Pinewoods Wind Farm Substation & Grid Connection

Chapter 9: Landscape

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Contents

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9.1 Introduction

This chapter describes the landscape context of the proposed development and assesses the likely significant landscape and visual impact of the scheme on the receiving environment.

Although closely linked, landscape and visual impact are assessed separately. Landscape Impact Assessment (LIA) relates to changes in the physical landscape brought about by the proposed development, which may alter its character, and how the landscape is experienced. This requires a detailed analysis of the individual elements and characteristics of a landscape that go together to make up the overall landscape character of that area. By understanding the aspects that contribute to landscape character, it is possible to make judgements in relation to its quality (integrity) and to identify key sensitivities. This, in turn, provides a measure of the ability of the landscape in question to accommodate the type and scale of change associated with the proposed development, without causing unacceptable adverse changes to its character.

Visual Impact Assessment (VIA) relates to assessing effects on specific views and on the general visual amenity experienced by people. This deals with how the surroundings of individuals or groups of people may be specifically affected by changes in the content and character of views as a result of the change or loss of existing elements of the landscape and/or introduction of new elements. Visual impacts may occur from; visual obstruction (blocking of a view, be it full, partial or intermittent) or; visual intrusion (interruption of a view without blocking).

Cumulative landscape and visual impact assessment is concerned with additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future.

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

- Environmental Protection Agency (EPA) publication '*Guidelines on the Information to be contained in Environmental Impact Statements*' (Draft 2017) and the accompanying Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (Draft 2015); and
- Landscape Institute and the Institute of Environmental Management and Assessment publication entitled *Guidelines for Landscape and Visual Impact Assessment – Third Addition* (2013).

9.1.1 Statement of Authority

This landscape and visual assessment (LVIA) was prepared by Richard Barker (MLA MILI) and Rory Curtis (GDip.LA MILI) of Macro Works Ltd, a specialist LVIA company with over 20-years of experience in the appraisal of effects from a variety of energy, infrastructure and commercial developments. Relevant experience extends to numerous electrical infrastructure developments including transmission lines and substations as well as the assessment of over 140 wind energy developments, including LVIA work on six Strategic Infrastructure Developments (SID), and 100 solar energy developments. Macro Works and its senior staff members are affiliated with the Irish Landscape Institute.

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9.1.2 Description of Proposed Development

In summary, the proposed development comprises the following main components:-

- 1 no. 110kV 'loop-in/loop-out' air-insulated switchroom (AIS) substation including control buildings, transformers and all ancillary electrical equipment; and
- All associated site development, access and reinstatement works.

The entirety of the proposed development is located within the administrative area of County Laois; while the overall Pinewoods Wind Farm project is located partly within County Laois and County Kilkenny. Additionally, candidate quarries which may supply construction materials are also located within County Kilkenny and Carlow.

A full description of the proposed development is presented in **Chapter 3**

9.1.3 Definition of Study Area

On the basis of assessments undertaken is respect of similarly sized developments, it is anticipated that the proposed development is likely to be difficult to discern beyond approximately 2km and is not likely to give rise to significant landscape or visual impacts beyond this distance. Therefore the study area for this assessment is a 2km radius around the proposed development site.

9.2 Methodology

The production of this LVIA involved desktop studies to understand the existing baseline environment; fieldwork recording the elements and characteristics of the landscape and the selection and capture of images to allow the preparation of photomontages; and the professional evaluation of the baseline environment and the effects which may occur as a result of the proposed development with the aid of the accompanying photomontages.

9.2.1 Desk Study

The desk study involved:-

- Establishing an appropriate study area from which to study the landscape and visual impacts of the proposed development;
- Review of a Zone of Theoretical Visibility (ZTV) map, which indicates areas from which the development is potentially visible in relation to terrain within the study area;
- Review of relevant legislation and guidance, including County Development Plans, particularly with regard to sensitive landscape and scenic view/route designations; and
- Selection of possible Viewshed Reference Points (VRPs/VPs) from key visual receptors to be investigated during fieldwork for actual visibility and sensitivity.

Concerns raised by local residents and consultees in previous submissions related to the permitted Pinewoods Wind Farm, as they relate to landscape and visual effects, were also assessed in the preparation of this chapter.

9.2.2 Fieldwork

The fieldwork undertaken to inform this assessment included:-

- Recording a description of the landscape elements and characteristics within the study area;

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- Selection of a refined set of VRP's for assessment. This includes the capture of reference images and grid reference coordinates for each VRP location for the visualisation specialist to prepare photomontages;
- Following the selection of VRPs, photo-realistic images (photomontages) of the proposed development were prepared by Macro Works.

9.2.3 Appraisal

This assessment, undertaken following the completion of fieldwork and the preparation of photomontages, includes:-

- Consideration of the receiving landscape with regard to overall landscape character as well as the salient features of the study area including landform, drainage, vegetation, land use and landscape designations;
- Consideration of the visual environment including receptor locations such as centres of population and houses; transport routes; public amenities and facilities and; designated and recognised views of scenic value;
- Consideration of design guidance and planning policies;
- Consideration of potentially significant effects and the mitigation measures that could be employed to reduce such effects;
- Estimation of the significance of residual landscape impacts;
- Estimation of the significance of residual visual impacts aided by photomontages prepared at all of the selected VRP locations; and
- Estimation of cumulative landscape and visual effects in combination with other surrounding existing, permitted or proposed developments.

9.2.3.1 Assessment Criteria for Landscape Impact

The classification system used by Macro Works to determine the significance of landscape and visual impacts is based on the IEMA *Guidelines for Landscape and Visual Impact Assessment* (2013). When assessing the likely impacts on the landscape resulting from a development, the following criteria are considered:-

- Landscape character, value and sensitivity;
- Magnitude of likely impacts; and
- Significance of landscape effects

The sensitivity of the landscape to change is the degree to which a particular landscape receptor (Landscape Character Area (LCA) or feature) can accommodate changes or new features without unacceptable detrimental effects to its essential characteristics. The value and sensitivity of landscapes is classified using the following criteria.

Sensitivity	Description
Very High	Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are high value landscapes, protected at an international or national level (World Heritage Site/National Park), where the principal management objectives are likely to be protection of the existing character.
High	Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national or regional level (Area of Outstanding Natural Beauty), where the principal management objectives are likely to be considered conservation of the existing character.
Medium	Areas where the landscape character exhibits some capacity and scope for

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	development. Examples of which are landscapes which have a designation of protection at a county level or at non-designated local level where there is evidence of local value and use.
Low	Areas where the landscape character exhibits a higher capacity for change from development. Typically this would include lower value, non-designated landscapes that may also have some elements or features of recognisable quality, where landscape management objectives include, enhancement, repair and restoration.
Negligible	Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value.

Table 9.1: Landscape Value and Sensitivity

The magnitude of a predicted landscape impact is a product of the scale, extent or degree of change that is likely to be experienced as a result of a proposed development. The magnitude takes into account whether there is a direct physical impact resulting from the loss of landscape components and/or a change that extends beyond the proposed site boundary that may have an effect on the landscape character of the area.

Magnitude of Impact	Description
Very High	Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
High	Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
Medium	Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality.
Low	Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements.
Negligible	Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable.

Table 9.2: Magnitude of Landscape Impacts

The significance of landscape and visual impacts are based on a balance between the sensitivity of the receptor and the magnitude of the impact. The significance of impacts is arrived at using the following matrix:-

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Scale/ Magnitude	Sensitivity of Receptor				
	Very High	High	Medium	Low	Negligible
Very High	Profound	Profound-substantial	Substantial	Moderate	Slight
High	Profound-substantial	Substantial	Substantial - moderate	Moderate-slight	Slight-imperceptible
Medium	Substantial	Substantial -moderate	Moderate	Slight	Imperceptible
Low	Moderate	Moderate-slight	Slight	Slight-imperceptible	Imperceptible
Negligible	Slight	Slight-imperceptible	Imperceptible	Imperceptible	Imperceptible

*Categories with orange shading are considered to equate with 'significant' impacts in EIA terms

**The significance matrix provides an indicative framework from which the significance of impact is derived. The significance judgement is ultimately determined by the assessor using professional judgement. Due to nuances within the constituent sensitivity and magnitude judgements, this may be up to one category higher or lower than indicated by the matrix.

Table 9.3: Impact Significance Matrix

It should also be noted that possible beneficial landscape impacts are not accounted for in the tables and matrix above. This is on the basis that developments of the nature of that proposed are very unlikely to generate beneficial landscape impacts. In the rare instances that this might occur, perhaps by facilitating the rehabilitation of a degraded landscape, the benefits will be discussed in the assessment and the significance of impact would default to the lowest end of the range (Imperceptible).

9.2.3.2 Assessment Criteria for Visual Impact

As with the landscape impact, the visual impact of the proposed development will be assessed as a function of receptor sensitivity versus magnitude of effect. In this instance, the sensitivity of visual receptors will be weighed against the magnitude of visual effects.

Visual sensitivity

Unlike landscape sensitivity, visual sensitivity has an anthropocentric basis. Visual sensitivity is a two-sided analysis of receptor susceptibility (people or groups of people) versus the value of the view on offer at a particular location.

To assess the susceptibility of viewers and the amenity value of views, the assessors use a range of criteria and provide a four-point weighting scale to indicate how strongly the viewer/view is associated with each of the criterion. Susceptibility criteria are extracted directly from the *IEMA Guidelines for Landscape and Visual Assessment* (2013), whilst the value criteria relate to various aspects of a view that

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might typically be related to high amenity including, but not limited to, scenic designations. The susceptibility criteria are set out below.

Susceptibility of receptor group to changes in view

This is one of the most important criteria to consider in determining overall visual sensitivity because it is the single category dealing with viewer susceptibility. In accordance with the *IEMA Guidelines for Landscape and Visual Assessment* visual receptors most susceptible to changes in views and visual amenity are:-

- Residents at home;
- People, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focussed on the landscape and on particular views;
- Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience;
- Communities where views contribute to the landscape setting enjoyed by residents in the area; and
- Users of road, rail or other transport routes where such travel involves recognised scenic routes and awareness of views is likely to be heightened.

Visual receptors that are less susceptible to changes in views and visual amenity include:-

- People engaged in outdoor sport or recreation which does not involve or depend upon appreciation of views of the landscape; and
- People at their place of work whose attention may be focussed on their work or activity, not their surroundings and where the setting is not important to the quality of working life.

Recognised scenic value of the view (County Development Plan designations, guidebooks, touring maps, postcards etc)

These represent a consensus in terms of which scenic views and routes within an area are strongly valued by the population because, in the case of County Development Plans, a public consultation process is required.

Views from within highly sensitive landscape areas

Again, highly sensitive landscape designations are usually part of a Landscape Character Assessment, which is then incorporated into the County Development Plan and is therefore subject to the public consultation process. Viewers within such areas are likely to be highly attuned to the landscape around them.

Intensity of use, popularity

Whilst not reflective of the amenity value of a view, this criterion relates to the number of viewers likely to experience a view on a regular basis and whether this is significant at county or regional scale.

Connection with the landscape

This considers whether or not receptors are likely to be highly attuned to views of the landscape i.e. commuters hurriedly driving on busy national route versus hill walkers directly engaged with the landscape enjoying changing sequential views over it.

Provision of elevated panoramic views

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This relates to the extent of the view on offer and the tendency for receptors to become more attuned to the surrounding landscape at locations that afford broad vistas.

Sense of remoteness and/or tranquillity

Remote and tranquil viewing locations are more likely to heighten the amenity value of a view and have a lower intensity of development in comparison to dynamic viewing locations such as a busy street scene, for example.

Degree of perceived naturalness

Where a view is valued for the sense of naturalness of the surrounding landscape, it is likely to be highly sensitive to visual intrusion by obvious human interventions.

Presence of striking or noteworthy features

A view might be strongly valued because it contains a distinctive and memorable landscape feature such as a promontory headland, lough or castle.

Historical, cultural or spiritual value

Such attributes may be evident or sensed at certain viewing locations that attract visitors for the purposes of contemplation or reflection heightening the sense of their surroundings;

Rarity or uniqueness of the view

This might include the noteworthy representativeness of a certain landscape type and considers whether other similar views might be afforded in the local or the national context;

Integrity of the landscape character in view

This criterion considers the condition and intactness of the landscape in view and whether the landscape pattern is a regular one of few strongly related components or an irregular one containing a variety of disparate components;

Sense of place

This criterion considers whether there is special sense of wholeness and harmony at the viewing location; and

Sense of awe

This criterion considers whether the view inspires an overwhelming sense of scale or the power of nature.

Those locations where highly susceptible receptors or receptor groups are present and which are deemed to satisfy many of the view value criteria above are likely to be judged to have a high visual sensitivity and vice versa.

