbines does not lead to emissions to air. The International Energy Agency (IEA 2009) records that wind power, along with energy efficiency and fuel-switching will play a major role in reducing emissions associated with power generation in the next 10 to 20 years.

The wind turbine at Vistakon will have the beneficial impact of generating power without the carbon dioxide, oxides of nitrogen, and sulphur dioxide emissions associated with fossil-fuel based power generation.

10.4.2 Interactions with Existing Air Emissions

Introduction

When a wind turbine is located in close proximity to sources of air pollutants, the wind turbine may impact on the dispersion of the pollutants and the pollutants may have an impact on the wind turbine.

Interaction between a wind turbine and pollutants from point sources is limited to when the wind turbine is directly upwind or directly downwind of a point source.

Impact of Wind Turbines on Dispersion of Air Pollutants

Emissions to air from the Vistakon site are subject to strict controls of the Integrated Pollution Prevention and Control licence. Dispersion of pollutants is calculated for worst-case scenarios, with little or no wind to assist dispersion. In such cases, the turbine will not be operational, and there will be no significant effects on the dispersion plumes.

In the condition that the wind turbine is operational, any pollutants will be dispersed more rapidly than in the worst case, as sufficient wind will be blowing to power the turbine.

Because of the turbulence that they create in their immediate vicinity, a wind turbine located downwind of a point source of air pollutants would be expected to assist marginally in the dispersion of air pollutants. A wind turbine located upwind of a point source may result in increased turbulence at the point source, but this is unlikely to be significant in terms of air dispersion.

If a wind turbine creates a down draft, then dispersion of air pollutants could be adversely affected. However this is unlikely due to the relatively slender profile, and circular cross-section of the turbine mast, and hence wind turbines are not considered to have the potential to adversely affect the dispersion of air pollutants from point sources.

10.4.3 Construction Phase Impacts

The primary air quality issue associated with the construction of a wind turbine and associated infrastructure would be short-term dust and exhaust emissions for the construction phase. Dust emissions during the construction phase are likely to result from the following activities:

- site earthworks
- handling of construction materials
- wind-blow from temporary stockpiles

- construction traffic movements

There is a potential short-term localised dust nuisance arising from these activities. No significant or longer term impacts are predicted.

Exhaust emissions will arise from vehicles accessing the site, in addition to plant and equipment operating on the site. The vehicular movements and plant operations will be short-term (up to six months). Because of the relatively low level of emissions and the short duration of the exposure, no significant impacts are predicted on air quality.

10.4.4 Embodied Carbon in Wind Turbines

The UK Parliament Select Committee on Science and Technology, Fourth Report, Appendix 8 (2004), includes an analysis of energy payback times for the manufacture and installation of wind turbines. Note: the energy payback period is the period of time over which the energy savings of a project equal the amount of energy expended to manufacture install and operate the project.

Process	Wind (no storage or backup)
	Terajoules per GW-year of electrical output
Materials (other than fuel)	581
Plant construction	242
Operation	517
Decommissioning	72
Land reclamation	Negligible
Total	1,387
Energy Payback Period (yrs)	1.1

There is a direct equivalence between energy consumption and associated carbon dioxide emissions, so the embodied carbon associated with the manufacture, installation and operation of a wind turbine will be recovered within fourteen months of commencing operation, as wind energy substitutes for electricity generated by fossil fuelled.

10.5 Greenhouse Gas Emission Reduction

The CO₂ emission rate for electricity generation varies with the precise fuel mix. The proposed turbine will significantly reduce Vistakon's carbon footprint.

Fossil fuel power generation results in emissions of oxides of nitrogen for all combustion sources, and sulphur dioxide and particulates for solid fuel combustion. Nitrous oxide, one of the oxides of nitrogen produced by fossil fuel power generation, has 310 times the greenhouse gas potential of CO₂. Operation of the proposed Vistakon turbine will reduce nitrous oxide emissions.

10.6 Mitigation Measures

Measures to reduce construction-phase impacts on ambient air quality are outlined below.

Most machinery used on site will be powered by diesel engines. In order to control the emission of excessive exhaust fumes and smoke, the contractor will ensure that all items of plant and equipment are correctly adjusted and maintained.

A dust minimisation plan will be prepared and implemented by the contractor during the construction phase of the project and will include a number of mitigation measures which will be put in place to minimise any dust generation during construction. The mitigation measures will take into account best available techniques such as those outlined in the BRE/DTI document *Control of Dust from Construction and Demolition Activities* (2003)

The following avoidance, remedial or reductive measures will be implemented as part of the dust minimisation plan:

- Vehicle speeds will be limited within the construction site.
- During very dry periods when dust generation is likely construction areas will be sprayed with water.
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor through regular servicing of machinery.
- Where activities that may be a significant local source of fine particulate emissions are taking place, measures such as screening will be used to control emissions and prevent a nuisance within the locality.

No mitigation measures are required for the operational phase, as no adverse impacts are predicted.

10.7 Residual Impacts

There will be minor emissions to the atmosphere during the construction phase. Containment and dust suppression techniques during construction will be sufficient to ensure that any off site impacts are negligible. Therefore, it is not envisaged that the turbines will have any significant adverse impacts on ambient air quality or climate. Long-term beneficial impacts are predicted relating both to air quality and climate.

10.8 References

Building Research Establishment (2003) *Control of Dust from Construction and Demolition Activities* BRE/DTI, United Kingdom

<http://www.seai.ie/>

11 Soils Geology Surface Water and Groundwater

11.1 Introduction

The impacts of the proposed Vistakon wind turbine on soils, geology, surface water and groundwater are assessed in this chapter. The potential impacts the development will have on the existing environment, during both construction and operation, are considered. Mitigation measures to reduce the likely impacts are proposed where relevant.

11.2 Methodology

The existing environment of the site was analysed using data collected from a desk study. The information has been derived from a number of different sources, including:

- Published geological and soil maps obtained from the Geological Survey of Ireland (GSI)
- Online geological, soils, and groundwater maps, obtained from the Geological survey of Ireland (GSI) website (www.gsi.ie)
- *Preliminary Site Investigation – National Technology Park – Area 4 Factual Report* (Priority Geotechnical Ltd., April 2010).

11.3 Existing Environment

11.3.1 Soils and Geology

11.3.1.1 Regional Bedrock Geology

The bedrock geology of the area surrounding the site comprises Carboniferous Dinantian Pure bedded Limestones with inliers of basalts and other volcanic rocks (www.gsi.ie).

11.3.1.2 Site Specific Bedrock Geology

The bedrock geology underlying the site comprises Carboniferous Dinantian Pure bedded Limestones. There have been no karst features mapped by the Geological Survey of Ireland on the site. However, karst features can be anticipated due to the nature of the bedrock and hydrogeological system. A surface 2D resistivity geophysical survey undertaken during the *Preliminary Site Investigation of the National Technology Park* in 2010 to the north west of the Vistakon site reveals solid and weathered limestone bedrock to be possibly 5 - 10m below ground level as proved at the site investigation locations. The survey mainly profiled the overburden on the site.

Prior to detailed design and construction, a site specific ground investigation comprising cable percussion and rotary boreholes and surface 2 D resistivity and seismic geophysics will be undertaken to determine the ground conditions underlying the wind turbine foundation, crane hard standing and site access road.

11.3.1.3 Site Specific Soils

A review of the Teagasc subsoil mapping indicates that soils in the study area are characterised by Made Ground over limestone derived glacial till. The *Preliminary Site Investigation – National Technology Park – Area 4 Factual Report* completed by Priority Geotechnical Ltd., April 2010, revealed the following ground conditions in the site to the northwest of Vistakon. The ground conditions uncovered here are an indication of what may be found on the turbine location site.

Table 1.0: Summary of Ground Conditions from the Site Northwest of Vistakon (Preliminary Site Investigation – National Technology Park – Area 4 Factual Report Priority Geotechnical Ltd., April 2010)

Stratum Encountered	Range of Thicknesses
Topsoil	0.2 -0.5m
Fill: described as soft sandy gravelly silt	0.3 -0.6m
Very soft to soft becoming firm to stiff with depth lightly sandy slightly gravelly CLAY/Slightly sandy CLAY	0.3 -3.1m
Very soft to soft becoming firm to stiff with depth slightly sandy slightly gravelly SILT	0.4 -2.3m
Loose (upper 3m) to medium dense lightly clayey gravelly SAND/Slightly gravelly clayey SAND	0.4-1.6m
Loose (upper 3m) to medium dense clayey very sandy GRAVEL/Slightly clayey sandy GRAVEL	0.5-2.8m

The strength of the material appeared to increase with depth but there is evidence from boreholes that there is up to 6m of very soft to soft material with SPT N values ranging between 4 – 7.

As stated in **Section 11.3.1.2**, prior to detailed design and construction, a site specific ground investigation will be undertaken to determine the ground conditions underlying the wind turbine.

11.3.1.4 Sites of Specific Geological Interest

The Limerick County Development Plan identifies areas of geological interest in Limerick County. No sites of geological interest are located within the Vistakon site or within 10kms of the site.

11.4 Surface Water

There are no watercourses or drainage ditches within or adjacent to the site of the proposed wind turbine. However the wet nature of much of the ground on the site means that pools and puddles form on parts of the site during wet weather.

The main channel of the River Shannon (Lower River Shannon SAC Site Code 0002165) is located approximately 750m to the northwest of the turbine site location. The Mulkear River (also part of the SAC) flows at a distance of approximately 250m to the north of the turbine site location. A flood barrier runs along the entire bank of the Mulkear River in the vicinity of the site, separating this part of the National Technology Park from the River.

Vistakon operates under an Integrated Pollution Prevention and Control Licence (IPPC Licence Reg. No. P0818-02). Stormwater from the existing Vistakon surface water drainage network is discharged via an emission point to the Mulkear River in compliance with the conditions of its IPPC licence. Conditions of the IPPC licence include monitoring of storm water discharge, and automatic diversion of stormwater to the firewater retention facility should stormwater at the Vistakon facility exceed the trigger levels set out in the IPPC Licence. Also, it is a condition of the licence, that in the event of a fire or a spillage at the Vistakon facility, any contaminated stormwater will be automatically diverted to the containment pond at the facility.

During operation, stormwater drainage from the access road and crane hardstanding will be infiltrated directly to ground.

Mitigation measures to prevent stormwater runoff to the Mulkear River during construction are proposed in **Section 4.10.5 of the Chapter 4 Construction Activities**.

11.4.1 Flooding

Map 6 of the Castletroy Local Area Plan 2019-20 'Castletroy Flood Extents Map' (Map 6 of the LAP) indicates areas zoned as 'Historic Flood Extents'. The site of the proposed wind turbine is indicated on the map as lying within this zone.

The Office of Public Works's (OPW's) online national flood hazard mapping (www.floodmaps.ie) indicates historic flooding events at the site of the proposed development. In response to consultation, the OPW has stated that part of the Vistakon site falls within the area which will benefit from the Drainage Scheme for Channel C1 of the Mulkear Ballymakeogh. Until this scheme is completed, this portion of the Vistakon site is at increased flood risk. The area identified as 'benefitting lands', as defined by the OPW, is a dataset prepared by the OPW identifying land that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and indicating areas of land subject to flooding or poor drainage.

The OPW flood map report for this area indicates periodic flooding prior to 1990. In 1990 a flood defence berm was constructed to defend the development study area. This flood barrier runs along the entire bank of the Mulkear River in the vicinity of the site. In the event of a major flood event overtopping the flood barrier, the River would be full of silt, so the contribution from the site would be insignificant.

The Limerick County Development Plan 2010 objectives in relation to flooding include the following objective:

Objective SE O17: Development not Sensitive to Flooding

“Appropriately designed development which is not sensitive to flooding may, subject to proper planning and sustainable development and subject to the incorporation and implementation of the requirements of the Planning System and Flood Risk Management Guidelines (DoEHLG/OPW, 2009), be permitted in flood plains provided it does not significantly alter the flood plain area or otherwise restrict water flow in the flood plain area.”