Visual Impact Magnitude

The magnitude of visual effects is determined on the basis of two factors; the visual presence of the proposed development and its effect on visual amenity.

Visual presence is a somewhat quantitative measure relating to how noticeable or visually dominant the proposal is within a particular view. This is based on a number of aspects beyond simply scale in relation to distance. Some of these include the extent of the view as well as its complexity and the degree of existing contextual movement experienced. The backdrop against which the development is

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presented and its relationship with other focal points or prominent features within the view is also considered. Visual presence is essentially a measure of the relative visual dominance of the proposal within the available vista and is expressed as such i.e. minimal, sub-dominant, co-dominant, dominant or highly dominant.

It should be noted that as a result of this two-sided analysis, a high order visual presence can be moderated by a low level of effect on visual amenity and vice versa. The magnitude of visual impacts is classified in the following table:-

Criteria	Description
Very High	The proposal intrudes into a large proportion or critical part of the available vista and is without question the most noticeable element. A high degree of visual disorder or disharmony is also generated, strongly reducing the visual amenity of the scene.
High	The proposal intrudes into a significant proportion or important part of the available vista and is one of the most noticeable elements. A considerable degree of visual disorder or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene.
Medium	The proposal represents a moderate intrusion into the available vista, is a readily noticeable element and/or it may generate a degree of visual disorder or disharmony, thereby reducing the visual amenity of the scene. Alternatively, it may represent a balance of higher and lower order estimates in relation to visual presence and visual amenity.
Low	The proposal intrudes to a minor extent into the available vista and may not be noticed by a casual observer and/or the proposal would not have a marked effect on the visual amenity of the scene.
Negligible	The proposal would be barely discernible within the available vista and/or it would not detract from, and may even enhance, the visual amenity of the scene.

Table 9.4: Magnitude of Visual Impact

9.2.3.3 Visual Impact Significance

As stated above, the significance of visual impacts is a function of visual receptor sensitivity and magnitude of visual impact. This relationship is expressed in the impact significance matrix in **Table 9.3.**

9.3 Description of Existing Environment

9.3.1 Landscape Baseline

The landscape baseline represents the existing landscape context and is the scenario against which any changes to the landscape brought about by the proposed development will be assessed. This also includes reference to any relevant landscape character appraisals and the current landscape policy context (both are generally contained within County Development Plans).

A description of the landscape context of the proposed development site and wider study area is provided below under the headings of 'landform and drainage', 'vegetation and land use', 'centres of population', 'transport route's and 'public amenities and facilities' as well as the immediate site context. Additional descriptions of the landscape, as viewed from each of the selected viewpoints, are provided under the detailed assessments later using a similar structure. Although this description forms part of the landscape baseline, many of the landscape elements

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identified also relate to visual receptors i.e. places and transport routes from which viewers can potentially see the proposed development. The visual resource will be described in greater detail in **Section 9.3.3** below.

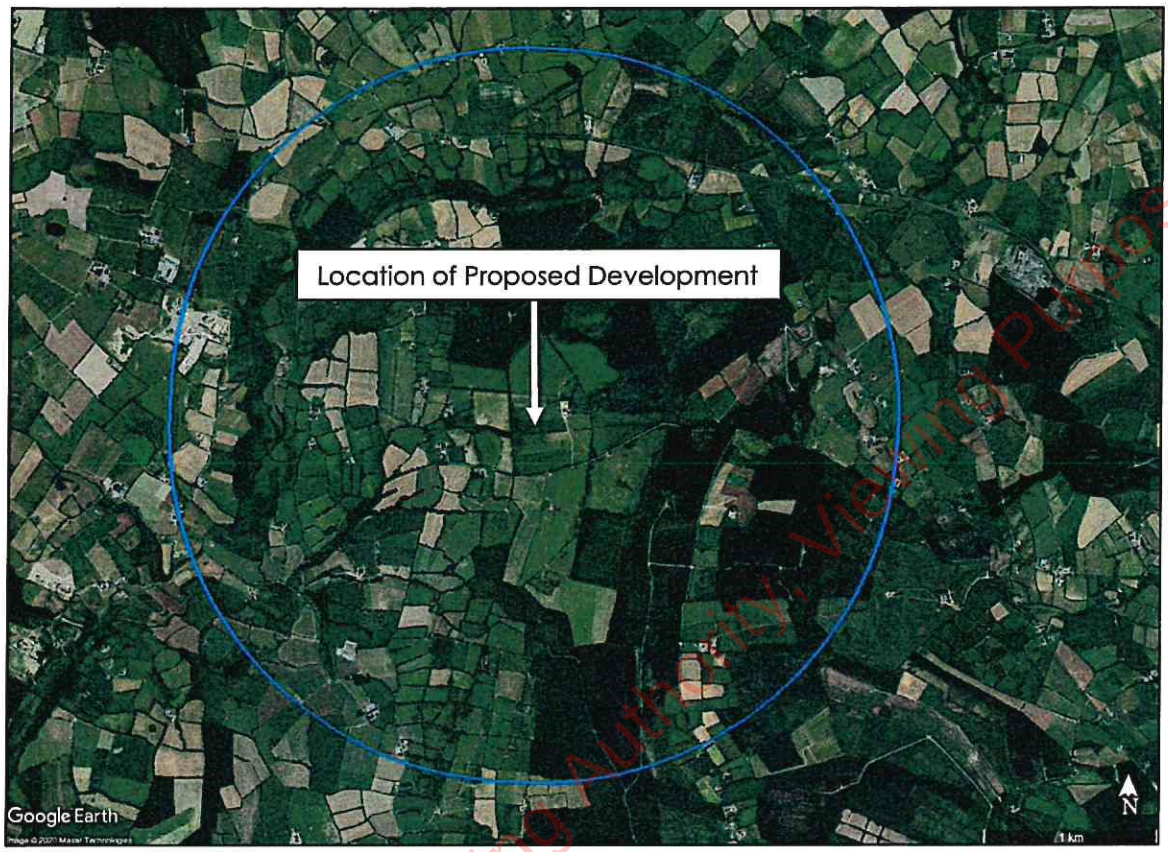

Figure 9.1: Aerial photograph showing the landscape context within the 2km radius study area.

9.3.1.1 Landform and Drainage

At a the macro level, the study area is situated in a transitional area at the north-western fringe of the Castlecomer Plateau, between a low lying rolling landscape to the west and more distinct undulating upland hills to the east. The eastern fringe of the Castlecomer Plateau tends to be the most elevated portion of the plateau, reaching c.336m above ordnance datum (AOD). Within the study area, orientated in a north to south alignment, there is an escarpment which rises to 302m AOD and slopes down to the river valley of the Owenbeg (Owveg) River (a tributary of the River Nore) in the northern and western segments of the study area at c.130m AOD. The centre of the study area, at the site of the proposed development, the terrain sits at c.240m AOD. Three lower order watercourses; Keelagh, Knockardagur and Aghnacross; flow from east to west in the study area into the Owenbeg River.

9.3.1.2 Vegetation and Land Use

Vegetation within the western study area is relatively uniform comprising of rolling agricultural farmland mainly consisting of good quality pasture and arable crops. The irregular, small sized fields are often bound by a mix of dense tree lined hedgerows and, on occasion, with low-clipped hedgerows. Areas of Transitional woodland scrub can be found throughout the study area. A block of commercial conifer forest occurs in the southeast of the study area, the site of the permitted

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Pinewoods Wind Farm, while riparian vegetation traces the watercourses that wind through the study area (**Figure 9.1** refers). Kilsaran Concrete is a notable industrial operation at the western extent of the study area.

9.3.1.3 Transport Routes and Centres of Population

The R430 regional road is the most substantial road in the study area, passing through the northern portion of the study area, while a network of local roads serve dwellings scattered across the study area. There are no defined or notable centres of population within the study area; with settlements generally comprising single dwellings or dwellings associated with agricultural landholdings.

9.3.1.4 Ecological Designations

River Barrow and River Nore Special Areas of Conservation (Site Code: 002162) traces the course of the Owenbeg (Owveg) River as it passes through the northern and western extents of the study area (see **Figure 9.2**).

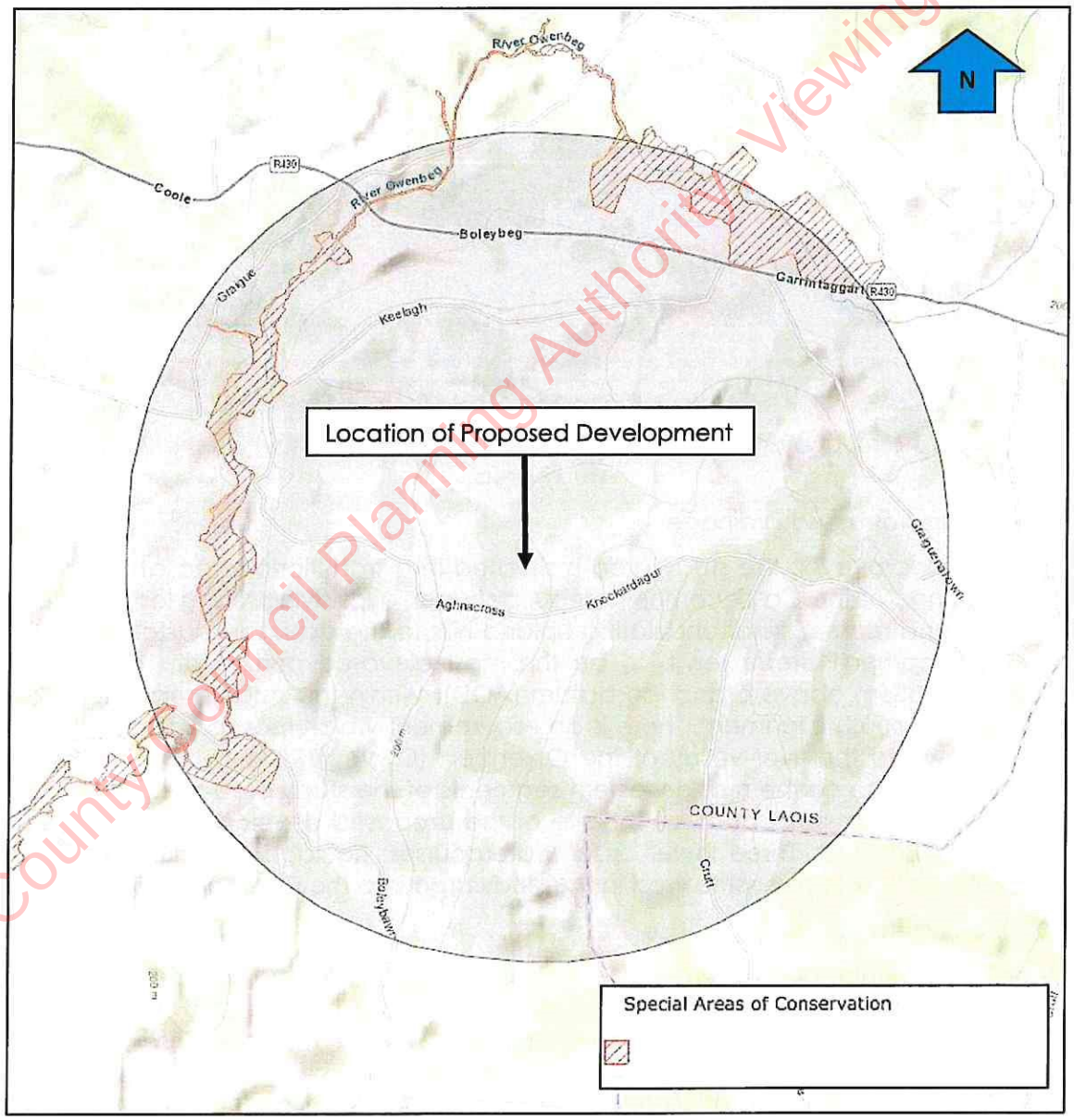

Figure 9.2: Map showing the location of the Special Area of Conservation

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9.3.2 Landscape Policy Context and Designations

As the proposed development and vast majority of the study area is within County Laois and only a small peripheral area occurs within County Kilkenny, the focus of the policy context for landscape will on be on reviewing the Laois County Development Plan 2017-2023. It is also noted that the proposed development will not be visible (see **Figure 9.4**) from that part of the study are located within County Kilkenny.

9.3.2.1 Laois County Development Plan 2017-2023

The Laois County Development Plan 2017-2023 contains a number of policies, the following are deemed to be relevant to this proposed development:-

- RUR15 - protect from injury scenic and exposed/elevated landscapes, scenic routes, views, prospects and vistas;
- RUR7 - Have regard to Laois' Landscape Character Assessment; and
- RUR13 - Protect rural amenities, natural archaeological and natural heritage, visual amenities, eco-systems, conservation areas, landscape and scenic views from adverse impacts of agricultural practices and development particularly in high amenity areas and ensure that it is appropriate in nature and scale, and ensure it does not have an undue negative impact on the visual/scenic amenity of the countryside and identify mitigating measures where required.

A Landscape Character Assessment was produced for County Laois and was incorporated into the current Laois County Development Plan 2017-2023. Within the landscape character assessment, 7 no. landscape character types (LCT) have been identified. The site is located in LCT 1 – Hills and Upland Areas (**Figure 9.3** refers). The Owenbeg (Owveg) River passes within the study area and is identified as a 'river corridor' on Map 6 of the Laois Landscape Character Assessment.

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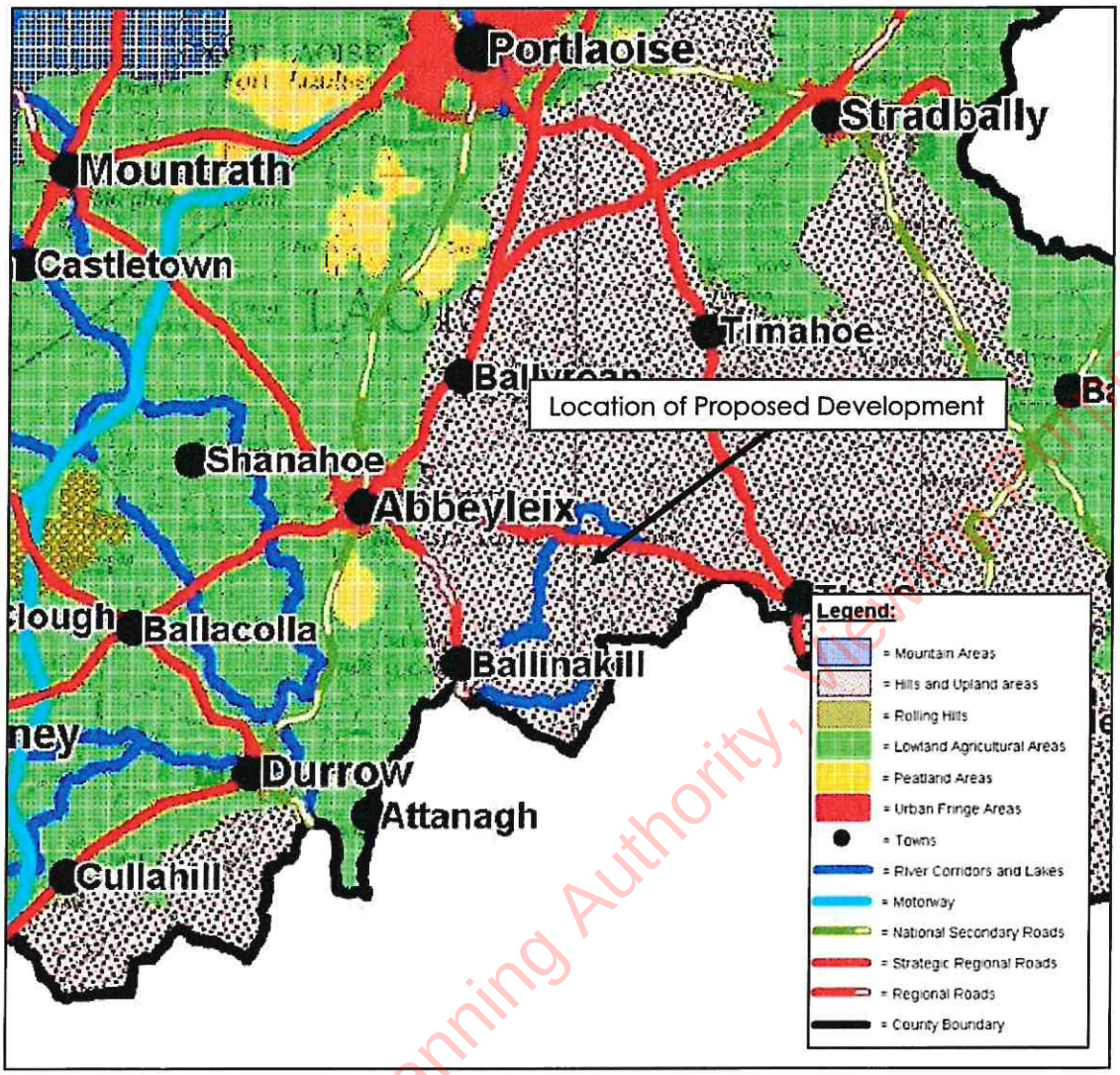

Figure 9.3: Excerpt from Laois County Landscape Character Assessment, Map 6, showing approximate location of the Proposed Development in relation to landscape character types.

The Landscape Character Assessment for County Laois has not incorporated a specific sensitivity rating for the LCTs. Sensitive landscapes are addressed in section 13.9 of the Landscape Character Assessment where it states that *"Sensitive areas include upland areas, visually open and expansive areas and areas in the vicinity of natural heritage or built heritage assets or scenic views"*. The Laois County Development Plan 2017-2023 contains eight policies relating to LCT1 – Hill and Upland Areas, the following seven are relevant to the portion of LCT1 that occurs within the study area:-

- LS1 - Preserve and enhance the rich heritage assets of these LCTs which provide visible evidence of all four key phases of the County's history;
- LS2 - Protect the positive contribution that views across adjacent lowland areas and landmarks within the landscape make to the overall landscape character;
- LS3 - Respect the remote character and existing low-density development in these LCTs;
- LS4 - Implement improvements to the visitor attractions of these areas;

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- LS5 - Define popular walking routes such as Cullahill Mountain and create new routes to additional areas of interest; and
- LS6 - Continue to encourage the improved management of field boundaries such as hedgerows and stone walls and hunting copses/ wooded copses;
- LS7 - Facilitate the development of sustainable rural industries that encourage interaction between urban and rural landscapes and dwellers, e.g. farmer's markets.

9.3.3 Visual Baseline

Only those parts of the study area that are likely to afford views of the proposed development are of interest to this part of the assessment. Therefore, the first part of the visual baseline is establishing a 'Zone of Theoretical Visibility' and subsequently, identifying important visual receptors from which to base the visual impact assessment.

9.3.3.1 Zone of Theoretical Visibility (ZTV)

A computer generated Zone of Theoretical Visibility (ZTV) map has been prepared to illustrate where the proposed development is theoretically visible from. The ZTV map is based solely on terrain data (bare ground visibility) and ignores features such as trees, hedges or buildings which may screen or obscure views of the proposed development. Given the complex vegetation patterns within this landscape, the main value of this form of ZTV mapping is to determine those parts of the landscape from which the proposed development will definitely not be visible, due to terrain screening, within the 2km study area.

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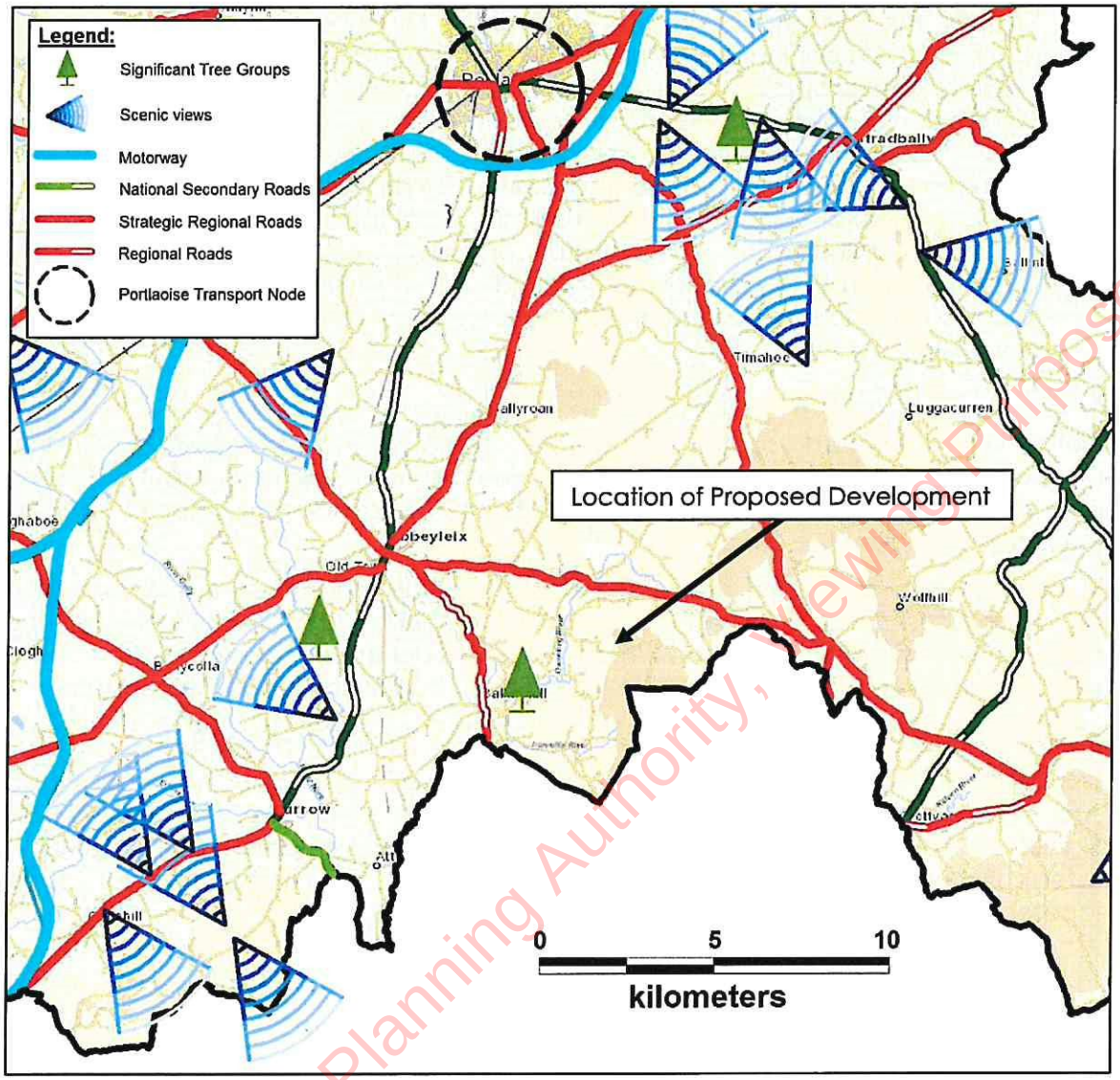

Figure 9.5: Excerpt from Map 1.7.11 of the Laois County Development Plan 2017 – 2023 showing approximate location of the proposed development in relation to Scenic Views.

9.3.3.4 County Kilkenny – Views and Prospects

The results of the Zone of Theoretical Visibility analysis presented in **Figure 9.4** shows that no views of the proposed development will be afforded from the portion of the study area that occurs within County Kilkenny. For this reason, a review of the Kilkenny County Development plan for scenic designations is not considered necessary.

9.3.3.5 Centres of Population and Houses

The settlement pattern within the study area is primarily composed of dispersed 'one-off' dwellings and rural farmsteads. Some rural dwellings are situated along the local roads while others are more isolated.

9.3.3.6 Transport Routes

The R430 regional road is the most notable transport route within the study area and

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is located c.1.5km north of the site at its nearest point but is entirely outside the ZTV pattern and, therefore, will not offer views of the proposed development. The L7797 local road in the western extent of the study area would appear to be the busiest local road that passes within the ZTV.

9.3.3.7 Tourism, Recreational and Heritage Features

Cooper's Hill Walk is a locally waymarked walking trail within the study area. It passes the site to the south along the L77951 before turning north at the Owenbeg (Owveg) River onto the L7795. It circles back and reconnects to form a looped walking trail (see **Figure 9.6**).