The proposed wind energy development is designed so that it is not sensitive to flooding. It will not significantly reduce the flood plain area or restrict water flow in the flood plain area.

11.5 Groundwater

11.5.1 Regional and Local Groundwater

Information from the Geological Survey of Ireland (GSI) Groundwater Protection Scheme indicates that the site of the proposed wind turbine is located in an area which has an aquifer classification of ‘Lm’, indicating that the site is underlain by a ‘locally important’ bedrock aquifer, which is moderately productive.

The Groundwater Protection Zone, within which the site falls, is classed as ‘M’, indicating that the aquifer is of moderate vulnerability. Refer to **Table 11.2** below.

Table 11.1 Vulnerability Mapping Guidelines

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 -3.0m	0 -3.0m	0 -3.0m	0 -3.0m	-
High (H)	>3.0m	3.0-10.0m	3.0-5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0-10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A
Notes: (1) N/A = not applicable (2) Precise permeability values cannot be given at present (3) Release point of contaminants is assumed to be 1-2m below ground surface					

Source: GSI website.

11.5.2 Site Specific Groundwater

‘Lm’ Locally Important Aquifer – Bedrock which is Generally Moderately Productive.

In response to consultation, the Geological Survey of Ireland has stated that

“groundwater vulnerability at the site of the proposed turbine is moderate, but that any removal of soils will increase the groundwater vulnerability. It also states that there are no karst or wells data for the area, however data bases are not exhaustive and karst features can be anticipated due to the nature of the bedrock and hydrogeological system. Therefore, disposal of fuel/chemicals/cement required for the installation of the wind turbine should be addressed in the environmental report.”

Vistakon has a number of wells on site, used to provide water for non-contact cooling process uses.

Four groundwater monitoring wells located at the existing facility are monitored biannually by Vistakon in compliance with its IPPC licence requirements.

Groundwater strikes were recorded during the Preliminary Site Investigation in the National Technology Park – Area 4 in 2010. A borehole and trial hole located in the north western area of the site revealed water strikes between 1.4 -6.0m below ground level. Static groundwater levels were not recorded.

11.6 Proposed Development

The proposed wind turbine is described in detail in **Chapter 3 Site and Scheme Description**. The construction phase of the turbine is detailed in **Chapter 4 Construction Activities**.

11.7 Potential Impacts

11.7.1 Construction Phase

Construction activities which have the potential to impact on soils, geology, surface water and groundwater include excavation, earthmoving, piling, and concreting operations. Surface run-off from wheel washing areas can contain of pollutants such as detergents, oil and fuel, suspended solids, grease and antifreeze.

The following are the potential impacts on soils, geology surface water and groundwater, which could occur during the construction phase:

11.7.1.1 Potential Impacts on Soils and Geology

- Potential soft ground on site will require rock-socketed pile foundations for the wind turbine, and ground improvement works for the access road.
- The possible presence of karst limestone on the site could potentially impact the soils and geology by creating weak spots in the ground which could impact foundation design.
- Soils have the potential to become polluted by spillages during construction.
- Soils have the potential to be compacted by plant and machinery during construction.

11.7.1.2 Potential Impacts on Surface Water and Groundwater:

- Surface water and groundwater have the potential to become polluted by spillages during construction.

- Surface water runoff has the potential for pollution of the site's surface water drainage system with suspended solids or hydrocarbons
- Piling works have the potential to impact on groundwater as the piling will puncture the overburden into the underlying aquifer.

11.7.2 Operational Phase

During operation, the crane pad and access road (refer to **Chapter 4, Sections 4.5.6 and 4.5.7**) will remain in situ to facilitate any future maintenance of the proposed turbine. No potential impacts on soils, geology, surface water or groundwater during the operational phase of the proposed development, are envisaged.

11.8 Mitigation Measures

11.8.1 Construction Phase

Mitigation measures which will be implemented to prevent any surface water runoff from entering the Mulkear River are described in **Section 4.10.5**.

The employment of good construction management practices will minimise the risk of pollution of soil, surface water and groundwater. Construction phase mitigation measures are described in **Chapter 4 Construction Activities**. It is envisaged that excavated material will be re-used as fill on site or will be used for landscaping on site.

Cognisance will be taken of CIRIA guidance on the control and management of water pollution from construction sites in their publication *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors* (Masters-Williams et al, 2001) (see also **Section 4.10.5**).

A contingency plan for pollution emergencies will be put in place prior to commencement of construction. The plan will be updated as required and will identify the actions to be taken in the case of an accidental spillage. The following mitigation measures will also be implemented:

11.8.1.1 Soils and Geology

- The presence of possible soft ground conditions may require either the excavation of poor ground, ground improvement or a thicker capping layer for the pavement of the access road and will require piled foundations for the wind turbine and crane hard standing. In localised weak spots, geogrids or stone platforms can be used to bridge over these areas or alternatively weak spots may be excavated and replaced with free draining fill to ensure no impact on possible existing drainage paths.
- As there is the potential for karst limestone, detailed ground investigations will be undertaken prior to construction to delineate the location of any underlying karst features. The formation levels will be inspected by suitably qualified geotechnical engineers or engineering geologists to verify that conditions are as expected
- The competency of the bedrock underneath each pile foundation will be proven, to a minimum of 5m below the pile. Rigorous and thorough quality control measures will be implemented during pile construction with the construction of each individual pile signed off by suitably qualified personnel.

- Ground improvement works may be required for foundations for roads and hardstandings. These may consist of dynamic compaction, grouting of karst features or the excavation of weak zones and replacement with free draining, well graded, high quality stone
- If a likelihood of flooding is predicted during construction, construction activities will cease until the risk has passed, in order to ensure that there will be no risk of pollution to the River Mulkear.

11.8.1.2 Surface Water and Groundwater

- There is an existing flood barrier which runs along the entire bank of the Mulkear River in the vicinity of the site.
- The surface water drainage will be connected the Vistakon site wide drainage system. This is monitored under the Vistakon IPPC licence.

Measures, as recommended in the CIRIA guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters include:

- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded.
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site.
- In principle, soil excavation will be completed during dry periods and undertaken with backhoes and dump trucks. Topsoil and subsoil will not be mixed together.
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access.
- Run-off will be controlled and passed through a settlement pond prior to discharge to enter the surface water drainage.
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land.
- Minimise the use of cleaning chemicals.
- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt.
- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.

11.9 Residual Impacts

With the employment of the mitigation measures above, it is considered that overall there will be no significant impacts on soils, geology, surface water and groundwater as a result of the construction and operation of the proposed development.

11.10 References

Geological Survey of Ireland website www.gsi.ie

Masters-Williams et al, (2001) *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors* CIRIA

Priority Geotechnical Ltd. (2010) *Preliminary Site Investigation – National Technology Park – Area 4 Factual Report*

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12 Material Assets

Mateasset

12.1 Introduction

This chapter evaluates the impacts, if any, which the proposed Vistakon wind energy development will have on material assets during both the construction and operation phases. Mitigation measures are proposed, where appropriate.

Material assets are defined in the EPA *Advice notes on Current practice in the preparation of EIS, 2003* as ‘resources that are valued and that are intrinsic to specific places, they may be either human or natural origin and the value may arise for either economic or cultural reasons’.

This chapter addresses the following aspects:

- Telecommunication services, television broadcasting and civil aviation,
- Land use and ownership
- Infrastructure and utilities
- Natural resources
- Waste management.

12.2 Methodology

A desk study was carried out on the existing material assets associated with the site of the proposed development. Projections of resource use were made, for both the construction and operational phases of the development, and the impact assessed.

Where relevant, impacts on particular material assets such as the road network and construction waste disposal facilities are considered in detail elsewhere in this EIS. Refer to **Chapters 4 Construction Activities** for further assessment of the impact of the proposed development on these assets. Cultural heritage is dealt with in **Chapter 13 Archaeological, Architectural and Cultural Heritage**. Refer to **Chapter 3 Site and Project Description** of this EIS for a detailed description of the site and surrounding areas.

12.3 Telecommunication Services, Television Broadcasting and Civil Aviation

Television broadcasting, communication networks, and systems associated with civil aviation have the potential to be affected by wind turbines. During the preparation of this EIS, the relevant bodies in relation to these were consulted. The full list of consultees is shown in **Section 1.7 of Chapter 1**.

12.3.1 Television and Telecommunications Broadcasting

Analogue television broadcasting was switched off in 2012, on the completion of the digital terrestrial television network. In general, digital terrestrial television is less susceptible to interference from wind turbines than analogue broadcasts.

In the consultation process with the television broadcasters no likely significant interference issues were identified by any of the main service providers.

RTE stated that there may be a slight impact on the television reception of a very small number of viewers in the immediate vicinity of the turbine who may experience interference to their TV reception from RTE's Woodcock Hill or Maghera transmission sites. However there may be an alternative service from RTE's transmission site at Mullaghanish. Vistakon will undertake to carry out any necessary remedial works – for example upgrading and re-orientating aerials, should the need arise.

12.3.2 Civil Aviation

The Irish Aviation Authority was consulted in relation to the proposed scheme (as part of the preparation of the 2011 EIS). The Irish Aviation Authority identified the potential for effects on their secondary radar installation at Wookcock Hill which was within 16 kilometres of the previous proposed wind turbine. In response to these concerns, an Aviation Impact Assessment was completed. This is appended to this EIS as **Appendix G**. This now represents a conservative assessment, as the proposed turbine is 20% lower than that assessed in 2011.

The Aviation Impact Assessment investigated the potential impacts of the larger turbine on Shannon Airport, on Coonagh airfield and on air traffic control radar installations at Shannon and Woodcock Hill. The assessment determined that:

- The proposed wind turbine was not likely to be within radar line of sight to the Shannon primary and secondary surveillance radars and the Woodcock Hill secondary surveillance radar;
- No additional shielding was identified which would significantly change the line of sight results.
- It was likely that the proposed turbine would be detected by the Shannon primary surveillance radar.
- The effect of the proposed wind turbine on the Shannon secondary surveillance radar would be negligible.
- The effect of the proposed wind turbine on the Shannon primary surveillance radar would be minor. It was likely the proposed wind turbine would appear as clutter on the Shannon Airport radar screens. However, due to the small size of the wind development (single turbine) this may be acceptable.
- The effect of the proposed wind turbine on the Woodcock Hill secondary surveillance radar is likely to be minor.
- The proposed wind turbine would not infringe the International civil Aviation Organisation based protected surfaces of Shannon Airport and Coonagh airfield.
- It was likely that the Irish Aviation Authority would require for the turbine to be lit.

The Irish Aviation Authority was consulted in relation to the outcome of the Aviation Impact Assessment. It advised that mitigation measures could be implemented to eliminate any impact on the Shannon primary surveillance radar and the Woodcock Hill secondary surveillance radar.

12.4 Land Use and Ownership

12.4.1 Local Settlement

The proposed facility will be located within the Vistakon site, to the north of the existing Vistakon facility. The site is zoned 'Enterprise and Employment' in the *Castletroy Local Area Plan 2009-2015*.

Undeveloped lands adjacent to and in the vicinity of the Vistakon facility are similarly zoned. The proposed development will be in keeping with this zoning.

An area zoned 'Neighbourhood Parkland/Open Space Recreational - Existing and Proposed' lies to the east of the existing Vistakon facility. An area zoned 'Existing Residential' lies to the south east of the facility.

The overall impact on local settlement and undeveloped land resource is considered to be neutral.

12.4.2 Potential Impact on Property Values

In 2003, Sustainable Energy Ireland commissioned a catchment area survey focused on people living with a wind farm in their locality, or in areas where wind farms are planned. The results were published in the SEI publication *Attitudes Towards the Development of Wind Farms in Ireland*. In relation to impacts on local property values, the percentage of respondents in agreement ('agree strongly' or 'agree slightly') with the following statement 'the wind farm has damaged (will damage) the value of my property' was as follows:

For existing wind farms, 12% agreed. For planned wind farms 8% agreed.

For 88% of respondents living in the vicinity of a wind farm, no adverse impact on property values was noted.

For a wind turbine in an existing industrial park, it is not envisaged that there will be significant impacts on local property values.

A Berkeley Laboratory report of a study on the impacts of wind turbines on property values *A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States* (Hoen *et al* 2013), prepared for the U.S. Department of Energy, was published in August 2013. The report looked at the effects of wind turbines on property values. The report states that the study was based on data collected from more than 50,000 home sales among 27 counties in nine States. These homes were within 10 miles of a turbine, with 1,198 within 1 mile (331 of which were within a half mile). The study found no statistical evidence "that home prices near wind turbines were affected in either the post-construction or post-announcement/pre-construction periods."

12.5 Infrastructure and Utilities

12.5.1 Road Infrastructure, Access and Traffic

The impacts of the construction phase on traffic and the road infrastructure are addressed in **Chapter 4 Construction Activities**. There will be no significant impact on the road infrastructure and traffic as a result of the construction phase of the proposed wind turbine.

The operation of the wind turbine will have no impact on the road infrastructure or on traffic.

12.5.2 Electricity Supply

Vistakon is supplied from the existing 38 kV ESB substation at the facility.

The operation of the wind turbine will reduce the consumption of mains electricity on the Vistakon site. No significant impact on existing power infrastructure is envisaged.

12.5.3 Water Supply and Usage

Vistakon's potable water supply is provided by Limerick County Council's 300mm diameter distributor main which runs along Plassey Park Road immediately adjacent to the western boundary of the site.

During the construction phase of the project, water will be required for consumption by the construction personnel, for general construction works. The volume of water required during construction will not be significant and will be supplied by a connection to the existing site watermain.

There will not be a significant impact on the Limerick County Council water supply, as a result of the construction of the proposed development.

No water will be required for the operational phase of the wind turbine.

12.6 Landfill Space

No significant off-site disposal of waste is predicted, and therefore no significant impacts on landfill space are predicted.

12.7 Natural Resources

There are no known mineral resources located within the site boundary. In so far as possible, construction materials will be from local sources and all imported material that will be used on site will be from approved sources. Further details regarding the construction of the development are outlined in **Chapter 5 Construction Activities**.

12.8 Waste Management

The only waste that is predicted to be generated during operation will be waste oil, which will arise in routine maintenance. This will be managed, recovered or disposed-of in accordance with the relevant waste legislation. Construction waste management is addressed in **Chapter 4 Construction Activities**.

12.9 Cumulative Impacts

It is anticipated that there will be no significant, cumulative adverse impacts on material assets.

12.10 References

Environmental Protection Agency (2003) *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* EPA, Wexford

Hoen, B., Brown, J.P., Jackson T., Wiser, R., Thayer, M., and Cappers, P. (2013) *A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States* (prepared for U.S Department of Energy)

Limerick County Council (2010) *Castletroy Area Local Area Plan 2009-2015*

Sustainable Energy Ireland (2003) *Attitudes Towards the Development of Wind Farms in Ireland*.

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13 Archaeology, Architectural and Cultural Heritage

13.1 Introduction

Moore Group was commissioned by Arup to determine the impact on the local cultural heritage resource of the immediate area surrounding the proposed development of a single wind turbine on a site adjacent to the existing Vistakon facility at the National Technology Park, Rivers, County Limerick.

- Cultural heritage: For the purposes of this report the definition of “cultural heritage” is taken broadly from the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972, which considers the following to be “cultural heritage”:
- Monuments: architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science;
- Groups of Buildings: groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science;
- Sites: works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view.

13.2 Study Methodology

13.2.1 Conventions and Legislation

Ireland has ratified several European and international conventions in relation to the protection of its cultural heritage. Outlined herein are summaries of relevant conventions and legislation.

The National Monuments Act 1930 to 2004

Irish legislation for the protection of archaeological heritage is based on the National Monuments Acts 1930 and amendments of 1954, 1987, 1994 and 2004. These acts are the principal statutes governing the care of monuments in the Irish Republic. They provide for the protection of national monuments through the use of preservation orders. The Minister for the Environment, Heritage and Local Government has a specific role in relation to the protection of the archaeological heritage through powers provided by these acts and the National Cultural Institutions Act 1997. The overall state archaeological service is provided by the Department of Arts, Heritage and the Gaeltacht and delivered through the Planning and Heritage Section of the Department and the National Museum of Ireland (Irish Antiquities Division) on behalf of the Minister.

Monuments are protected under the National Monuments Acts in a number of ways:

- National Monuments in the ownership or guardianship of the Minister or a local authority. A National Monument is a monument under preservation by the State, as a result of its being considered to be of national importance. The legal basis for this status is the National Monuments Acts 1930 to 2004. The original National

Monuments Act was enacted in 1930 updating an original inventory of monuments comprised of those to which the Ancient Monuments Protection Act, 1882 applied. The most recent amendment in 2004 includes provisions for the partial or complete destruction of National Monuments by the Government. Only a small section of our monuments are in state ownership. The remainder are protected by the state under the National Monuments Acts but the care and preservation of these features depends largely on the interests and respect of individuals.

- National Monuments, which are subject to a preservation order; where it appears to the Minister that a monument, considered to be a national monument, is in danger or is actually being destroyed or falling into decay the Minister may, by preservation order or temporary preservation order, undertake the preservation of the monument. A temporary preservation order will remain in force for six months and then expire.
- Historic monuments or archaeological areas recorded in the Register Of Historic Monuments; contains a list of all historic monuments known to the Minister. Owners or occupiers must not, other than with consent, alter, deface, demolish or in any manner interfere with a historic monument entered in the register (National Monuments (Amendment) Act, 1987)
- Monuments recorded in the Record of Monuments and Places (RMP). All known sites and monuments are identified and listed for protection in the Record of Monuments and Places, a statutory inventory of sites protected under the National Monuments (Amendment) Act, 1994. Monuments entered into it are referred to as Recorded Monuments. Owners or occupiers of Recorded Monuments are required to give two months' notice to the Minister and obtain consent before carrying out any works in relation to the monument. This is to allow the National Monuments Service time to consider the proposed works and how best to proceed to further the protection of the monument. For national monuments in the ownership or guardianship of the Minister or a local authority or which are subject to a preservation order, the prior written consent of the Minister is required for any works at or in proximity to the monument. The RMP consists of a set of 6 maps of the different counties with an accompanying index which shows all the sites, monuments and zones of archaeological potential, recorded to date and protected in the county. The inventory concentrates on pre 1700 AD sites.

The European Landscape Convention 2000

In 2002 Ireland ratified the European Landscape Convention - also known as the Florence Convention, which promotes the protection, management and planning of European landscapes and organises European co-operation on landscape issues. It is the first international treaty to be exclusively concerned with all dimensions of European landscape. The Convention came into force on 1 March 2004 and is part of the Council of Europe's work on natural and cultural heritage, spatial planning and the environment. It applies to the entire territory of the ratifying parties and relates to natural, urban and suburban areas, whether on land, water or sea. It therefore concerns not just remarkable landscapes but also ordinary everyday landscapes. The European Landscape Convention introduces the concept of "landscape quality objectives" into the protection, management and planning of geographical areas.

The Planning and Development Act 2000

Under arrangements which came into operation on 1 January 2000 (The Planning and Development Act 2000), the system of listing buildings was replaced with strengthened procedures for the preservation of protected structures and structures in architectural conservation areas (ACA).

A protected structure is a structure that a local authority considers to be of special interest from an architectural, historical, archaeological, artistic, cultural, scientific, social or technical point of view. Details of protected structures are entered by the authority in its Record of Protected Structures (RPS), which is part of the development plan. Each owner and occupier of a protected structure is legally obliged to ensure that the structure is preserved.

The legislation obligates planning authorities to preserve the character of places and townscapes which are of special architectural, historic, archaeological, artistic, cultural, scientific, social or technical interest or that contribute to the appreciation of protected structures, by designating them Architectural Conservation Area in their development plan. The Act also provides comprehensive protection for landscapes including views, prospects and the amenities of places and features of natural beauty or interest under a local authority's development plan. A development plan is required to include objectives for the preservation of the character of the landscape including the preservation of views and prospects. A planning authority may also designate, for the purposes of preservation, landscape conservation areas.

The Architectural Heritage and Historic Properties Act, 1999

The Architectural Heritage (National Inventory) and Historic Properties (Miscellaneous Provisions) Act, was passed in 1999 as a direct response to the Granada Convention (see below). The Act provides for the establishment of a national inventory of architectural heritage and for related matters and to provide for the obligations of local sanitary authorities in respect of registered historic monuments. Although this Act provides no direct protection for architectural sites, it is used by local authorities to inform the compilation of their Record of Protected Structures which, under the Planning and Development Act 2000, does afford legal protection.

European Convention on the Protection of the Archaeological Heritage (Valletta Convention), 1997

In 1997 the Republic of Ireland ratified the Council of Europe European Convention on the Protection of the Archaeological Heritage (the 'Valletta Convention'). Obligations under the Convention include: provision for statutory protection measures, including the maintenance of an inventory of the archaeological heritage and the designation of protected monuments and areas; the authorisation and supervision of excavations and other archaeological activities; providing for the conservation and maintenance of the archaeological heritage (preferably in situ) and providing appropriate storage places for remains removed from their original locations; providing for consultation between archaeologists and planners in relation to the drawing up of Development Plans and development schemes so as to ensure that full consideration is given to archaeological requirement, making or updating surveys, inventories and maps of archaeological sites and taking practical measures to ensure the drafting, following archaeological operations, of a publishable scientific record before the publication of comprehensive studies and preventing the illicit circulation of elements of the archaeological heritage, including co-operation with other states party to the convention.

European Convention on the Protection of the Architectural Heritage (Granada Convention), 1997

Also in 1997 the Republic of Ireland ratified the Council of Europe Convention on the Protection of the Architectural Heritage of Europe (the 'Granada Convention'). Obligations under this convention include maintenance of inventories of architectural heritage, provision of statutory measures to protect the architectural heritage, the adoption

of integrated conservation policies, which include the protection of the architectural heritage as an essential town and country planning objective, developing public awareness of the value of conserving architectural heritage etc.

UNESCO World Heritage Convention, 1972

In an international context Ireland is a ratified member of The World Heritage Convention, adopted by UNESCO in 1972. The Convention provides for the identification, conservation and preservation of cultural and natural sites of outstanding universal value for inclusion in a world heritage list. The World Heritage status is a non-statutory designation and no additional statutory controls result from this designation. However the impact of proposed development upon a World Heritage Site will be a key material consideration in determining planning applications.

13.2.2 Local Development Plans

Limerick County Development Plan 2010 – 2016

The Planning Authority is fully committed to preserving the site and setting of our archaeological heritage. There is a stated preference under National Policy for preservation in situ. Consequently, the Planning Authority recommends that issues of archaeological heritage be addressed as early as possible by potential developers, through consultation with the relevant agencies, the Planning Department and the Authority's archaeologist. The Planning Authority may request potential developers to carry out archaeological assessments in areas adjacent or in the vicinity of Recorded Monuments. Proposed developments can have a visual as well as a physical impact on the archaeological remains and developers are advised to consider the setting of the monuments in the wider landscape when considering areas for development potential. The Planning Authority will refer all proposed developments likely to impact on the archaeological heritage to the National Monuments Service.

Furthermore the Planning Authority acknowledges that County Limerick has a rich architectural heritage including impressive demesne features, large houses and vernacular developments. The Authority has listed over 1400 in the Record of Protected Structures and continues to add to this list. Limerick's architectural heritage also includes historic gardens and designed landscapes. Recent research work by the National Inventory of Architectural Heritage has demonstrated that the county has a far higher concentration of wrought landscapes than any other county in Ireland. This is an element of the country's heritage which is being increasingly recognised and valued both aesthetically and as a potential resource that may be exploited for economic, social and tourism reasons. Where appropriate the Architectural Conservation Area mechanism may be used to protect and preserve such places.