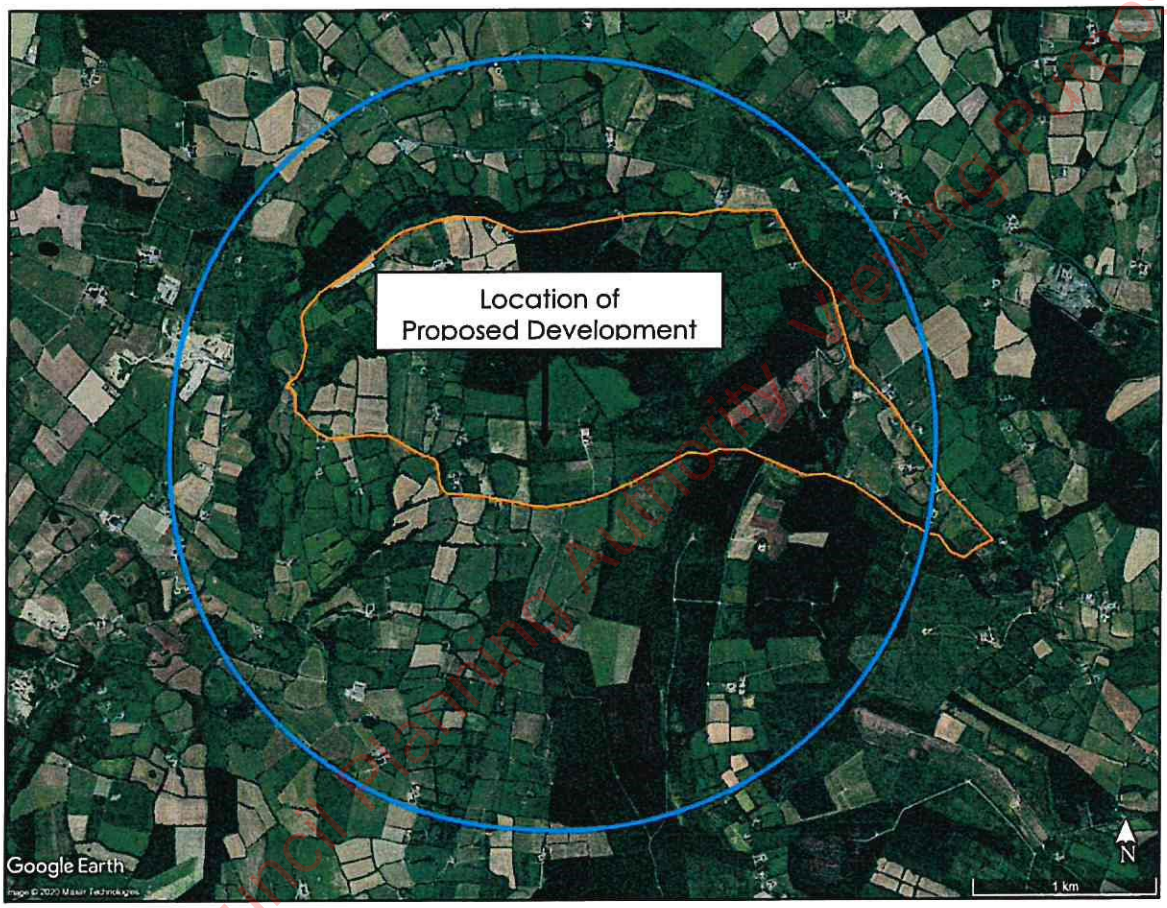

Figure 9.6: Study area (illustrated in blue) and the route of the local waymarked walking trail (illustrated in orange)

9.3.4 Identification of Viewshed Reference Points as a Basis for Assessment

The results of the ZTV analysis provide a basis for the selection of Viewshed Reference Points (VRPs/VPs), which are the locations used to study the landscape and visual impact of the proposed development in detail. It is not warranted to include each and every location that provides a view of this development as this would result in an unwieldy report and make it extremely difficult to draw out the key impacts arising from the project. Instead, receptor locations were selected that are likely to provide views of the proposed development from different distances, different angles and different contexts.

The visual impact of a proposed development is assessed using up to 6 no. categories of receptor type as listed below:-

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- Key Views (from features of national or international importance);
- Designated Scenic Routes and Views;
- Local Community views;
- Centres of Population;
- Major Routes; and
- Amenity and heritage features.

Where a VRP might have been initially selected for more than one reason, it will be assessed according to the primary criterion for which it was chosen. The characteristics of each receptor type vary as does the way in which the view is experienced. These are described below.

9.3.4.1 Key Views

These VRPs are at features or locations that are significant at the national or even international level, typically in terms of heritage, recreation or tourism. They are locations that attract a significant number of viewers who are likely to be in a reflective or recreational frame of mind, possibly increasing their appreciation of the landscape around them. The location of this receptor type is usually quite specific.

9.3.4.2 Designated Scenic Routes and Views

Due to their identification in the County Development Plan, this type of VRP location represents a general policy consensus on locations of high scenic value within the Study Area. These are commonly elevated, long distance, panoramic views and may or may not be mapped from precise locations. They are more likely to be experienced by static viewers who seek out or stop to take in such vistas.

9.3.4.3 Local Community Views

This type of VRP represents those people who live and/or work in the locality of the proposed development. Although the VRPs are generally located on local level roads, they also represent similar views that may be available from adjacent houses. The precise location of this VRP type is not critical; however, clear elevated views are preferred, particularly when closely associated with a cluster of houses and representing their primary views. Coverage of a range of viewing angles using several VRPs is necessary in order to sample the spectrum of views that would be available from surrounding dwellings.

9.3.4.4 Centres of Population

VRPs are selected at centres of population primarily due to the number of viewers that are likely to experience that view. The relevance of the settlement is based on the significance of its size in terms of the study area or its proximity to the site. The VRP may be selected from any location within the public domain that provides a clear view either within the settlement or in close proximity to it.

9.3.4.5 Major Routes

These include national and regional level roads and rail lines and are relevant VRP locations due to the number of viewers who may be impacted by the proposed development. The precise location of this category of VRP is not critical and might be chosen anywhere along the route that provides clear views towards the proposal site, but with a preference towards close and/or elevated views. Major routes typically provide views experienced whilst in motion and these may be fleeting and intermittent depending on screening by intervening vegetation or buildings.

9.3.4.6 Tourism, Recreational and Heritage Features

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These views are often one and the same given that heritage locations can be important tourist and visitor destinations and amenity areas or walking routes are commonly designed to incorporate heritage features. Such locations or routes tend to be sensitive to development within the landscape as viewers are likely to be in a receptive frame of mind with respect to the landscape around them. The sensitivity of this type of visual receptor is strongly related to the number of visitors they might attract and, in the case of heritage features, whether these are discerning experts or lay tourists. Sensitivity is also heavily influenced by the experience of the viewer at a heritage site as distinct from simply the view of it. This is a complex phenomenon that is likely to be different for every site.

Experiential considerations might relate to the sequential approach to a castle from the car park or the view from a hilltop monument reached after a demanding climb. It might also relate to the influence of contemporary features within a key view and whether these detract from a sense of past times. It must also be noted that the sensitivity rating attributed to a heritage feature for the purposes of a landscape and visual assessment is not synonymous with its importance to the Archaeological or Architectural Heritage record.

5 no. VRPs were selected for the assessment of the proposed development and are listed in **Table 9.5** and illustrated at **Figure 9.7**.

VRP No.	Location	Distance to site	Direction of view
VP1	Local road, Knockardagur	0.2km	N
VP2	Elevated viewing platform adjoining local road, Knockardagur	0.3km	NW
VP3	Local road, Aghnacross	1.0km	E
VP4	Local road, Moat	2.0km	NE
VP5	Local road, Keelagh	1.3km	SE

Table 9.5: Outline description of selected Viewshed Reference Points (VRPs)

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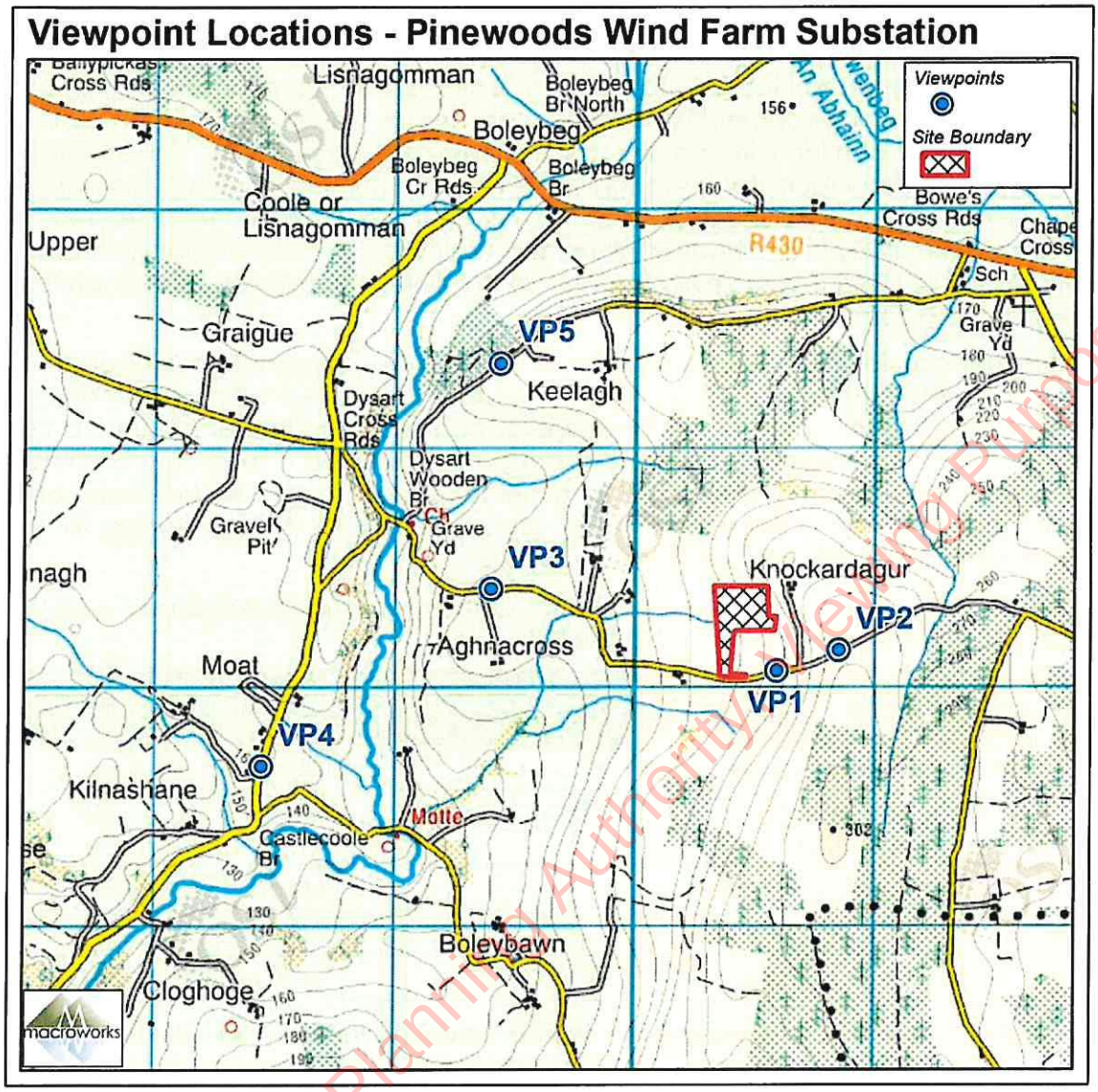

Figure 9.7: Showing the locations of VRPs

9.4 Description of Likely Effects

9.4.1 Landscape Effects

In this section, landscape impacts were considered for both the construction phase and the operational phase. The first aspect of determining the significance of landscape impacts is establishing the sensitivity of the receiving landscape. The significance of landscape impacts are assessed on the basis of landscape sensitivity weighed against the magnitude of physical landscape effects within the proposed development site and effects on landscape character in the wider landscape setting.

9.4.1.1 Landscape Character, Value and Sensitivity

In accordance with *Guidelines for Landscape and Visual Impact Assessment 2013* (GLVIA) (2013) (p71), sensitivity is a function of the susceptibility of the landscape to the type of change proposed and the value placed on that landscape. Landscape value and sensitivity are considered in relation to a number of factors highlighted in

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the GLVIA (2013), which are set out below, and discussed relative to the proposed development and wider study area. Landscape Character Value and Sensitivity are now assessed using the methodology described in **Section 9.2.3**.

Landscape Quality (condition)

Landscape quality relates to the physical state of the landscape and its individual elements. The landscape of the study area varies in terms of condition and quality.

The study area is situated at the transition between two landscape types, the uplands of the Castlecomer Plateau and the lower lying, more gently rolling terrain at the north-western fringes. The Castlecomer Plateau has a heightened landscape value, which is strongest in the core areas of the plateau and begins to reduce in the areas approaching the adjoining low lying areas. Land-use within the study area is predominantly intensive agriculture, with some areas of forestry occurring at higher elevations. There are active and former quarries to the west of the Owenbeg (Owveg) River. The low lying position of the Owenbeg (Owveg) River, in combination with the adjoining riparian vegetation results in a largely enclosed character in the immediate environs resulting in a landscape discrete component with a heightened, albeit localised, sensitivity. The landscape to the east of the proposed development is that of farmed and forested hills, with some areas reverting to scrub. The conifer plantations in this area are commercial operations and highlight the economic and productive processes at work in the landscape.