Where groups of buildings, including villages, small towns, elements of larger towns and streetscapes are concerned the Planning Authority relies upon the provisions in the planning legislation, which permits the establishment of Architectural Conservation Areas. The creation of areas with such a status does not preclude development but the development permitted must be of a high standard and complement the surviving architectural styles.

There is an Architectural Conservation Area in Castletroy.

In terms of landscape characterisation, the site of the proposed development lies within the Shannon Coastal Zone. This zone comprises a large area of northern County Limerick and is bounded on one side by the Shannon Estuary while its southern boundary is defined

by the gradually rising ground, which leads onto the agricultural zone and the western hills to the south west. The presence of the estuary is the defining characteristic of the region. The landscape itself is generally that of an enclosed farm type, essentially that of a hedgerow dominant landscape. This differs from the other agricultural landscapes of the County in that the field patterns, particularly close to the estuary, tend to be less regular than those elsewhere in the County.

13.2.2.1 Castletroy Local Area Plan 2009-2015 (adopted July 2009)

The Local Area Plan for Castletroy covers the period 2009 - 2015. It is a legal document and establishes a framework for coordinated and sustainable development of Castletroy and for the conservation and enhancement of its natural and built environment over the next six years and beyond. All planning applications for Castletroy will be considered in the context of the contents of the Plan. The Plan has been prepared in accordance with the requirements of the Planning and Development Acts, 2000 - 2006 and the Planning and Development Regulations 2001 - 2008. The Plan also has regard to the policies and provisions of national, regional and local guidance documents. The Planning and Development Act clearly specifies those matters that must be included in a Local Area Plan, as well as matters that may be included.

13.2.2.2 Castletroy Dromore Architectural Conservation Area

In recognition of the Castletroy Dromore Architectural Conservation Area's special architectural and parkland qualities, the University of Limerick campus is designated as a single Architectural Conservation Area.

Accordance to the Castletroy Local area Plan *It is the policy of the Council to protect and enhance the character of structures within the designated Architectural Conservation Area by seeking to ensure that development:*

- (a) *Contributes to or enhances the character and streetscape of the area.*
- (b) *Avoids a negative visual impact on the landscape and visual appearance of the area.*
- (c) *Reflects and respects the scale and form of existing structures within the area.*
- (d) *Retains/incorporates/replicates exterior features that contribute or enhance the character and townscape of the area."*

The Local Archaeological Heritage Resource

"A number of sites within the plan area are designated as Recorded Monuments (RMP). It is the policy of the Council:

- *To safeguard the value and settings of archaeological remains and monuments in and around Castletroy.*
- *To seek the preservation of archaeological remains in situ or, and only where appropriate, through archaeological excavation.*
- *To provide guidance to property owners and developers regarding the archaeological implications of a proposed work or development.*
- *To promote pre-planning consultations in relation to the archaeological heritage with the Planning Authority.*
- *To require archaeological monitoring outside the area of the RMP on development proposals where the scale and nature of such developments may, in the opinion of the*

planning authority have a negative impact on previously unknown archaeological remains/artefacts. Applicants are advised to consult the archaeological maps, which are available in the Planning Offices for consultation in order to ascertain whether proposed developments are located within areas of archaeological potential. The following policies shall apply to such sites:

- 1) Where a development site coincides with areas of archaeological potential the planning application will be referred to the DoEHLG for their recommendations;*
- 2) In cases where it is deemed that the Archaeological Heritage would be affected by a proposed development (due to their location, size or nature), the Planning Authority will require an archaeological assessment;*
- 3) In relation to development proposals the Planning Authority will adopt a policy of archaeological monitoring which will be required on developments where the scale and nature of such developments may, in the opinion of the Planning Authority, have a negative impact on previously unknown archaeological features/artefacts; and*
- 4) In relation to archaeological assessment of sites, applicants will also be required to define the buffer area or area contiguous with any monument which will preserve the setting and visual amenity of the site."*

13.2.3 Methodology

13.2.3.1 Introduction

The assessment of impacts upon the archaeological, architectural and cultural heritage was based on a desktop study of published and unpublished documentary and cartographic sources, followed by a field survey and consultation with statutory stakeholders. In light of the legislative protection afforded to the cultural heritage resource (see above) this chapter assesses the archaeological, architectural, cultural and historical importance of the subject area and examines both the direct and indirect effects of the proposed development on the receiving environment as well as potential impacts and recommends mitigation measures (see **Figures 13.1 to 13.11**).

13.2.3.2 Desk Based Study

World Heritage Sites and Candidate World Heritage Sites were reviewed to see if any are located within the vicinity of the proposed development.

All known cultural heritage sites were mapped in GIS along with aerial photography and Ordnance Survey Ireland (OSI) First Edition Mapping (Circa 1830). Sites mapped included the following:

- National Monuments, a now out of date data set previously available from www.heritagedata.ie
- Record of Monuments and Places (RMP) from www.archaeology.ie
- Records of Protected Structures (RPS) from Limerick City Council
- Record of Protected Structures (RPS) from Limerick County Council
- National Inventory of Architectural Heritage (NIAH) for County Limerick from www.buildingsofireland.ie

- Demesnes Landscapes and Historic Gardens indicated on the OSI First Edition Mapping

All townlands located within 2km of the site of the proposed development were listed and crossed referenced with:

- National Monuments, a list for County Limerick available from www.archaeology.ie
- Preservation Orders, a list available from the DoEHLG
- Lists contained in the Appendices 6 and 7 to the Report of the Commissioners or Church Temporalities of Ireland (1879) which contain lists of Churches, School Houses and Graveyards that were vested in the Representative Church Body and the Burial Boards under The Irish Church Act, 1869.

The Limerick County Development Plan 2010-2016 was reviewed and several other documentary and literary sources were reviewed to obtain a comprehensive understanding of the cultural heritage of the region.

Based upon all the information reviewed, all sites were mapped in GIS and significant sites / regions / landscapes were highlighted for further analysis during the field survey.

In order to assess the potential impact of the proposal, the following sources were also consulted or reviewed:

- Limerick County and Local Area Development Plans
- Excavations Bulletin
- Topographical files of the National Museum of Ireland
- Cartographic Sources
- Toponym analysis
- Aerial photographs
- Published archaeological inventories
- Documentary Sources: a number of literary references were consulted.

13.2.3.3 Field Survey

Following a detailed desk study of the study area a field survey was undertaken on the 3 August 2011 to further assess the potential impacts that the proposed development would have on the immediate cultural heritage resource.

13.3 Project Background

13.3.1 Description of the Project

The proposed project involves the construction of one wind turbine, with a total height of 120m, on a site adjacent to the Vistakon Production Facility at the National Technology Park, Castletroy, County Limerick.

The main features of the development include:

- 1 wind turbine.
- Associated transformer located within or adjacent to the turbine.

- Buried electrical and fibre-optic cabling in the Vistakon site.
- Access road
- Crane pad.

In addition, a temporary construction compound will be established on site for the duration of the construction period. The turbine location identified is based on an optimised technical, economic and environmental layout. Unforeseen ground conditions may require minor movements (micro-siting) in the position of the turbine. Any alteration to the location of the proposed works would be agreed with Limerick County Council, prior to commencement of construction.

13.3.2 Location Details

The subject area is located to the east of Limerick City, in the National Technology Park between the Mulkear River and the R445 Anacotty Road. The site of the proposed development is a green field that is located to the north west of the existing Vistakon facility. The site is easily accessed via a hardcore car park that lies to the east of an access road between the Annacotty roundabout and a local access roundabout to the north. Site locational details are given in the following **Table 13.1**.

Table 13.1 Site Location Details

County	Limerick
Barony	Clanwilliam
Parish	Kilmurry
Townland (s)	Rivers townland to the immediate east of Castletroy.
OS Sheet number (s)	LI006
RMP	210m to the south of LI006-059 classified as an enclosure site.
ITM Ref. (E,N)	Centred on 563349/658188

13.3.3 Geology and Landscape

In general, the landform is undulating and is largely under pasture, with arable lands dispersed across the area. Along the Mulkear River the catchment topography is underlain with Carboniferous Limestone with adjoining marshy fields that have been improved over time by drainage works. Apart from alluvial deposits along waterways the soil of this association is made up of 70% Grey brown podzolics, 20% gleys and 10% brown earth. The parent material is made from calcareous non-tenaceous glacial till of predominantly Carboniferous limestone composition. In places there may be a small mixture of sandstone, shale or volcanic material.

13.3.4 Baseline Data

13.3.5 Archaeological, Architectural and Historical Background

13.3.5.1 Mesolithic Period

The Mesolithic (middle stone age) people were the first inhabitants of Ireland, arriving about 9000 years ago. They were a mobile society relying on wild resources for food, which was hunted and gathered using stone tools as well as boats, nets and traps. Settlement was in temporary and semi-permanent groups of huts constructed of wood slung with hide, which may have operated as seasonal or hunting camps.

The Mesolithic period in Limerick is best represented by excavations carried out in Killuragh Cave found south of Cappamore, County Limerick. Killuragh Cave lies on the eastern edge of a limestone reef, the summit of which, is just over 60m above sea level. The eastern escarpment faces out onto the flood plain of the Mulkear River. The escarpment is up to 10m in height and at one point, a flat terrace lies up to 2m below the summit. The known entrances to the cave system are at the northern end of the terrace. The cave was first investigated by the then landowner, the late Mr. Benny O'Neill. The archaeological significance became apparent when along with a bone assemblage, he recovered a flint hollow scraper and what was thought to be a polished stone axe. Mr O'Neill recalled that much of the bone and the stone axe came from at least 2 ft (0.60m) below the surface of the deposits and were mostly in a small area which lay at the junction of the entrance passage and the main chamber. This material was reported to the National Museum of Ireland. This included artefacts, human and animal bone as well as fragments of burnt material and flecks of charcoal. As a result, two archaeological investigations of the remaining deposits in the vicinity of the cave were undertaken. In total 39 shards of pottery were recovered and all except one shard were from the investigation of the spoil heap. One large shard of flat-rimmed pottery was found, which is decorated with a shallow incised line below the rim. A similar incised line occurs on another shard and these shards appear to come from one or perhaps two thick walled, bucket-shaped vessels of coarse gritted fabric.

There is also emerging evidence for Mesolithic activity along the banks of the Shannon more notably a series of early cremations at Hermitage, County Limerick (Collins and Coyne 2003).

13.3.5.2 Neolithic Period

Farming was first adopted in the Middle East but spread gradually across Europe in succeeding centuries, arriving in Ireland about 4000 BC. Tending of crops and animals required a more sedentary lifestyle and larger permanent settlements were built. The megalithic (from the Greek mega – large and lith – stone) monuments of the Neolithic people built as communal tombs or for ceremonial purposes, are relatively common in the landscape. New methods were adopted for shaping stone tools and the first long distance trade networks were established.

Although there is no direct evidence of Neolithic activity in the immediate area, there is significant archaeological evidence for Neolithic activity in surrounding areas. This activity is more apparent in the archaeological record of Limerick due to the presence of a number of known megalithic monuments. Megalithic monuments can be divided into funerary monuments, communal tombs for the burial of the dead and those with a more esoteric function such as stone circles, stone rows or single standing stones whose

function was probably ceremonial. Single standing stones may have acted as foci or markers at the edges of territories.

Lough Gur, in County Limerick is only one such example of settlement dating to this period. The numerous sites are found scattered around a horseshoe-shaped lake where Stone Age, Bronze Age and Iron Age communities farmed, hunted and fished, shaped pottery, fashioned weapons and defences and worshipped for generations. Excavations carried out by Prof. O'Riordain in the 1950s exposed a multi period complex of archaeological sites including a number of rectangular houses and megalithic tombs at Knockadoon townland. Finds also included a Bronze Age shield and distinctive beaker pottery pointing to the influence of different cultures in the settlement.

13.3.5.3 Bronze Age

As stone tools were replaced by the use of copper, later combined with tin to make bronze, the structure of society also changed over centuries. While some communal megalithic monuments, particularly wedge tombs continued to be used, the Bronze Age is characterised by a movement towards single burial and the production of prestige items and weapons, suggesting that society was increasingly stratified and warlike. In late Bronze Age Ireland the use of the metal reached a high point with the production of high quality decorated weapons, ornament and instruments, often discovered from hoards or ritual deposits.

The Grange Stone circle near Lough Gur is the largest and finest example of this Bronze age site in Ireland. It was built c. 2,200 B.C. after the arrival of the Bronze Age People in Lough Gur. It is a ritual site akin to our churches of the present day and also served as an astronomical calendar. We can only speculate on the rituals which took place here but know that they were of great importance also to people from surrounding settlements. The circle is aligned on the sunrise of the summer solstice. Included in the archaeological finds were thousands of shards of Beaker pottery. The breaking of Beaker pots against the standing stones seems to have been part of a ceremony. The largest stone is called Rannach Crom Dubh and is over 40 tonnes in weight and was transported over a distance of 3 miles. Within the subject area during the construction stage for the N18 the Limerick Southern Ring road a number of Bronze age sites were excavated. These are represented by a number of burnt mounds, Fulachta fiadh and a barrow. Fulachta Fiadh, which consist of small, horseshoe shaped grass covered mounds, are composed of burnt and fire cracked stones and a central pit or trough. They may have functioned as cooking places. They are common throughout the country and many are identified each year.) Barrows can be multi-period and some date to the Middle Neolithic. They may cover or contain megalithic Linkardstown type cists of the Neolithic, all of the burials type of the Bronze Age (see below), or cremations or inhumations of the Iron Age. In the east of Ireland, the mounds of these sites have been levelled in large numbers, leaving Ring-ditches, or have been remodelled into ceremonial enclosures, as at Tara, or Medieval Mottes as at Rathmore, Co. Kildare. Where an enclosing fosse is not noted on the ground, it is often found during excavation. Saucer barrows have low mounds, usually under 1m, and range from 5-20m in diameter with one or more enclosing fosses and banks. Bell barrows resemble bowls but have a berm between the mound and the fosse. Ring Barrows resemble Saucer barrows but have a flat interior rather than a mound. Another type of barrow has a bank and a hollow interior, these are pond barrows. Excavation has revealed that a significant number of barrows belong to the Iron Age (c. 300 BC-100 A.D), but many more are of Bronze Age date.

13.3.5.4 Iron Age

The Iron Age coincides with the spread of Celtic culture and peoples and is known as a 'dark age' in Irish prehistory. This is reflected in the relative lack of finds from the period. As in Europe, there are two phases of the Iron Age in Ireland; the Hallstatt and the La Tène. The Hallstatt period dates from 700BC onwards and spread rapidly from Austria, across Europe, and then into Ireland. The later Iron Age or La Tène culture also originated in Europe during the middle of the 5th Century BC. Life in Iron Age Ireland seems to have been much as it was in the early historic period – mixed farmers living in or around small defended settlements known as ringforts or stone cashels. This period is also associated with the arrival of the Celts. It is believed these people lived in family groups helping each other work the land for food. They would have had farms consisting of cattle, pigs, sheep, grain and vegetables so land would have held some importance to them. They would have used horses, probably to help with farming, as Y-shaped pendants, harnesses to help lead horses, had been found in more recent times. Hillforts, crannógs, ringforts, souterrains, cist burials, monoliths and ogham stones are all associated with this period.

There are no recorded Iron Age sites within the vicinity of the proposed wind turbine.

13.3.5.5 Early Historic to Modern Period

"Like many other towns and cities in Ireland, Limerick was founded by the Vikings. In the 9th century, the invaders sailed up the Shannon Estuary in search of loot from the monasteries on its banks and islands. They settled on an island known as Inis Sibhton (later to be known as King's Island). They built a clay and wattle settlement and, after some years of bloody skirmishings, began to trade with the native Irish. It was from this crude settlement that the city of Limerick originated. In the twelfth century, the Normans penetrated to the city. In 1168, St. Mary's Cathedral was built, and it remains to this day the most interesting and important building in Limerick. The city was chartered by Richard I in 1197, making it the oldest chartered city in Ireland. In 1210, King John visited the city for the second time, and built King John's Castle there. The building is one of the finest examples of Norman architecture in Ireland. In the following years, Limerick became an English town, surrounded by high walls. Across the Abbey River (a diversion of the Shannon) lived the Irish and the Danes, who had also been driven to live outside the walls. The work of erecting walls around the Irish town (as it became known) was begun about 1395, and it was finally enclosed at the end of the 15th century. Thus Limerick took on the shape of an hourglass in its physical layout, with the Englishtown on the north and Irishtown on the south. In 1467 a mint was set up in the city. In 1497 and 1498 there was a great famine, followed by pestilence in 1521. Payne's Description of Ireland gives a favourable account of the city and of one of its schools in the year 1589: "A wondrous proper city and a strong; and it standeth environed with the river of Shenan and it may be called little London for the situation and the plenty, but the castle hath need of reparation. I saw in a grammar school in Limerick one hundred and three score scholars, most of them speaking good and perfect English, for that they have use to construe the Latin into English". There followed another turbulent period in Limerick's history. The 17th century saw three terrible sieges inflicted on the city - the Cromwellian Siege of 1651 and the two Williamite Sieges of 1690 and 1691. These wars decimated the population and destroyed many buildings. By contrast, the 18th century was a period of growth and expansion. The worst of the city's troubles were over, though life continued to be hard for the ordinary people. As well as the rebuilding of the ruined city, other major works were also undertaken. In 1760, there were 17 gates in the city's walls: Thomond Gate, Island Gate, Sally Port, Little Island, Abbey North Gate, Abbey South Gate, Fish Gate, Baal's Bridge, East Water Gate, John's Gate, Mungret Gate, West Water

Gate, Creagh Gate, Quay Gate, Bow Gate, New Gate, and the Water Gate of King John. Today, more than two centuries afterwards, most of the names live on in the city as local placenames. The year 1760 marked a dramatic change in the development and physical layout of Limerick. The old city was bursting within its cramped boundaries, as dreadful slums and warrens of lanes criss-crossed its thoroughfares. In response to this pressure, the city walls were largely demolished, and a new brick city built outside. The man responsible for this development was Edmund Sexton Pery, the Speaker of the Irish House of Commons. He was the great driving force in the building of Georgian Limerick, and the centre city area today is still known as 'New Town Pery'. Pery also built John's Square, and these recently restored stone houses are also an enduring monument to him and the other men involved in their construction.

After Catholic Emancipation Limerick was spared some of the worst rigours of the Famine and its people fared comparatively well. By 1848, Limerick was connected to Dublin by rail, opening up many local markets on the route to the larger manufacturing interests in Ireland and Great Britain. On 14th July, 1880, the Freedom of Limerick was conferred on Charles Stewart Parnell, and, in 1882, Michael Davitt received the same honour. The twentieth century saw more military action, as the War of Independence and the Civil War caused their share of casualties and destruction in the city and county. March 7th, 1921, marked a black spot in the city's history when mayors O'Callaghan and Clancy were murdered in their own homes by the Black-and-Tans. The achievement of self-government in 1922 marked the end of the old order. Limerick had been garrisoned for more than 700 years and the pervasive influence of the garrison can be traced to this day. King John's Castle, and a variety of other buildings are physical remnants of this period. Outside the city's walls, other local communities such as Garryowen and Thomondgate, grew up in the seventeenth and eighteenth centuries. When the building of the Wellesley (later Sarsfield) Bridge was completed in 1835, the Ennis Road was opened up and lined with rows of red brick houses. In the 1850s, Peter Tait established the Limerick Clothing Factory and developed the first mass production of clothing in the world. He exported uniforms and suits to America and other countries.

In this century, after the setting up of the Irish Free State, many new housing estates were built throughout the city. Emigration, always a drain on the population, continued as many of the traditional industries based on the products of the rich agricultural hinterland experienced financial difficulties and collapsed. But the advent of foreign industries to Limerick and Shannon in the late 1950s brought a new upsurge in industrial development. Limerick's unique history is best summed up in the motto carved on the city's coat of arms: *Urbs antiqua fuit studisque asperrima belli* (It was an ancient city hardened in the pursuits of war)."

An Introduction to Limerick History by Jim Kemmy, The Old Limerick Journal, Vol.22, December 1987.

13.3.6 National Monuments

As previously noted under Conventions and Legislation, refer to Section 13.2.1 above, National Monuments include sites in the care or guardianship of the state (Minister for Arts, Heritage and the Gaeltacht) or a local authority and sites protected by Preservation Orders.

Sites in the Ownership or Guardianship of the State

The dataset from www.archaeology.ie does not indicate any national monuments in the immediate vicinity of the proposed development area. The closest, recorded Monuments

are located within Limerick city and include King Johns Castle (Nat mon. No 288), Fannings Castle (Nat Mon. No 383) and Kilrush Church (Nat Mon. No 366).

Sites in the Ownership or Guardianship of a Local Authority

A review of the 'Report of the Commissioners or Church Temporalities of Ireland (1879)' was carried out to determine if there were potential National Monuments in the ownership or Guardianship of the Local Authority. When the Church of Ireland was disestablished by an Act of Parliament in 1869, it was the largest landlord in Ireland. Its lands were occupied by some 11,000 tenants on 900 different estates throughout the island at a value of £227,000. On disestablishment its property was transferred to the Commissioners of Church Temporalities in Ireland, previously known as the Ecclesiastical Commissioners. This responsibility was in turn transferred in 1881 to the Irish Land Commission and then to the Board of Works for the new state. With locations in every county, the monuments vested (either singly or in groups) numbered over 100, and included, many cathedrals, abbeys, friaries, oratories, round towers, as well as stone crosses, ogham stones and stone roofed cells. These lands now in ownership or guardianship of the Local Authority can potentially be National Monuments; none were recorded within the study area.

Sites Protected by Preservation Orders

All townlands within 2km of the proposed development site were cross referenced with the list of sites under Preservation Orders available from the Department of Arts, Heritage and the Gaeltacht and no sites with this protective status were found.

13.3.7 Record of Monuments and Places

There are a number of sites on the Record of Monuments and Places (RMP) located within the study area. **Table 13.2** lists all relevant RMP sites. These are indicated on **Figure 13.3**. The nearest site is an enclosure in Castletroy. This site was visited but there was no above ground expression evident. The nearest other site is a fulacht fiadh site on the opposite bank of the river in Ballyvollane. West along the River Shannon is the ruined tower house known locally as the Black Castle. This site is well screened by trees and intervening hedgerows from the site of the proposed development. The full list of RMPs found in the wider vicinity appears in **Appendix H**.

Table 13.2 RMP sites located in the vicinity of the Proposed Development Site

SMR	Townland	Condition	Description	NGR	Distance
L1006-059	Castletroy	Not visible	Enclosure	1 63340, 158420	210m
L1006-017001	Castletroy	Extant	Castle-tower house	1 62792, 158611	710m
L1006-017002	Castletroy	Extant	Bawn	1 62771, 158587	710m
L1006-017003	Castletroy	Extant	Gateway	1 62770, 158573	700m
L1006-093	Ballyvollane	Extant	Fulacht fia	1 63838, 158910	300m
L1006-064	Mountshannon	Extant	Enclosure	1 65014, 158463	1.7km
L1006-018	Rivers	Extant	Enclosure	1 64068, 157682	1.02km
L1006-063	Rivers	Extant	Enclosure	1 63786, 157494	800m
L1006-094001	Rivers	Excavated	Fulacht fia	1 63832, 157437	875m
L1005-026002	Newcastle	Extant	Graveyard	1 62322, 157628	1.1km
L1005-026001	Newcastle	Extant	Church	1 62322, 157628	1.1km

13.3.7.1 Architectural Heritage

13.3.7.2 Record of Protected Structures

The following sites are listed in the inventory of protected structures for the townlands in the immediate environs of the proposed development. These sites are indicated on **Figure 13.4** and more information is provided in **Appendix H**.