Scenic Quality

There is a degree of scenic value associated with the Owenbeg (Owveg) River, although views tend to be rather limited to the immediate vicinity of the river valley due to the enclosed character of the area. A lesser degree of scenic quality exists in the northern and western extents of the study area, where agriculture is more intensive. Although these areas have a 'pleasant' pastoral aesthetic it is not valued in terms of scenic quality beyond its immediate environs which is reflected in the fact that there are no designated views in these areas. It is notable that with increasing elevation to the east of the study area, broad, open, long distance views to the west begin to open up. The presence of the locally waymarked walking trail (Cooper's Hill Walk) suggests that areas along the route are valued at a local level.

Rarity and Representativeness

It is not considered that this landscape is rare although the Owenbeg (Owveg) River is a locally distinctive landscape setting.

Conservation Interests

The Owenbeg (Owveg) River is subject to an ecological designation, forming part of the River Barrow and River Nore SAC, suggesting this is a valuable landscape component.

Recreation Value

Cooper's Hill Walk is the only known relevant public amenity resource within the study area.

Perceptual Aspects and Associations

A degree of rural tranquillity occurs in some parts of the study area. Areas to the west and north have more pastoral characteristics with a degree of consistency in terms of the scale and pattern of the fields and hedgerows. Mature tree lines and

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hedgerows offer a moderate degree of containment. The areas along the Owenbeg (Owveg) River contribute to a sense of the naturalistic, offering a sense of tranquillity and remoteness. Generally, the study area is a productive rural area dotted with farmsteads and dispersed dwellings.

Evaluation of Landscape Sensitivity

On the basis of the factors outlined above, it is considered that this is a diverse and productive rural setting; with relatively high integrity in parts, which contributes to the rural subsistence and amenity of the surrounding dispersed rural population. Notwithstanding the scenic qualities along Cooper's Hill Walk in the elevated areas in the eastern portion of the study area, and the naturalistic values associated with the Owenbeg River; overall, this is a landscape with robust productive landscape values. On balance for these reasons, the landscape sensitivity is deemed to be **Medium-low**.

9.4.1.2 Magnitude of Landscape Impacts – Construction Phase

Physical landscape impacts will occur during the construction phase at the proposed development site. This will result from disturbance to the landform and land cover of the proposed substation footprint and its associated access track and site entrance.

There will be more extensive excavation required to create level foundations for the substation. This is a sloping site and there is a need to modify and redistribute subsoil material around the site to facilitate the required gradients for the buildings, structures and electrical equipment. The proposed substation has been designed using a split level footing to ensure an optimum cut and fill balance to reduce impacts during construction.

The existing land cover at the proposed development site is predominantly pasture. Short sections of the east–west running hedgerow along the southern perimeter of the proposed substation will be removed to facilitate construction of the proposed access track. Similarly, a short section of hedgerow will also require removal to accommodate the construction of the proposed site entrance.

In addition to the physical disturbance of the landform and land cover within the proposed development site during construction, there will also be temporary effects on the landscape character of the site and its immediate surrounding landscape. This will occur due to the intensity of construction activities, which will involve the frequent movement of construction vehicles to and from the site and within the site. There will be site welfare facilities and vehicle parking as well as areas of the site dedicated to the storage of excavated earth and building materials Cranes and partially completed structures will also be characteristic elements of the construction phase which will be more visible from a broader area than surface level construction activities. Construction phase works; including the movement of heavy machinery, excavation and stockpiling of material as well as the temporary storage of construction materials; will result in temporary effects; however, such effects are likely to be most noticeable in the immediate vicinity of the proposed development.

These are all typical construction phase activities for a development of this scale but they represent a noticeable increase in the baseline levels of activity experienced in and immediately around this rural site. Most importantly, construction stage effects will be short-term in terms of duration (EPA guidance deems effects of between1-7 years to be short-term). On the basis of the factors discussed above, it is considered that the magnitude of construction phase landscape impacts will be **Medium**.

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9.4.1.3 Significance of Landscape Impacts – Construction Phase

The significance of landscape impacts is a function of landscape sensitivity weighed against the magnitude of effects on the landscape. This is derived from the significance matrix (**Table 9.3**) used in combination with professional judgement. Based on a Medium-low landscape sensitivity judgement and a Medium magnitude of construction effect on the landscape, the significance of the construction impact is considered to be **Moderate** within the immediate vicinity of the application site. Thereafter, significance will reduce somewhat at increasing distances as the development becomes a progressively smaller component of the wider landscape fabric, even in the context of the more sensitive landscape components/features identified within the study area.

9.4.1.4 Magnitude of Landscape Impacts – Operational Phase

Following the completion of the construction phase for the proposed development, the main landscape effects remaining to be considered at the operational phase relate to permanent changes in landscape character regarding the physical impact on the landscape, the introduction of above-ground elements and any permanent removal of vegetation.

The main effect of the proposed development will be an increased sense of industrialisation and intensity of built development within this predominantly rural setting. It will also contribute to the diversity of land use, slightly diminishing the integrity of this substantially rural landscape setting. Electrical substations are relatively familiar features throughout the Irish countryside so there will not be a sense of ambiguity associated with its location in this setting, particularly in the context of the adjacent permitted Pinewoods Wind Farm to which the proposed development is directly related.

As proposed mitigation planting becomes established around the perimeter of the proposed development, it will assist in screening low level or near ground infrastructure and activity associated with the proposed development. It will also assist in assimilating the substation into it the surrounding landscape setting of fields and hedgerows.

The scale and intensity of the proposed development will have a noticeable influence on the landscape of the immediate surrounds of the site; however, such effects are extremely localised and beyond approximately 500m, it is likely be perceived as another minor and fairly typical element in the broader context of this rural landscape fabric.

In terms of duration, the operational stage landscape impacts will be long term or permanent in accordance with EPA definitions.

On balance of the factors outlined above, the magnitude of operational phase landscape effect arising from the proposed development is deemed to be **Medium-low**.

9.4.1.5 Significance of Landscape Impacts – Operational Phase

The significance of operational phase landscape impact is a function of landscape sensitivity weighed against the magnitude of operational phase landscape effects. This is derived from the significance matrix (**Table 9.3**) used in combination with professional judgement. Based on a Medium-low sensitivity judgement and a Medium-low magnitude of operational phase landscape effects, the significance of impact is considered to be **Moderate-slight** within the study area. Thereafter, the

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significance will reduce to **Slight** and **Imperceptible** at increasing distances as the development becomes a progressively smaller component of the wider landscape fabric.

9.4.2 Landscape Impacts – Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

9.4.3 Visual Impacts

The likelihood of visual impacts was considered for the construction phase, the operational phase and the decommissioning phase. The first aspect in determining the significance of visual impacts is establishing the sensitivity of each of the selected viewshed reference points.

9.4.3.1 Visual Receptor Sensitivity

Unlike landscape sensitivity, visual sensitivity has an anthropocentric basis. Visual sensitivity is a two-sided analysis of receptor susceptibility (people or groups of people) versus the value of the view on offer at a particular location.

To assess the susceptibility of viewers and the amenity value of views, the assessor uses a range of criteria and provides a four point weighting scale to indicate how strongly the viewer/view is associated with each of the criterion identified in **Section 9.2.3.2** above.

Strong association	Moderate association	Mild association	Negligible association

Values associated with the view	VP1	VP2	VP3	VP4	VP5
Susceptibility of viewers to changes in views					
Recognised scenic value of the view					
Views from within highly sensitive landscape areas					
Primary views from residences					
Intensity of use, popularity (number of viewers)					
Viewer connection with the landscape					
Provision of vast, elevated panoramic views					
Sense of remoteness / tranquillity at the viewing location					
Degree of perceived naturalness					
Presence of striking or noteworthy features					

Laois County Council Planning Authority Viewing Purposes Only!

Sense of Historical, cultural and / or spiritual significance					
Rarity or uniqueness of the view					
Integrity of the landscape character within the view					
Sense of place at the viewing location					
Sense of awe					
Overall sensitivity assessment	**M**	**HM**	**M**	**ML**	**M**
N = Negligible; L = low sensitivity; ML = medium-low sensitivity M = medium sensitivity; HM = High-medium sensitivity; H = high sensitivity; VH = very high sensitivity					

Table 9.6: Analysis of Visual Receptor Sensitivity at Viewshed Reference Points

9.4.3.2 Magnitude of Visual Impact – Construction Phase

It is not considered gainful to assess construction phase visual impacts from specific receptor locations using photomontages, which is instead reserved for the operational phase of the proposed development in relation to both pre-mitigation and residual (post-mitigation establishment) impact scenarios. This approach is partly on the basis that construction phase visual effects are constantly changing in nature, intensity and location. Furthermore, many construction related visual effects such as dust, lighting and heavy vehicle movements are also not easily depicted or readily experienced through the use of static photomontages. Furthermore, a more generalised approach to assessing construction phase visual impacts is also warranted on the basis that such effects are only short-term or temporary in nature.

Construction phase visual effects will occur in relation to the proposed development throughout the predicted 15-18 month construction period. Excavation works will involve the appearance of a cut face of bedrock, slowly increasing in surface area as works progress. Visual receptors most likely to be affected by the proposed development during construction phase are the residents of dwellings to the west of the application site.

The greatest level of construction phase visual effects for these receptors will likely occur when the proposed strain towers have emerged, the cranes are still present, and construction vehicles and associated traffic is moving within as well as to and from the site.

Construction related visual effects from the proposed development will be short-term in duration and their combined magnitude of effect is considered to be similar to the construction stage effects on landscape character, i.e. **Medium**, and only for the closest of receptors with the clearest views towards the site.

9.4.3.3 Significance of Visual Impacts – Construction Phase

Despite the fact that there are a variety of receptors with differing sensitivities (medium-low to high-medium) within the study area as shown in **Table 9.6**, it is not anticipated that the Medium magnitude of construction effects will result in any significant construction phase visual impacts as a result of any part of the proposed development.

9.4.3.4 Magnitude of Visual Impacts at Viewshed Reference Points – Operation

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Phase

Each of the identified VRPs will be assessed to determine the magnitude of effect of visual impacts during the operational phase. This judgement, based on the photomontages presented at **Volume II**, **Annex 9.2**, will be considered with respect to the sensitivity of the receptor, as determined in **Table 9.**, to yield a judgement on the significance of visual impact.

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Viewshed Reference Point		Direction of View	Distance to proposed development
VP1	Local road, Knockardagur	N	0.2km
Representative of:	• Recreational walking trail • Local community views		
Receptor Sensitivity	**Medium**		
Existing View	This is a slightly elevated view that is framed by a mature roadside hedgerow in the foreground. This section of road is generally enclosed but a fleeting view is afforded, over this field gate, of sloping agricultural fields. Tree canopies within a conifer plantation protrude above the ridge in the middle ground while the Slieve Bloom Mountains form a distant backcloth.		
Visual Effect of the proposed development (pre-mitigation)	An intervening hedgerow partially screens views of the proposed development and the re-contoured terrain, which nestles into the hillside. The proposed control building, being recessed into the area of cut, is partially screened by a combination of terrain and vegetation to the fore. The tower structures rise from the development site and intrude into the views, but will not obstruct important features. Their light lattice frame construction means they are recessive against this backdrop of vegetation and distant hills. They will be identifiable to a casual observer but at c.300m distance their scale is such that they represent only small degree of visual intrusion. For these reasons, the visual presence of the proposed development is considered to be sub-dominant. Much of the proposed development is visible from this location although the intervening hedgerow helps the development to bed-in to the landscape. The control building will have a similar scale and appearance to many residential dwellings in rural Ireland, thus it will not look out of place in this scene and it will not rise above the terrain immediately beyond. Similarly, the strain towers do not protrude above the ridgeline of the Slieve Bloom Mountains in the background. There will be an increased intensity of built development within this rural scene, but it is relatively well assimilated into the prevailing land form and land cover context. For these reasons the magnitude of visual impact is deemed to be Medium-low.		
Visual Effect of the proposed development (post-mitigation)	The new hedgerows to the north and east of the cut faces will be visible. They will cover the berms in these locations but will not have any screening effect on the remainder of the proposed development. The intervening existing hedgerow will be bolstered, helping to screen the lower portions of the proposed development but it will not be sufficient to reduce the magnitude of visual impact.		
Summary	Based on the assessment criteria and matrices outlined above, the significance of visual impact is summarised below.		
	Visual Receptor Sensitivity	**Visual Impact Magnitude**	**Significance of Visual Impact**
	Medium	Medium-low	**Moderate-slight**