Table 13.3 Record of protected structures in vicinity of proposed development

Building Name	Townland	Ref. No.	Description
Kilmurry Church	Newcastle	CT1	Church of Ireland
Glebe House	Newcastle	CT2	Dwelling
Castle Troy	Castletroy	CT3	Mediaeval Structure- Castle
Park House	Castletroy	CT7	Country House
Annacotty Mill	Rivers	CT16	Industrial
Letter Box	Rivers	CT17	Commercial- 'ER VII'
Annacotty Creamery	Rivers	CT18	Commercial
Yoma	Newcastle	CT24	Suburban House
Cooleen	Newcastle	CT26	Suburban House
Sunning Hill	Newcastle	CT27	Suburban House
Cooltara	Newcastle	CT28	Suburban House
Singland	Newcastle	CT32	Country House

13.3.7.3 National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage for Castletroy lists the following sites within the vicinity of the proposed development. The list does not comprise the full inventory rather it features buildings that may be potentially impacted by the proposed development. Further information on the NIAH sites is provided in **Appendix H**.

Table 13.4 NIAH sites in vicinity of Proposed Development

Name	Townland	Reg. No.	Description
Woodstown House	WOODSTOWN	21900606	country house
Castle Troy House	CASTLETROY	21900610	house
Yoma	NEWCASTLE	21821001	house
Cooleen	NEWCASTLE	21821002	house
Cooltara	NEWCASTLE	21820004	house
Saint Mary Magdalen's Church	NEWCASTLE	21821004	Church

13.3.7.4 Demesne Landscapes and Historic Gardens

A review of the First Edition OSI maps indicates that there are no demesne landscapes within Castletroy townland. The nearest significant residence is Castletroy house (NIAH reg No. 21900610), home of the Matterson family. The house is situated beside the ruins of Castletroy Castle to the west of the subject site near the banks of the River Shannon. The Mattersons were proprietors of a bacon factory, in the mid 19th century, when the

house was valued at £16-5 shillings. It was later acquired by Colonel Richard Arthur Milton Henn, son of Thomas Rice Henn in the early 20th century.

In the wider area there are a number of large demesne including Mountshannon Demense to the north of the Mulkear River and Woodstown house to the south east of Annacotty. Mountshannon house now in ruins was bought from the White family by John FitzGibbon before 1780. It appears to be named Ballingown on the Taylor and Skinner map of the late 1770s. Bence Jones writes that it was enlarged by the 1st Earl of Clare and remodelled by the 2nd Earl. In the early 1850s the house was valued at £179 and was held by the Earl in fee. The contents of the house were sold in 1888 and the house itself to the Nevin family circa 1893 (Bence Jones). The house was burnt in the early 1920s. Mulkear House now known as Woodstown House or Saint Vincents Centre is now a convalescent home. It was original built by the Reverend J. Crampton in 1812 at a cost of £3,000. He was still resident in 1837. It was later occupied by George Gough in the early 1850s, held by him from John Tuthill and valued at £35.

13.3.7.5 Other Architectural Heritage

No other sites of architectural significance were noted during the field survey.

13.3.8 Cartographic Analysis

The following section considers the First and Second Edition Ordnance Survey sheets for the study area.

A review of the 1st and 2nd edition OS maps did not identify any features within the site of the proposed development. The land is featureless, simply consisting of an enclosed field to the east of the townland boundary between Castletroy and Rivers. The notable sites in the wider area include Castle Troy castle (RMP LI006-017001) to the north west and an enclosure marked Bundotia fort to the south east (RMP LI006-018).

13.3.9 Aerial Photography

A inspection of aerial photographs available on Archaeology.ie and OSI Smartmaps website revealed no anomalies on the site of the proposed development. The image taken in 1995, photograph 13.2, shows that the proposed wind turbine site was significantly disturbed during the development of the technology park. This disturbance would have directly impacted on any potential archaeological features in the area. Further to the northwest on the site of the enclosure RMP LI006-059 there is a discernible anomaly but there was nothing visible above ground during the site inspection. Later aerial photographs, photos 13.3 and 13.4, taken in 2000 and 2005 respectively, show the proposed site as consisting of overgrown scrub land surrounded by a tree lined boundary.

13.3.10 Toponym Analysis

Townland names are useful in terms of understanding the geology, archaeology, land use, ownership and folklore of an area. The names can provide information on families, topographical features, and historical incidents. In terms of the built environment many names reference churches, fords, castles, raths, graveyards, roads and passes etc. Townlands are the smallest administrative land divisions used in Ireland and are in fact the only surviving administrative structure with a continuous history of development going back to medieval times if not earlier. Irish townlands generally relate not to settlements, but land units and as such they acquired legal title at an early date. The

townlands are the basic divisions of the countryside and they were carefully recorded in the maps and books that accompanied the great land transfers of the seventeenth century. The names feature on the Ordnance Survey maps, the first edition of which was completed for the whole country circa 1842. In the compilation of the Ordnance Survey scholars such as Eugene O'Curry and John O'Donovan were commissioned to provide the Survey with the anglicised forms of the Irish place-names, and it is these anglicised forms that have been in general use ever since. In compiling the following data a number of resources were consulted including the Placenames Database of Ireland www.logainm.ie and Irish Names of Places by P.W. Joyce (Joyce, 1913).

Within the study area, the townland names reflect the natural landscape and history of the region. Castletroy is an Anglicisation of Caladh an Treoigh which translates as 'the riverside meadow of Treoch', Treoch being derived from the surname De Treo. The surrounding townlands all reference both the Mulkear and Shannon rivers, ie Mountshannon and Rivers. Newcastle townland references a tower house of the same name (RMP LI005-205) located along the R445 Dublin road.

13.3.11 Previous archaeological fieldwork

A review of 'excavations.ie' indicated that no known archaeological investigations have been carried out in the environs of the site of the proposed turbine. The closest excavations are listed in **Appendix H**.

13.3.12 Topographical Files

The topographical files of the National Museum of Ireland (NMI) identify all recorded finds held in the NMI archive that have been donated to the state in accordance with national monuments legislation. The files sometimes include reports on excavations undertaken by NMI archaeologists in the early 20th century. Valuable information that can be gleaned might include the exact location, ground type, depth below ground level and condition when found, of each find. However, the amount and the usefulness of the information available on each find can vary considerably. No finds are listed in the townlands relevant to the proposed development.

13.3.13 Field Survey

A field inspection was carried out on the 3rd of August 2011 in bright conditions with good visibility. The survey consisted of a walk-over of the site of the proposed development, followed by an inspection of the local archaeological sites.

The significant accessible protected structures were also visited, and assessed in terms of potential visual impacts.

The site of the proposed development is located to the north west of the existing Vistakon plant and consists of wedge shaped field orientated north east south west. The field is divided into a hard cored car park to the east and an overgrown area of scrub and bush to the west. Both areas are separated by an earth bund. The field is delimited by mature trees, including oaks, and is reasonably well screened from the access road. Within the interior of the scrub area the grass was very overgrown and the ground was uneven underfoot. Based on the aerial photograph taken in 1995, this field was probably cleared of all topsoil which was heaped along its northern boundary. This disturbance would have cleared away any above ground features and probably removed any potential archaeological finds or features.

A visit to the possible enclosure site LI006-059 to the northwest, similarly failed to identify any above ground features. The area of the possible enclosure lies in low marshy ground, to the south of an earthen bank along the Mulkear River. The only notable difference in the area of the enclosure was a discernible difference in vegetation and growth in the general area of the site. This variation may indicate the presence of subterranean archaeological features. It may however also be related to natural drainage.

The record of protected structures for the area lists a number of significant buildings in the wider subject area including a Church in Newcastle, the medieval structure at Castletroy, the Mill at Annacotty and five suburban houses built in the international style in the 1930s. All the above sites were visited and assessed in relation to views vis á vis the proposed turbine. The church in Newcastle is well screened by mature trees and its natural aspect faces in the opposite direction to the proposed site, there is no line of view and consequently there will be no impact. The castle at Castletroy (RMP LI006-017001) is also set in trees and although it may be possible to see the turbine in excess of 710m towards the south east the impact would be negligible. Likewise the Mill at Annacotty is too far away and well screened to be impacted. The five international style suburban houses, namely Yoma, Coleen, Sunning Hill, Cooltara and Singland all occupy mature sites with good natural screening. They are also all in excess of 1.2 kilometres to the south west of the turbine site and will experience no visual impact.

13.4 Impacts

13.4.1 Predicted Direct Impacts

Where an architectural or cultural heritage feature or site is physically located within an area where works take place and the work entails the removal of part, or all of the site or feature, a direct impact will occur. There is also potential for direct impacts on as yet undiscovered sites and features. However given the considerable level of ground disturbance on the proposed site during the mid-1990s it is unlikely that any potential finds or features survive and consequently there will be no direct impacts on the cultural heritage resource.

13.4.2 Indirect Impacts

Where an architectural or cultural heritage site or its setting is located in close proximity to works, an indirect impact may occur. There is also potential for indirect impacts on as yet undiscovered archaeology. Although indirect effects may occur during construction and operation of the proposed development, the greatest potential for long term indirect effects would occur during the operational phase.

Indirect impacts could take the form of impacts on the settings of architectural or cultural heritage features. Impacts on setting are primarily visual and consider the effect of the development upon the setting of a site within the wider landscape.

As previously stated, the wider area was surveyed and the most proximate recorded structures and NIAH sites were visited. Consideration was also given to any unrecorded structures of architectural merit in the vicinity of the development. The campus for the National Technology Park is a relatively new development on what was originally a green field site with a limited amount of historical development. Within Castletroy townland, the significant buildings consist of the Tower House RMP LI006-017001 and the associated bawn and gateway, an adjacent house, and three other houses including Willowbank, Roselawn and Castletroy Houses. The visual impact of the development on

the towerhouse will be imperceptible. Willowbank and Roselawn are no longer extant and Castletroy House (NIAH Reg. No. 21900610) is well screened and will experience no visual impact.

The campus of the University of Limerick is designated as a distinct Architectural Conservation Area. This is in recognition of its special architectural and parkland areas. Its nearest point to the subject site is along its eastern boundary which is located approximately 1km from the subject site. Within the intervening area there are a number of roads, tree lines and large buildings associated with the National Technology Park Complex that effectively limit any inter-visibility. Any impacts to the visual amenity of the ACA will be negligible.

Generally in the wider area, although the turbine is of considerable scale, there are only a limited number of open views and a lot of natural screening which will have the effect of lessening the impact. There are also existing transmission masts and pylon lines in the area of the proposed development and the turbine has to be regarded in that context. The turbine will add to the overall cumulative indirect visual impact of the area but will not impact noticeably on the local built heritage resource.

13.5 Mitigation Measures

Given the extent of the ground disturbance that previously took place on the site of the proposed development, it is unlikely that there are in situ archaeological finds or features present. It is therefore recommended that construction can proceed without further archaeological mitigation. With regard to indirect impacts, it is proposed that the existing tree and hedge line be retained, where feasible, to provide a level of screening from the surrounding areas.

13.6 Residual Impacts

There will be no significant residual impacts on the archaeological or architectural heritage resource as a result of the construction or operation of the proposed wind turbine.

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14 Cumulative Impacts, Other Impacts and Interactions

14.1 Introduction

This chapter addresses the cumulative impacts, indirect impacts and main interactions between different aspects of the environment likely to be significantly affected by the proposed wind energy project. This chapter also addresses environmental effects which have not been specifically addressed in the individual chapters of the EIS.

Only topics that could be logically linked to the development have been examined in detail. Accordingly, when a topic is not mentioned, the authors have concluded that no potential for impact exists.

14.2 General

The requirement to address cumulative impacts, indirect impacts and interactions of effects comes from the Regulations and EIA Directive 85/337/EEC as amended by 97/11EC and 2003/35/EC. Schedule 6 of the Planning and Development Regulations 2001, which mirrors Article 3 of the EIA directives, specifies the information to be contained in an EIS, including the information listed below (emphasis is the author's):

“A description of the aspects of the environment likely to be significantly affected by the proposed development, including in particular:

- human beings, fauna and flora,
- soil, water, air, climatic factors and the landscape,
- material assets, including the architectural and archaeological heritage, and the cultural heritage, and
- the inter-relationship between the above factors.”

“A description is also required of the likely significant effects (including direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative) of the proposed development on the environment resulting from:

- the existence of the proposed development, and
- the use of natural resources.”

14.3 Methodology Used to Assess Cumulative and Indirect Impacts and Interactions

Reference was made to the EPA Documents, *Guidelines on the information to be contained in Environmental Impact Statements*, EPA 2002, and *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*, EPA 2003 (EPA guidelines) in the preparation of this chapter of the EIS.

The EU has also prepared guidelines, *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*, published by the Office for Official Publications of the European Communities in May 1999 (EU guidelines).

At the screening stage in the preparation of the EIS for the proposed wind energy project, the potential for significant cumulative and indirect impacts and interactions was examined and any such potential impacts were identified. Where the potential for significant cumulative and indirect impacts and interactions was identified, such impacts and interaction of impacts were included in the scope and addressed in the baseline and impact assessment studies for each of the relevant environmental media and aspects of the project. The cumulative and indirect impacts and interaction of impacts are presented in the chapters of the EIS which address the most relevant environmental media.

The matrix and expert opinion approaches, as outlined in the EU Guidelines, were used in the identification of the potential for significant cumulative and indirect impacts and interactions. Refer to **Table 14.1** for the matrix of potential interactions. Modelling and carrying capacity analyses were used to evaluate impacts.

Reference was also made to the EPA guidelines *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*, in particular to the guidance given for topics which would usually be addressed when preparing an EIS for developments of a particular project class.

14.4 Definitions

There are no generally agreed and accepted definitions for indirect impacts, cumulative impacts or inter-relationship of impacts.

The EPA Guidelines define cumulative impact thus: *The addition of many smaller impacts to create one larger more significant impact.*

The EPA Guidelines do not define indirect impacts. The EPA Guidelines use the term synergistic impacts. Synergistic impact is defined as: *Where the resultant impact is of greater significance than the sum of its constituents.*

The EU guidelines use slightly different definitions as follows:

Indirect Impacts: Impacts on the environment, which are not a direct result of the project, often produced away from or as a result of a complex pathway (sometimes referred to as second or third level impacts or secondary impacts).

Cumulative Impacts: Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project.

Impact Interactions: The reactions between impacts whether between the impacts of just one project or between the impacts of other projects in the area.

The term 'impact interactions' is equivalent to the term 'inter-relationship of effects'. The EU guidelines accept that their definitions overlap to a certain extent. The EU guidelines also refer to 'Cross-Media Impacts', in which the impact in one environmental medium may also have an indirect impact on another medium.

14.5 Effects in Different Environmental Media

14.5.1 Matrix of Effects

Table 14.1 presents the effects matrix. The effects matrix examines the potential for the topic or issue in the left hand column to have an effect on the environmental media listed in the top row of the matrix.

If there is the potential for an effect during the construction phase, this is indicated by a ‘C’. An ‘O’ indicates the potential for an effect during the operational phase and ‘OC’ indicates the potential for an effect during both phases. If there is considered to be no potential for an effect, this is indicated by ‘-’.

The purpose of the effects matrix is to identify potential effects in different media. Actual effects and their significance are dealt with in the most relevant chapter.

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Table 14.1 Potential Interaction of Effects Matrix (C = Construction, O = Operational)

	Noise and Vibration	Air Quality	Climate	Landscape And Visual	Archaeological Architectural & Cultural Heritage	Human Beings	Material Assets	Flora and Fauna	Soils & Geology	Surface Water & Ground-water	Road Network & Traffic
Noise and Vibration	-	-	-	-	-	CO	-	CO	-	-	-
Air Emissions	-	-	-	-	-	C	-	C	-	-	-
Emissions to water	-	-	-	-	-	-	-	-	-	-	-
Landscape and Visual	-	-	-	-	O	CO	-	CO	-	-	-
Archaeological Architectural & Cultural Heritage	-	-	-	-	-	-	-	-	-	-	-
Human Beings	-	-	-	-	-	-	-	-	-	-	C-
Material Assets	O	-	-	CO	O	-	O	O	-	-	-
Flora & Fauna	-	-	-	-	-	CO	-	-	-	-	-
Soils & Geology	C	C	-	-	C	-	C	C	-	C	-
Traffic	C	C	-	-	-	C	-	-	-	-	-

14.5.2 Potential Interactions

The potential effects of noise and vibration during construction and operation on human beings and fauna are addressed in **Chapters 9, Noise and Vibration** and **7 Flora and Fauna**. Mitigation measures are proposed to ensure there will not be a significant impact.

Chapter 8, Landscape and Visual Assessment addresses the potential landscape and visual impacts of the proposed development and also the potential effects on human beings, tourism and on recreational amenity. **Chapter 13, Archaeology, Architecture and Cultural Heritage**, addresses the potential effects of the development on cultural heritage features, arising from visual impact. In general, there will be no significant visual impacts during the construction phase as it will be temporary and localised in nature (refer to **Table 8.5**). The operational impacts on viewpoints will range from slight to significant (refer to **Table 8.5**). During operation there will be a moderate to significant change to landscape character in the local setting of the proposed turbine.

The potential effects on human beings, flora and fauna as a result of air emissions generated during the construction of the proposed wind turbine, are addressed in **Chapter 10, Air Quality**. The assessment concluded that there will not be a significant impact.

14.5.3 Amenity

The impact of the proposed development on the amenity of the local area has been addressed in a number of sections of this EIS. In **Chapter 6, Human Beings**, other impacts that the proposed development will have on amenity are assessed. **Chapter 8 Landscape and Visual** addresses the impacts of the proposed development on the landscape character of the site, on scenic routes, views and prospects and on waymarked ways.

14.5.4 Indirect Effects

There will be no significant negative impact on the national power grid.

Other indirect effects are described in the chapters of the EIS which address the different environmental media.

14.6 Cumulative Impacts

The cumulative impacts are addressed in the relevant chapters of the EIS, including as follows:

- The cumulative landscape and visual impacts arising from the proposed development, in conjunction with the proposed windfarm development at Castlewaller and existing visual elements in the area, are assessed in **Chapter 8**. The cumulative visual impact will range from 'none' to 'slight' depending on the viewpoint and the distance. For some, the impact will be viewed as negative, but for many others the impact will be positive in nature.

- Compliance with IPPC noise limits is assessed based on the cumulative impact of wind turbine noise and existing facility noise. There will be no significant cumulative noise impacts.

14.7 References

Directive 97/11EC amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, Official Journal of the European Communities, 1997

Planning and Development Regulations, 2001, Statutory Instrument No 600 of 2001, Government Publications Office, Dublin, 2001

Environmental Protection Agency (2002) *Guidelines on the information to be contained in Environmental Impact Statements* EPA, Wexford

Environmental Protection Agency (2003) *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* EPA, Wexford

Office for Official Publications of the European Communities (1999) *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*

Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, Official Journal of the European Economic Communities, 1985.

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15 Summary of Impacts and Mitigation Measures

15.1 Introduction

It has been the intention of Vistakon to reduce the adverse effects of the proposed development on the environment to a practical minimum. Where unavoidable environmental effects have been identified during the environmental impact assessment process, measures have been proposed to mitigate these effects as much as reasonably possible.

This chapter summarises the likely residual environmental effects associated with the proposed development. The predicted impacts and recommended mitigation measures are comprehensively detailed in the relevant chapters of the EIS, and are summarised in **Table 15.1** below.

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Table 15.1 Assessment of Potential Effects and Mitigation Measures