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Viewshed Reference Point		Direction of View	Distance to proposed development
VP4	Local road, Moat	NE	2.0km

Representative of:	• Local community views
Receptor Sensitivity	**Medium-low**
Existing View	A broad and open view is afforded from this location due to the absence of roadside vegetation. The terrain gently falls away from this viewpoint towards the Owenbeg (Owveg) River before rising more steeply on the far side to form a sparsely populated, farmed and forested ridge in the background.
Visual Effect of the proposed development (pre-mitigation)	The proposed development is situated on the west facing slope just below the ridgeline in the background of the view. At a distance of 2km, the scale of the proposed development is modest in the context of this vista and may not be noticed by a casual observer. It emerges just above a band of woodland, which it visually integrates with. The control building and towers are nestled within the re-contoured terrain and fit within the existing field boundaries. Intervening vegetation screens almost the entire access track. The proposed development presents a new feature on the distant farmed slope, but this broad view has a degree of inherent complexity. A variety of land uses and field sizes occur on undulating terrain which is interspersed with agricultural buildings and farmsteads. This complexity helps to absorb the proposed development. In particular, the buildings on the ridgeline immediately above the proposed development compete for attention and provide built development context in this portion of the vista. These factors combine such that the visual presence of the proposed development is considered to be sub-dominant. The proposed development represents a minor intensification on the slope of the ridge but is not incongruous in terms of scale, form or function in this working rural landscape. It occupies only a very small portion of the available view, is well integrated within the prevailing landscape pattern and, consequently, the impact on visual amenity is limited. For these reasons the magnitude of effect is deemed to be low-negligible.
Visual Effect of the proposed development (post-mitigation)	A portion of the proposed mitigation planting will be visible from this VP. It will not have a screening effect and, therefore, will be insufficient to reduce the magnitude of visual impact.
Summary	Based on the assessment criteria and matrices outlined above, the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	Significance of Visual Impact
Medium-low	Low-negligible	**Slight-imperceptible**

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Viewshed Reference Point		Direction of View	Distance to proposed development
VP5	Local road, Keelagh	SE	1.3km
Representative of:	• Recreational walking trail • Local community views		
Receptor Sensitivity	**Medium**		
Existing View	Views from this local road are heavily channelled along its route to the southwest due to the presence of tall vegetation on either side. There are very limited opportunities for views to the southeast, towards the proposed development site, even in winter when leaves have fallen. In the foreground brambles and ivy weave over moss covered dry stone walls. The far side of the adjoining field is bounded by an overgrown hedgerow in the middle ground. A farmed and forested ridge provides a backcloth to the view in the middle distance.		
Visual Effect of the proposed development (pre-mitigation)	The vast majority of the proposed development will be completely screened throughout the year by an intervening conifer forest. Only the upper portion of some of the towers, the apex of the roof of the control building and a sliver of the upper edge of the cut face and drainage bund will be identifiable. These aspects of the development will be visually absorbed by vegetation surrounding the site and will not be prominent. Indeed, they are unlikely to be noticed by a casual observer and the visual presence is considered to be minimal as a result. As the proposed development is unlikely to be noticed, there will be no notable impact on visual amenity and the magnitude of effect is deemed to be negligible.		
Visual Effect of the proposed development (post-mitigation)	The proposed new hedgerow above the northern cut face will be visible and will hide the earthen berms on which it is planted. This will help the development blend into the view but will not alter the visual effect of the proposed development.		
Summary	Based on the assessment criteria and matrices outlined above, the significance of visual impact is summarised below.		
	Visual Receptor Sensitivity	**Visual Impact Magnitude**	**Significance of Visual Impact**
	Medium	Negligible	**Imperceptible**

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magnitude of impact. Therefore, given the characteristics of the receiving environment, the modest nature of the proposed development, the siting of the proposed development which does not break the ridgeline and the functional inter-dependence of the developments, visual impacts are not assessed to be significant.

9.5 Mitigation Measures

The main mitigation measure employed in this instance is mitigation by avoidance. As part of the design process, detailed consideration was given to the appropriate siting of the proposed development to ensure that it would be located in a robust rural area capable of absorbing it and where it would not be prominent or seen in silhouette above a primary ridgeline. The overall site design also sought to maximise, to the greatest possible degree, the retention of existing hedgerows within the site and bordering the site to avoid a sense of ambivalence, to aid visual screening and to maintain the existing field pattern.

In addition, planting is proposed around the perimeter of the proposed development. However, it should be noted that while will have a limited effect in screening the proposed development; it will assist in assimilating the development within the surrounding landscape and maintaining field patterns through the provision of additional hedgerow.

9.5.1 Construction Phase

Aside from standard practice construction stage measures to minimise land and vegetation disturbance (such as clearly delineating the works area) and dust emissions (through damping down of access tracks if necessary), there are no specific landscape & visual mitigation measures to be implemented. The appropriate management and reinstatement of shallow excavations, in a timely manner, will ensure that any adverse effects caused, for example at the proposed site entrance, are minimised insofar as possible.

Similarly, the progressive reinstatement and landscaping of the site will remediate any short term adverse effects on the local landscape. As part of the reinstatement and landscaping process, planting of hedgerows will also be completed at the site entrance. This planting will be located sufficiently behind the visibility splay to allow for future growth and will ensure that extensive views of the proposed development are not afforded from the local road.

9.5.2 Operational Phase

Any vegetation which is not required to be removed to facilitate the proposed site entrance and access tracks within the site or at the interface with the local road, will be retained and avoided insofar as possible during construction. In terms of planting, the following is proposed:-

- New hedgerows will be planted atop the embankment along the northern and eastern boundaries of the proposed substation. The species to be will, in the first instance, be agreed with the Ecological Clerk of Works and will be selected to reflect the species composition of existing adjacent hedgerows. The species mix is likely to comprise low growing woody species of local provenance including Blackthorn, Hawthorn and Hazel;
- The hedgerows along the southern and western boundaries of the proposed substation will be retained and will be supplemented by additional planting where deemed appropriate. Proposed species will be whip species to complement the existing broadleaf hedgerow species mix around the site and

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will be of local provenance; and
- It is intended to manage and maintain proposed hedgerows at c. 3-4m in height.

The strategy for the exposed cut faces, exposed while constructing the level platform for the proposed substation, is to encourage natural regeneration. This will mean, by default, the most suitable species for the conditions will colonise and will help the raw cut face to blend into its surroundings.

Areas of ground disturbed during the construction phase will be will be seeded with suitable grass and wildflower seed mix.

These proposed mitigation measures are illustrated on the landscape masterplan enclosed at **Volume II, Annex 9.3**.

9.5.3 Decommissioning Phase

As set out at **Chapter 3 (Sections 3.2** and **3.8)**, the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

9.6 Residual Impacts and Monitoring

9.6.1 Post-mitigation Landscape Impacts

Whilst mitigation screen planting and replacement planting will help assimilate the proposed development within the landscape setting, it is not considered that the macro level effects on landscape character and landscape fabric will be noticeably reduced from those predicted for the operational phase in **Section 9.4.3**. Therefore, it is concluded that the landscape effects post-mitigation effects will remain as assessed in respect of the pre-mitigation effects.

9.6.2 Post-mitigation Visual Impacts

In addition to the preparation of a landscape masterplan, a set of photomontages have been created specifically to illustrate the effect of the proposed planting for each of the VRPs.

Once the proposed planting becomes established, it will aid the proposed development to visually blend in with the receiving landscape; however, it will not entirely screen the proposed development from any of the VRPs. Where views are afforded of the development from the surrounding landscape, the proposed mitigation planting will help assimilate the proposed development into the view, thus slightly reducing the magnitude of visual effect; however, in no instance will it be sufficient to reduce the visual impact significance at any of the selected VPs. However, it should be reiterated that the predicted significance is already at the lower end of the significance spectrum for each VP.

9.7 Summary

9.7.1 Landscape Impacts

An appraisal of the existing baseline conditions for landscape was undertaken with reference to the policy context and the sensitivity of the receiving landscape and this is assessed to be medium-low.

The magnitude of construction phase landscape effects is deemed to be medium, and consequently the significance of construction phase impacts on the landscape was assessed to be **Moderate**.

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The magnitude of operational phase landscape effects arising from the proposed development is assessed to be medium-low and will be relatively localised. Based on the medium-low sensitivity judgement and a medium-low magnitude of operational phase landscape effects, the significance of the operational phase impact is assessed to be **Moderate-Slight**.

It was identified that the proposed development was likely to contribute to cumulative landscape impacts in conjunction with the permitted Pinewoods Wind Farm and the permitted Laois-Kilkenny Grid Reinforcement Project. Cumulative landscape effects were assessed for the construction, operational and decommissioning phases, and were assessed to be of a low magnitude and, hence, not significant.

The proposed mitigation measures will not alter any of the predicted impacts on the landscape so the significance of residual impacts on the landscape is assessed to remain unchanged when compared to the pre-mitigation impact.

9.7.2 Visual Impacts

The magnitude of visual impacts during construction phase is assessed to be no greater than medium, even at the closest receptor locations where clear views towards the proposed development site are afforded.

A set of photomontages were produced to visually represent the proposed development during the operational phase (pre and post mitigation) and to allow for a comprehensive cumulative impacts assessment in combination with the permitted Pinewoods Wind Farm and Laois-Kilkenny Grid Reinforcement Project. The magnitude of visual effects will not be greater than Medium-low at any of the selected viewpoints during the construction, operational or decommissioning phases.

There are a variety of possible receptors with differing sensitivities within the study area; each of which were taken into consideration when determining the significance of visual impact for each viewpoint. Acknowledging the full range of visual receptor sensitivities and when assessed in combination with the predicted landscape impact and cumulative impact, the overall visual assessment concludes that the significance of visual impact will be no greater than **Moderate-Slight** for any visual receptor within the study area and that the proposed development will not give rise to any significant landscape or visual impacts or effects.

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Pinewoods Wind Farm Substation

Chapter 10: Cultural Heritage

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Contents

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but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information in the discovery of sites of archaeological significance.

Cartographic sources are important in tracing land-use development within an area of land take, as well as providing important topographical information on sites and areas of possible archaeological significance. Cartographic analysis of relevant maps has been made to identify any topographical anomalies that may no longer remain within the landscape.

Documentary sources were consulted to gain background information on the historical and archaeological landscape of the wider development area.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and the possibility of previously unidentified archaeological remains.

Laois County Development Plan (2017 - 2023) and Kilkenny County Development Plan (2014 – 2020) contain Objectives and Policies on the preservation and management of archaeological, architectural and cultural heritage features.

National Inventory of Architectural Heritage (NIAH) is a section within the Department of Culture, Heritage and the Gaeltacht. The work of NIAH involves identifying, recording and evaluating, on a non-statutory basis, the architectural heritage of Ireland from 1700 to the present day. The NIAH website also contains a non-statutory register of historic gardens and designed landscapes in County Laois, and this was assessed to look for the presence of any such features within the proposed development area or the 1km study area.

Environment Protection Agency's "*Guidelines on the Information to be Contained in Environmental Impact Statements*" and "*Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*" provide definitions for likely effects on archaeological, architectural and cultural heritage remains.

10.2.3 Field Inspection

Field inspection is necessary to determine the extent, character and condition of archaeological, architectural and cultural heritage features, and can also lead to the identification of previously unrecorded or suspected sites and portable finds through topographical observation and local information.

A site visit was carried out on 14 May 2020, and all areas of land take associated with the proposed development were walked and visually assessed. In addition, a walkover survey of the permitted Pinewoods Wind Farm site was carried out on 14 May 2020 to assess for any likely cumulative effects between the proposed development and the permitted wind farm. Detailed walkover surveys of the permitted Pinewoods Wind Farm site were also carried out in August 2012 and August 2014 as part of the cultural heritage impact assessment and EIAR/EIS prepared in respect of that development.