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
CONSTRUCTION PHASE		
Site Clearance and Preparation		
- Removal of topsoil - Clearance of vegetation - Excavation of soil for turbine foundation and general site re-grading - Setting up of site fencing, site office, site facilities, secure storage compound, temporary car parking - Importation of construction equipment	- A construction environmental management plan will be prepared and implemented with the objective of keeping disruption and nuisance to a minimum. The plan will have regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, Environmental Good Practice on Site, CIRIA 2005. - A dust minimisation plan will be formulated for the construction phase of the project - Approximately 50% of excavated spoil may be reused to backfill over the lower pad. The remaining subsoil will be re-used on site where feasible. - In so far as possible, construction materials will be from local sources. All fill material, if required, will be from approved sources. - As required by the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. - Measures for control of rainwater runoff (refer to Section 4.10.5). - Measures for storage of fuels, etc on site. - Construction will be short term and temporary	Slight Temporary increase in traffic in the vicinity of the site.
Generation of Waste		
- Construction waste, - Excavated material	- Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery and finally disposal to landfill (refer to Section 4.10.4). - Control and reuse of surplus soil is detailed in Site Clearance and Preparation above, in this table.	Negligible Waste not suitable for reuse will use up landfill space. No significant impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Site Tidiness		
Untidy site	The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness: - A regular program of site tidying will be established to ensure a safe and orderly site,, - Scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind, - Food waste will be strictly controlled on all parts of the site, - Loaded lorries and skips will be covered, - Surrounding roads used by trucks to access to and egress from the site will be cleaned regularly using an approved mechanical road sweeper. Roads will be cleaned subject to local authority requirements. Site roads will be cleaned on a daily basis, or more regularly as required, - Road edges and footpaths will be cleaned using a hand broom with controlled damping, - Wheelwash facilities will be provided with rumble grids to remove excess mud from wheels. These facilities will be located at all exits from the site, - In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed-of in the normal manner.	Negligible No significant impact predicted.
Visual Impact		
- Site establishment will require erection of Permanent and temporary fencing, - Erection of signage. - Removal of land cover and excavation - Temporary office and welfare facilities.	- Construction activity will be adequately fenced-off in order to avoid damage or disturbance to landscape elements outside of minimum area required for such works. - Construction works will proceed in a controlled and orderly manner. - Site hoardings, cranes, temporary buildings and plant will be removed once construction has been completed. - The construction compound will be fully re-instated at the end of the construction contract.	Imperceptible to Moderate Temporary imperceptible to moderate visual effects during construction phase.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
- Craneage will be a significant element of the construction methodology and it is envisaged that various craneage systems will be used for lifting materials in to place. - Construction of turbine - Construction of access road		
Traffic		
Increase in traffic due to construction activities in form of HGVs, abnormal loads for delivery of cranes and turbine components, and workforce and general site traffic.	- A Construction Management Plan will be implemented which will include construction traffic management. - Construction traffic will be temporary and of short duration.	Very Slight No significant impact predicted.
Noise and Vibration		
Principal sources of noise: - Earthworks plant and equipment. - Construction plant and equipment. - Construction traffic. - Piling. Principal source of vibration: - Piling	- In accordance with best practice, noise aspects during the construction phase will be managed in accordance with BS 5228: Noise control on construction and open sites. - Hours will be limited during which noisy site activities are permitted. - Channels of communication will be established between the Contractor/Developer and Local Authority. - A Site Representative will be appointed responsible for matters relating to noise. - Typical levels of noise will be monitored during critical periods and at sensitive locations. - Plant will be selected with low inherent potential for the generation of noise. - All site roads will be kept even so as to mitigate the potential for vibration from lorries. - Barriers will be erected as necessary around items such as generators or high duty compressors. - Noisy plant will be sited as far away from sensitive properties as permitted by site constraints. - Piling work will be managed to minimise the temporary noise and vibration impacts arising from this work.	Negligible Temporary slight increase in noise levels during the construction phase. The impact of the construction works will be negligible. No significant impacts from piling.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Air Emissions		
- Emissions from construction plant and vehicles. - Dust from movements on site in dry windy weather.	- Because of the relatively low level of emissions from construction plant and vehicles, and the short duration of the exposure, no significant impacts are predicted on air quality. - A Construction Management Plan will be implemented. - A Dust Minimisation Plan will be formulated for the construction phase of the project. The focus of the control procedures will therefore be to reduce the generation of airborne material. The following measures shall be included as a minimum as part of the dust minimisation plan, to reduce dust emissions in the areas surrounding the site during construction: - Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic only, apart from the contractor's car park which will be hardcore only. - Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions. - Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on paved roads as site management dictates. - Vehicles delivering material with dust potential (soil, aggregates) will be enclosed or covered with tarpaulin at all times to restrict the escape of dust. - Wheel washing facilities will be provided for vehicle exiting site in order to ensure that mud and other wastes are not tracked onto public roads. - Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary. - Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. - Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods. - During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.	Imperceptible Potential short-term, localised dust nuisance arising from construction activities. No significant impacts on air quality are predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Climate		
Construction vehicles, generators etc., may give rise to CO₂ and NO_x emissions.	There will be minor emissions to the atmosphere during the construction phase. No mitigation measures required.	Negligible No significant impact on climate predicted.
Soils and Geology		
- Excavation works below the existing ground level will be required during the construction of the proposed development. - Rock-socketed piling will be required for turbine foundation - Potential impact on soil from leaks or spills from fuel, etc. - Soils have the potential to be compacted by plant and machinery during construction. - For foundations of the access track and hard standing ground improvement works may be required. These may consist of dynamic compaction, grouting of voids or the excavation of weak zones and replacement with free draining, well graded, high quality stone.	- Re-use surplus soil, where possible. Refer to previous section of this table – Site Clearance and Preparation - The employment of good construction management practices will serve to minimise the risk of pollution of soil. - In localised weak spots, geogrids or stone platforms can be used to bridge over these areas or alternatively weak spots may be excavated and replaced with free draining fill to ensure no impact on possible existing drainage paths.	Negligible No significant impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Surface Water and Groundwater		
- Potential impact on surface water during heavy precipitation from stormwater runoff which could contain silt, or oils from plant and vehicles. - Potential impact on the River Mulkear should a flood event take place at the site.	- A Construction Environmental Management Plan will be prepared and implemented for the duration of the construction phase of the project. - Measures, as recommended in the CIRIA guidance <i>Control of Water Pollution from Linear Construction Projects</i> will be implemented to minimise the risk of spills and contamination of soils and waters - Measures for control of stormwater runoff will be implemented, including the installation of a temporary interceptor drain, and use of silt traps. Surface water runoff collected in the interception drain, and water which may require pumping from the excavation for the turbine foundation will undergo a silt removal process in order to meet the conditions of the Vistakon IPPC licence (refer to Section 1.6.7) prior to being discharged to the existing Vistakon surface water drainage network (refer to Section 4.10.5). - Stormwater runoff from the site will be monitored. - Plant and vehicles serviced regularly to minimise leaks. - Fuels and lubricant stored in bunded areas. - Refuelling of plant in controlled areas only. - If a likelihood of flooding is predicted during construction, construction activities will cease until the risk has passed, in order to ensure that there will be no risk of pollution to the River Mulkear.	Negligible No significant impact predicted.
Flora and Fauna		
- Potential for impact on bats due to habitat loss - Potential impacts on breeding birds within the site from a combination of direct habitat loss and disturbance. - Potential impact on lamprey species in the River Mulkear from vibration from piling operations	- A Construction Environmental Management Plan will be prepared and implemented for the duration of the construction phase of the project. - Measures, as recommended in the CIRIA guidance <i>Control of Water Pollution from Linear Construction Projects</i> will be implemented to minimise the risk of spills and contamination of soils and waters - To prevent incidental damage by machinery or by the deposition of spoil during the site clearance stage, any trees /habitats earmarked for retention will be securely fenced early in the construction phase. The fencing will be clearly visible to machine operators. - Removal of vegetation will be undertaken outside the bird breeding season from March 1st to August 31st. - If a likelihood of flooding is predicted during construction, construction activities will cease until the risk has passed, in order to ensure that there will be no risk of pollution to the River Mulkear.	‘No Impact’ to ‘Moderate’ No significant impact on flora and fauna. No impact on the water quality of the Mulkear River. There will be no impact on the integrity of the adjacent Lower River Shannon cSAC.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	- River Mulkear is located approximately 250m from construction site - Significant distance (250m) between the proposed piling activities and the Mulkear River. In addition, the vibrations that will be generated by the piling for the foundation of the proposed turbine will be high frequency vibrations. High frequency vibrations are naturally attenuated closer to the source than low frequency vibrations.	
Archaeological Architectural and Cultural Heritage		
- The work associated with the proposed development will involve ground disturbance. Given the considerable level of ground disturbance on the proposed site during the mid-1990s it is unlikely that any potential finds or features survive and consequently there will be no direct impacts on the cultural heritage resource. - Potential for indirect impacts in the form of impacts on the settings of architectural or cultural heritage features – primarily visual.	With regard to indirect impacts, existing tree and hedge line be retained to provide a level of screening from the surrounding areas. No other mitigation measures required. <i>For inspection purposes only. Consent of copyright owner required for any other use.</i>	No Impact No significant impact on archaeological, architectural and cultural heritage.
Human Beings		
20 (peak) jobs on site and additional jobs off-site.	- No controls or mitigation measures required. - In addition to the direct employment during the construction phase, there will be substantial off-site employment and economic activity associated with the supply of construction materials and services during the construction phase.	Moderate Beneficial Employment.
Impact on local residents from construction and from construction traffic.	- Careful management of site operations. - Traffic management.	Slight

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
		Short term temporary effects during construction phase.
Use of Natural Resources		
Construction phase will require: • Potable water • Power • Fuel • Materials such as steel and concrete.	• Equipment will be serviced regularly to ensure efficient operation. • Materials will be carefully stored and handled to avoid waste and damage. • Water use will be controlled to avoid waste.	Negligible Resource use will be typical for the type and size of project.
OPERATIONAL PHASE		
Visual Impact		
• Visual impact • Impact on landscape character	• The wind turbine has been sized and will be located in a position that will balance the environmental impacts together with operations of the site and maximising the wind energy potential. • The turbine will be painted off-white or light grey, with a matt or semi-matt finish. • Electricity lines will be under ground.	Imperceptible to significant The residual impacts on views will vary from imperceptible to significant depending on proximity to the development and direction of view and the character of intervening topography. The impact of the wind turbine within the landscape will very much depend on by whom and how it is experienced. With regard to landscape character, the turbine, will be a new 'entity' in the

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
		landscape and will result in a moderate to significant impact or change in its local setting.
Traffic		
There will be no increase in traffic as a result of the operation of the proposed development.	No mitigation measures required.	No Impact No significant impact predicted.
Noise and Vibration		
Wind turbines generate noise in operation.	Turbine has been located a minimum of 500 metres from the closest dwelling.	No significant impacts are predicted.
Air Emissions		
- There will be no emissions to air as a result of the operation of the proposed development. - The combustion of natural gas will be reduced, resulting in reduced NOx emissions	No adverse impacts, therefore mitigation measures not required.	Slight/Positive Long-term beneficial impacts are predicted relating both to air quality and climate.
Climate		
- No adverse impacts. - The combustion of natural gas will be reduced, resulting in reduced CO₂ emissions	No mitigation measures required.	Slight/Positive Long-term beneficial impacts are predicted relating both to air quality and climate.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Soils, Geology, Surface Water and Groundwater		
No adverse impacts	No mitigation measures required.	No Impact
Flora and Fauna		
- Potential for bats to collide with turbine or blades. Potential for birds to collide with turbine or blades. All but one of the bat species confirmed or expected are low fliers, and as a result are considered to be at low risk from the proposed development. - Potential for mute swans to collide with turbine or blades - Potential disturbance to breeding birds within the site.	- Bats - To ensure a safe distance from the turbine for low-flying bats along hedgerows, a vegetation-free buffer zone of 50m minimum from the nearest vegetation to the turbine rotors shall be cleared to reduce the risk of collision and/or barotrauma to species that mainly fly low along hedgerows, tree lines and forest edge such as lesser horseshoe, brown long-eared and pipistrelle bats. Outside of the buffer zone, trees and treelines will be retained where possible. - No mitigation measures with respect to Leisler's Bat are required or proposed. There is currently no evidence of Leisler's bat mortality due to wind turbines in Ireland, and no published results of bat/turbine interaction at Irish wind turbine sites - Disturbance to breeding birds will decline over time with habituation. - Studies to date indicate that the collision risk for birds is low and the turbine is not likely to cause a threat to local bird populations. - With regard to mute swans landing on the Mulkear River, the stretch of the Mulkear directly northeast of the Vistakon facility s comprises a section of shallow rapids making it unsuitable for mute swans landing. With regard to landing mute swans landing on the River Shannon the approach would be from the southwest. However, there is sufficient distance from the proposed turbine (770m) to the potential flight path to rule out potential collision.	Imperceptible to Slight. No significant impact on flora and fauna.
Archaeological, Architectural and Cultural Heritage		
No impacts	As the entire area has been previously disturbed, no mitigation measures required.	No Impact
Human Beings		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Health and Safety Impacts	- The Health and Safety policy, procedures and work practices of the proposed development will be in conformance to all relevant health and safety legislation both during its operational stages. The proposed development will be designed and constructed to best industry standards, with an emphasis being placed on the health and safety of employees, local residents and the community at large. The technology to be employed in the proposed development is well understood and has been used successfully in equivalent projects internationally, with no implications for health and safety. The design and construction of the turbine will be subject to independent third party verification. - Night lighting for aviation, which will consist of a small medium intensity flashing white warning light at the top of the nacelle or turbine hub.	No Impact No impact predicted.
Potential impact on views from public recreational areas.	- River bank walks along the Rivers Shannon and Mulkear will be largely screened from views of the turbine given the riparian woodland enveloping the rivers' edges and islands. - Limited views from University of Limerick.	Imperceptible to moderate Impacts on views from river bank walks may be slight to moderate in winter. Slight to moderate impacts on views from the Lough Derg Way. Impacts on views from designated walking routes further from the site will be imperceptible to slight. Slight to moderate impact on views from University of Limerick.
Potential impact of shadow flicker on residential amenity.	- The distance of the proposed turbine from residences (la minimum of 500 metres), and intervening buildings and vegetation will help minimise shadow flicker effects. - A shadow flicker control module will be incorporated in the turbine, which will enable Vistakon to switch off the turbine for the duration of identified adverse impacts on sensitive receptors.	No significant impacts are predicted.
No adverse impacts predicted on Tourism.	No mitigation measures required.	No Impact No adverse impacts predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Use of Natural Resources		
- No use of natural resources during operation - Reduce consumption of natural gas	No adverse impacts predicted, therefore no mitigation measures required.	No Adverse Impact Slight Beneficial Impact
Telecommunications		
Potential impact on telecommunications.	No adverse impacts predicted, therefore no mitigation measures required.	No Impact No impact predicted.
Aviation radar		
Potential impact on aviation surveillance radar	Radar mitigation measures to be agreed with the Irish Aviation Authority	No residual impact predicted

Appendix A

Glossary of Impacts

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A1 Glossary of Impacts

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Appendix B

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B1 Lower River Shannon SAC (Site Code 0002165) Site Synopsis

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Appendix C

Screening Report for Appropriate Assessment

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C1 Screening Report for Appropriate Assessment

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Appendix D

Ecology Photographs

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D1 Ecology Photographs

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Appendix E

Aardwolf Bat Survey Report

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E1 Aardwolf Bat Survey Report

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Appendix F

Shadow Flicker Assessment Report

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F1 Shadow Flicker Assessment Report

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Appendix G

Aviation Impact Assessment

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G1 Aviation Impact Assessment Report

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Appendix H

Appendix to Chapter 13

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H1 Appendix to Chapter 13

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