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Figure 10.1: Aerial photograph of proposed development site

10.2.4 Significance Criteria

The likelihood of significant effects can be identified from detailed information about a project, the nature of the area affected and the range of resources possibly affected. The construction and operation of electrical substations, and ancillary equipment, and their associated activities can affect the archaeological, architectural and cultural heritage resource of a given landscape in a number of ways:-

- Permanent and temporary land-take, associated structures, landscape mounding and their construction may result in damage to or loss of archaeological remains and deposits, or physical loss to the setting of historic monuments and to the physical coherence of the landscape;
- Archaeological sites can be affected adversely in a number of ways: disturbance by excavation, topsoil stripping and the passage of heavy machinery, disturbance by vehicles working in unsuitable conditions, burial of sites thus limiting accessibility for future archaeological investigation;

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- Hydrological changes in groundwater or surface water levels can result from construction activities such as de-watering and spoil disposal, or long-term changes in drainage patterns. These may desiccate archaeological remains and associated deposits;
- Visual and noise effects on the historic landscape can arise from construction traffic and facilities, built earthworks and structures, landscape mounding and planting, noise, fences and associated works. These features can impinge directly on historic structures and historic landscape elements as well as their visual amenity value;
- Landscape measures, such as tree planting, can damage sub-surface archaeological features due to topsoil stripping and through the root action of trees and shrubs as they grow;
- Ground consolidation by construction activities or the weight of permanent embankments can cause damage to buried archaeological remains, especially in colluvium or peat deposits;
- Disruption due to construction also offers the possibility of adversely affecting archaeological remains. This can include machinery, site offices, service trenches, etc; and
- Although not widely appreciated, positive effects can accrue from permitted developments. These can include positive resource management policies, improved maintenance and access to archaeological monuments and the increased level of knowledge of a site or historic landscape as a result of assessment and fieldwork.

There is no standard scale against which the significance of likely effects on the archaeological and historic landscape may be judged. The severity of a given level of land take or visual intrusion varies with the type of monument, site or landscape features and its environment. Significance of effect can be judged taking the following into account:-

- The proportion of the feature affected and how far physical characteristics fundamental to the understanding of the feature would be lost;
- Consideration of the type, date, survival/condition, fragility/vulnerability, rarity, potential and amenity value of the feature affected; and
- Assessment of the levels of visual, noise and hydrological effects, either in general or site specific terms, as may be provided by other specialists.

For this assessment, the significant effects criteria outlined in **Table 10.1** are used.

Level of Effects	Significance Criteria
Imperceptible	An effect capable of measurement but without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment

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Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound Effects	An effect which obliterates sensitive characteristics

Table 10.1: Significance of Effects

10.3 Policy and Legislation

10.3.1 Archaeological Resource

The National Monuments Act, 1930 to 2004 and relevant provisions of the National Cultural Institutions Act, 1997 are the primary means of ensuring the satisfactory protection of archaeological remains, which includes all man-made structures of whatever form or date, except buildings habitually used for ecclesiastical purposes.

A number of mechanisms under the National Monuments Act are applied to secure the protection of archaeological monuments. These include the Record of Monuments and Places, the Register of Historic Monuments, the placing of Preservation Orders and Temporary Preservation Orders on endangered sites and National Monuments in the Ownership or Guardianship of the Minister for Culture, Heritage and the Gaeltacht or a Local Authority.

The Minister may acquire National Monuments by agreement or by compulsory order. The State or the Local Authority may assume guardianship of any National Monument (other than dwellings). The owners of National Monuments (other than dwellings) may also appoint the Minister or the Local Authority as Guardian of that monument if the State or Local Authority agrees. Once the site is in ownership or Guardianship of the State, it may not be interfered with without the written consent of the Minister.

Section 5 of the 1987 Act requires the Minister to establish and maintain a Register of Historic Monuments. Historic Monuments and archaeological areas present on the Register are afforded statutory protection under the 1987 Act. Any interference with sites recorded on the Register is illegal without the permission of the Minister. Two months' notice in writing is required prior to any work being undertaken on or in the vicinity of a Registered Monument. The Register also includes sites under Preservation Orders and Temporary Preservation Orders. All Registered Monuments are included in the Record of Monuments and Places.

Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

Section 12(1) of the 1994 Act requires the Minister to establish and maintain a Record of Monuments and Places where the Minister believes that such monuments exist. The Record comprises a list of monuments and relevant places and a map/s showing each monument and relevant place in respect of each county in the State. All sites recorded on the Record of Monuments and Places receive statutory protection under the National Monuments Act 1994.

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Section 12(3) of the 1994 Act provides that:-

> *"where the owner or occupier (other than the Minister for Arts, Heritage and the Gaeltacht) of a monument or place included in the Record, or any other person, proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such a monument or place, he or she shall give notice in writing to the Minister of Arts, Heritage and the Gaeltacht to carry out work and shall not, except in the case of urgent necessity and with the consent of the Minister, commence the work until two months after the giving of notice"* (www.archaeology.ie).

10.3.2 Architectural and Built Heritage Resource

The main laws protecting the built heritage are the Architectural Heritage (National Inventory) and Historic Properties (Miscellaneous Provisions) Act, 1999 and the Planning and Development Act 2000 (as amended). The Architectural Heritage Act requires the Minister to establish a survey to identify, record and assess the architectural heritage of the country. The National Inventory of Architectural Heritage records built heritage structures within all the counties of the State. As inclusion in the Inventory does not provide statutory protection, the document is used to advise Local Authorities on compilation of a Record of Protected Structures (RPS) as required by the Planning and Development Act 2000 (as amended).

The Planning and Development Act 2000 (as amended) requires Local Authorities to establish a Record of Protected Structures to be included in the County Development Plan. This Plan includes objectives designed to protect the archaeological, architectural and cultural heritage resource during the planning process. Buildings recorded in the RPS can include Recorded Monuments, structures listed in the NIAH, or buildings deemed to be of architectural, archaeological or artistic importance by the Minister. Sites, areas or structures of archaeological, architectural or artistic interest listed in the RPS receive statutory protection from injury or demolition under the 2000 Act. Damage to or demolition of a site registered on the RPS is an offence. The RPS list is not always comprehensive in every county.

A Local Authority has the power to order conservation and restoration works to be undertaken by the owner of a Protected Structure if it considers the building in need of repair. An owner or developer must make a written request to the Local Authority to carry out any works on a Protected Structure and its environs, which will be reviewed within 12 weeks of application. Failure to do so may result in prosecution.

10.4 Description of the Existing Environment

10.4.1 General Archaeological and Historical Background

Laois is an inland county in the south Midlands covering an area of 1,719 square km, which equates to 2.4% of the national landmass. It is located near the centre of the country and shares borders with Carlow, Kildare, Kilkenny, Offaly and Tipperary. In physical terms, the landmass of Laois consists of a central plain containing most of the productive agricultural land, surrounded by a number of upland areas including the Slieve Bloom Mountains in the north west, Killeshin Plateau in the south east and Cullahill Mountain in the south. There are also significant cutaway peatlands in the county, mainly situated between Portlaoise, Mountrath and Abbeyleix.

During the Mesolithic period (c. 7000-4000 BC) people existed as hunters/gatherers, living on the coastline, along rivers and lakesides. They used flint and other stone to

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manufacture sharp tools, and locating scatters of discarded stone tools and debris from their manufacture can sometimes identify settlements.

The earliest evidence for settlement in County Laois dates from the Neolithic period (*c.* 4000-2400 BC). During this period the population became more settled with a subsistence economy based on crop growing and stock-raising. While some 1,500 megalithic tombs are recorded in Ireland, they are rare in the Midlands and no definite examples are known in County Laois. Five megalithic structures and seven unclassified megalithic tombs are recorded in County Laois (www.archaeology.ie).

The Bronze Age (*c.* 2400-600 BC) is characterised by the introduction of metalworking technology to Ireland and coincides with many changes in the archaeological record, both in terms of material culture as well as the nature of the sites and monuments themselves. Though this activity has markedly different characteristics to that of the preceding Neolithic period, including new structural forms and new artefacts, it also reflects a degree of continuity.

Bronze Age monuments from County Laois include stone rows and standing stones, cist burials, barrows and *fulachta fiadh* which are one of the most numerous monument types in Ireland with over 4,500 examples recorded (Waddell 2005, 174).

During the Iron Age (*c.* 600 BC-400 AD) new influences came into Ireland which gradually introduced the knowledge and use of iron, although for several centuries bronze continued to be widely used. The Iron Age in Ireland however is problematic for archaeologists as few artefacts dating exclusively to this period have been found, and without extensive excavation it cannot be determined whether several monument types, such as ring barrows or standing stones, date to the Bronze Age or Iron Age.

The Early Medieval period (*c.* 400-1169 AD) is depicted in the surviving sources as entirely rural, characterised by the basic territorial unit known as *túath*. Walsh (2000, 30) estimates that there were at least 100, and perhaps as many as 150, kings in Ireland at any given time during this period, each ruling over his own *túath*.

During this turbulent period roughly circular defensive enclosures known as ringforts were constructed to protect farmsteads. They were enclosed by an earthen bank and exterior ditch, and ranged from approximately 25m to 50m in diameter. The smaller sized and single banked type (univallate) was more than likely home to the lower ranks of society, while larger examples with more than one bank (bivallate/trivallate) housed the more powerful kings and lords. They are regarded as defended family homesteads and the extant dating evidence suggests they were primarily built between the 7th and 9th centuries AD (Stout 1997, 22-31). Cashels are stone built and are generally situated in coastal or mountainous areas.

The ringfort is considered to be the most common indicator of settlement during the Early Medieval period. Detailed study (*ibid.*, 53) has suggested there is an approximate total of 45,119 possible ringforts or enclosure sites throughout Ireland.

Enclosures belong to a classification of monument whose precise nature is unclear. Often they may represent ringforts, which have either been damaged to a point where they cannot be positively recognised, or are smaller or more irregular in plan than the accepted range for a ringfort. An Early Medieval date is in general likely for this site type, though not a certainty.

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The Early Medieval period is characterised by the foundation of a large number of ecclesiastical sites throughout Ireland in the centuries following the introduction of Christianity in the 5th century AD. The early churches tended to be constructed of wood or post-and-wattle, although between the late 8th and 10th centuries mortared stone churches gradually replaced the earlier structures. Many of the sites, some of which were monastic foundations, were probably originally defined by an enclosing wall or bank similar to that found at coeval secular sites. This enclosing feature was probably built more to define the sacred character of the area of the church than as a defence against aggression. An inner and outer enclosure can be seen at some of the more important sites; the inner enclosure surrounding the sacred area of church and burial ground and the outer enclosure providing a boundary around living quarters and craft areas. Where remains of an enclosure survive it is often the only evidence that the site was an early Christian foundation.

Medieval Ireland is considered a very turbulent time in Irish history as kings battled each other to obtain the power of High King of Ireland, or *Ard Ri*. As early as the middle of the 3rd century, the general area surrounding Portlaoise was ranked as a kingdom and annexed by Conary, King of Ireland, to his native dominion of Munster, instead of being, as formerly, attached to Leinster. In the war waged by Roderic O'Conor, King of Ireland, against Diarmait MacMurrough, King of Leinster, which led to the invasion under Strongbow, the King of Ossory was one of the princes who were specially summoned by the former of those potentates.

The commencement of Viking raids at the end of the 8th century and their subsequent settlement during the following two centuries marked the first ever foreign invasion of Ireland. Viking settlement evidence is scarce and has been found in Cork, Dublin and Waterford, however excavations there have revealed extensive remains of the Viking towns. Outside these towns, understanding of Viking settlement is largely drawn from documentary and place-name evidence. In addition to Cork, Dublin and Waterford, documentary sources provide evidence for the Viking foundation of the coastal towns of Limerick and Wexford (Edwards 2006, 179). Other indirect evidence which suggest Viking settlement, or at least a Norse influence in Ireland, is represented by upwards of 120 Viking-age coin hoards, possible votive offerings of Viking style objects, and the assimilation of Scandinavian art styles into Irish designs. While the initial Viking raids would have been traumatic, the wealth and urban expansion brought into the country as a result of Viking trading would have eventually benefited the Gaelic Irish and cultural assimilation in some parts would have been significant.

The district now forming Queen's County (the former name of County Laois) was known by the name of Glenmaliere and Leix. Leix was made a county palatine, and on the division of the immense possessions of William, Earl Marshal, between his five daughters, it was allotted to the youngest, who had married William de Braosa, Lord of Brecknock. Their daughter Maud married Roger Mortimer, Lord of Wigmore, and from this connection the imperial house of Austria, and the royal families of Britain, France, Prussia, Denmark, Holland, Sardinia and Saxony derive their descent. Mortimer, preferring to reside on his English estates, employed one of the O'Mores to defend and manage his Irish property. Within 20 years however, O'More had become so powerful that he held it by himself and became one of the fiercest opponents of the English settlers in that part of the Pale. So fully was his authority recognised as lord of the district that he was summoned by the English government

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to oppose Bruce and the Scotch. For two centuries after, the district was the seat of an almost incessant war between the O'Mores and the English. During the same period the Mac Gillypatricks, or Fitzpatricks, maintained their independence in Ossory, but generally adhered to the English.

The Later Middle Ages is a period marked by continuous raids by the Irish on the Pale, and retaliation measures taken by the English crown to secure its authority by attempting to control the Irish families living outside its walls. Portlaoise originated as a fort erected in the mid-16th century as part of the English attempts to subdue the territories of the O'Mores and O'Conors during the reign of Edward VI.

In an attempt to limit the devastation caused by raids on the Pale, the region was reduced to shire ground and incorporated under the name of Queen's County. This new arrangement however did not immediately calm the country. For security, a number of affluent families of native Irish, Anglo-Irish and English descent alike erected a type of castle known as a tower house. Though they are not castles in a strict military sense, they are designed primarily to repulse attack while displaying the wealth and status of the family. They are typically tall rectangular crenellated towers, of three to five storeys, with defensive features as well as features to enhance the domestic comfort of the building.

This general area was largely under the control of two powerful Irish families, the O'Conors and the O'Mores. Owen MacRory O'More, the chief of the O'More family, was so powerful that Sir George Carew, President of Munster, accompanied by the Earls of Thomond and Ormonde, was induced to hold a parley with him to bring him back to his allegiance to the English crown and halt his raids. Their attempt however to subdue his family's activities was unsuccessful when they were entrapped in an ambush, and the Earl of Ormonde made prisoner, and detained till a ransom of £3000 was paid. The O'More power was not to last and when their chief was killed shortly after this, in a skirmish with Lord Mountjoy, followers of the O'Mores were driven into counties Cork and Kerry, then nearly depopulated.

At this juncture many English families, to whom grants of the land thus forfeited by the O'Mores had been made, settled in the county. Seven of them, whose founders were most influential in securing the new settlements, acquired the names of the Seven Tribes. The families so called were those of Cosby, Barrington, Hartpole, Bowen, Ruish, Hetherington and Hovenden or Ovington. In 1556 the fort within Laois, known to the English as "*Fort Protector*", was renamed Maryborough in honour of Queen Mary. The fort attracted settlers and a map of 1560 shows a small walled town around a fort. Maryborough (Portlaoise) was granted a market in 1567 and borough status in 1569. In 1580 the town was plundered by John, son of the Earl of Desmond. In 1597 it was burned by Rory O'Mordha and appears to have been burned again the following year. In the reign of Charles I, large grants of land were made to Villiers, Duke of Buckingham, now forming the extensive manor of Villiers. In the same reign, and during the unsettled period of the Commonwealth, the families of Pigott, Coote, Prior, Parnell and Pole settled there; those of Vesey, Dawson, Staples, Burrows and Johnson obtained lands after the Revolution.

There are many theories as to why Portlaoise was chosen in 1556 as the principal town of a new shire. One possibility was that it was built on the site of the Newtown of Leys and that some sort of hamlet may have lingered into the 16th century. This would explain the name of the parish, which almost certainly has a Medieval origin.

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The street pattern of the 16th century town is quite unusual and offers no apparent explanation for its form. The form of the 16th and 17th century housing within the town remains unknown.

County Laois had its full share of the calamities of the civil war in 1641, at the beginning of which the insurgents secured Maryborough, Dunamase and other places of strength. The Earl of Ormonde, arriving at Athy from Dublin, detached parties for their relief; on his retreat the whole of the county submitted to General Preston, but was forced again to submit to the royal arms. In 1646 Owen Roe O'Neill seized upon several forts. In 1650 Cromwell's forces entered the county and met with much resistance. In the course of the struggle most of its fortresses were dismantled by his generals, Hewson and Reynolds. During the rebellion of 1699, a victory was gained by the troops of William at a noted togher or bog-pass near Cappard, where they defeated a much superior number of the Irish. After the termination of the war, the country was so harassed by the ravages of the raparees that the resident gentlemen applied to King William to have a force of infantry and dragoons quartered in it, and specified the castle of Lea as one of the principal stations for their reception.

The arrival of Anglo-Normans in Ireland towards the end of the 12th century resulted in great changes during the following century. Large numbers of colonists arrived from England and Wales and established towns and villages. They brought with them new methods of agriculture which facilitated an intensification of production. Surplus foods were exported to markets all along Atlantic Europe which created great wealth and economic growth. Results of this wealth can be seen in the landscape in the form of stone castles, churches and monasteries.

The political structure of the Anglo-Normans centred itself around the establishment of shires, manors, castles, villages and churches. In the initial decades after the Anglo-Norman invasion a distinctive type of earth and timber fortification was constructed- the motte and bailey. Mottes were raised mounds of earth topped with a wooden or stone tower while the bailey was an enclosure, surrounded by an earthen ditch with a timber palisade, used to house ancillary structures, horses and livestock. There are 11 motte and baileys recorded in County Laois (www.archaeology.ie).

In certain areas of Ireland however Anglo-Norman settlers constructed square or rectangular enclosures, now termed moated sites. Their main defensive feature was a wide, often water-filled, fosse with an internal bank. As in the case of ringforts, these enclosures protected a house and outbuildings usually built of wood. They appear to have been constructed in the latter part of the 13th century though little precise information is available. There are 61 moated sites recorded in County Laois (*ibid*.).

More substantial stone castles followed the motte and bailey and moated sites in the 13th and 14th centuries. Tower houses are regarded as late types of castle and were erected from the 14th to early 17th centuries. Their primary function was defensive, with narrow windows and a tower often surrounded by a high stone wall (bawn). An Act of Parliament of 1429 gave a subsidy of £10 to "*liege*" men to build castles of a minimum size of 20 ft in length, 16 ft in breadth and 40 ft in height (6 m x 5 m x 12 m). By 1449, so many of these £10 castles had been built that a limit had to be placed on the number of grants being made available. The later tower houses

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were often smaller, with less bulky walls and no vaulting. There are 31 tower houses recorded in County Laois (*ibid.*).

The 14th century throughout north west Europe is generally regarded as having been a time of crisis, and Ireland was no exception. Although the Irish economy had been growing in the late 13th century, it was not growing quickly enough to support the rapidly expanding population, especially when Edward I was using the trade of Irish goods to finance his campaigns in Scotland and Wales. When the Great European Famine of 1315-1317 arrived in Ireland, brought about by lengthy periods of severe weather and climate change, its effects were exacerbated by the Bruce Invasion of 1315-1318. Manorial records which date to the early 14th century show that there was a noticeable decline in agricultural production. This economic instability and decline was further worsened with the onset of the Bubonic Plague in 1348.

Before the Tudors came to the throne, the kings of England were also the kings of western France, and so, during the 14th and 15th centuries, the various lords who ruled in Ireland were largely left to themselves. The Tudors however took more of an interest in the affairs of Ireland. They wanted to put a stop to the raids of the Gaelic Irish on the areas under English rule. To do this, they ruthlessly put down any rebellions and even quashed inter-tribal feuds. English settlers were then brought in to settle their lands. The first of these plantations occurred in the mid-16th century in what is now Laois and Offaly. After the Desmond rising in Munster in 1585 came another plantation and parts of south western Tipperary were planted at that time.

From 1593 until 1603 there was a countrywide war between the Gaelic Irish, who were supported by the French, and the Elizabethan English. The Irish were finally defeated and with the "*Flight of the Earls*" in 1607, Ulster, which had previously been independent of English rule, was planted.

Expansion in the agricultural sector following a period of economic growth in Ireland from the mid-1730s led to rising prices and growth in trade. This increase in agricultural productivity lead to growth in related industrial development throughout the country.

The planned estate town of Abbeyleix, located approximately 7km north west of the proposed development area, was founded c. 1770 by the second Viscount de Vesci who considered the Oldtown of Abbeyleix to be too close to the river Nore and therefore liable to flooding. He razed the original town and choose a slightly elevated site away from the river which is the location of the modern town.

The proposed development would be located in Knockardagur townland, which is in the barony of Cullenagh and parish of Dysartgallen. Lewis (1837, Vol. I, 593) records the parish of Dysartgallen as containing, along with Ballinakill, 4,018 inhabitants. He notes that the parish contained 10,557 acres and that:-

> "*the soil is generally good, and the land in a profitable state of cultivation; there is a small quantity of bog, and grit-stone is quarried for building*" (*ibid.*).

10.4.2 Site-Specific Archaeological Background

There are two Recorded Monuments within 1km of the proposed development, each of which is described below (see **Figure 10.2**).

10.4.2.1 RMP LA030-015: enclosure

Centred on a point approximately 780m west of the proposed development area

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and indicated on historic cartographic sources, the enclosure takes the form of a circular area measuring approximately 39.2m in diameter and is defined by an earthen bank from south west to north east and elsewhere by a scarp. No other visible surface remains survive.

10.4.2.2 RMP LA030-016: enclosure

Centred on a point approximately 140m north east of the proposed development area, part of a large sub-circular enclosure is visible on aerial photography in this location. No evidence of this monument survives above-ground.

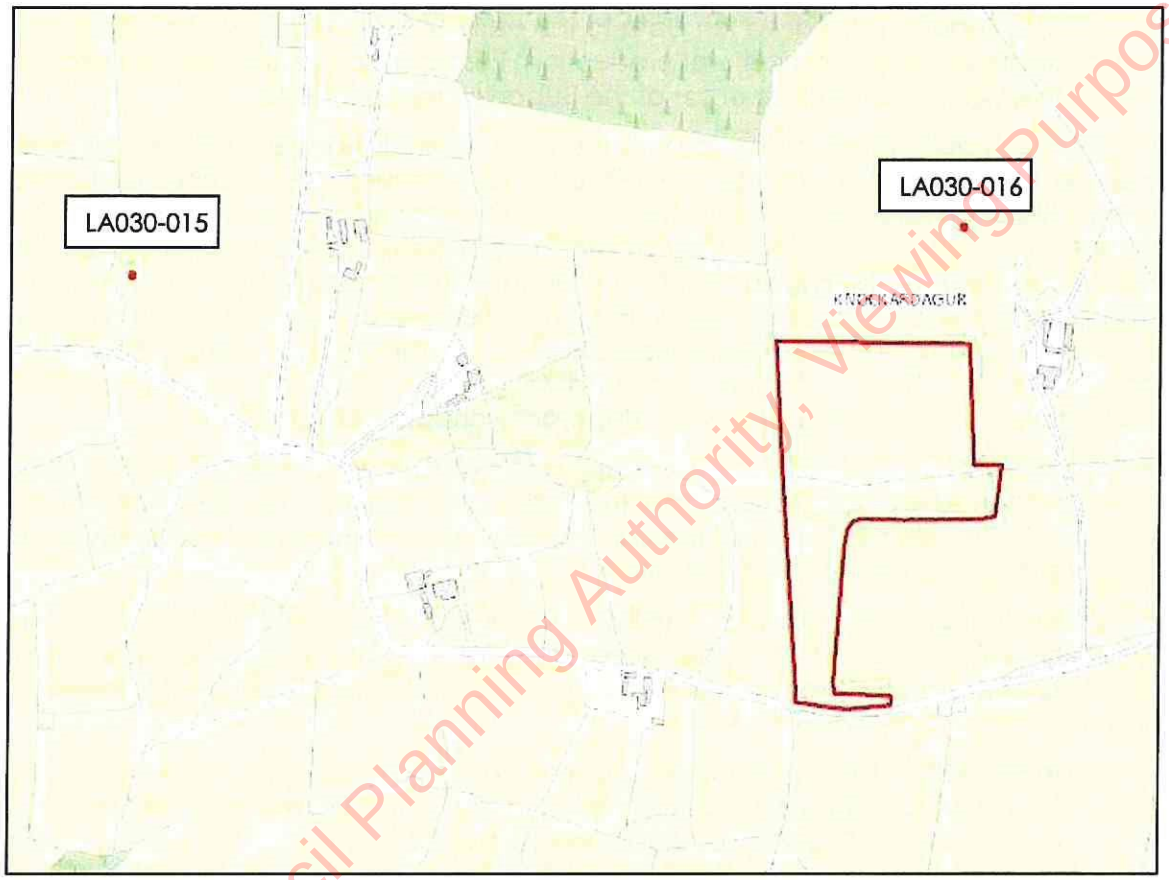

Figure 10.2: Recorded Monuments within 1km of the Proposed Development Area

10.4.3 Cartographic Analysis

10.4.3.1 Ordnance Survey Map First Edition 1:10,560 1841 (**Figure 10.3**)

A townland boundary is located a short distance west of the proposed development. Research suggests that:-

> "*hoards and single finds of Bronze Age weapons, shields, horns, cauldrons and gold personal objects can all be shown to occur on boundaries*" (Kelly 2006, 28).

The proposed access track will cross an area shown as "*Sheep Walk*" on the First Edition map; a sheep walk was a tract of land used for grazing sheep. Three small structures are recorded to the north east of the proposed development and outside all areas of proposed land take. A north/south oriented farm track is recorded

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extending from the above-mentioned structures.

There are no archaeological, architectural or cultural heritage features recorded on the First Edition 1:10,560 map within the proposed development area.

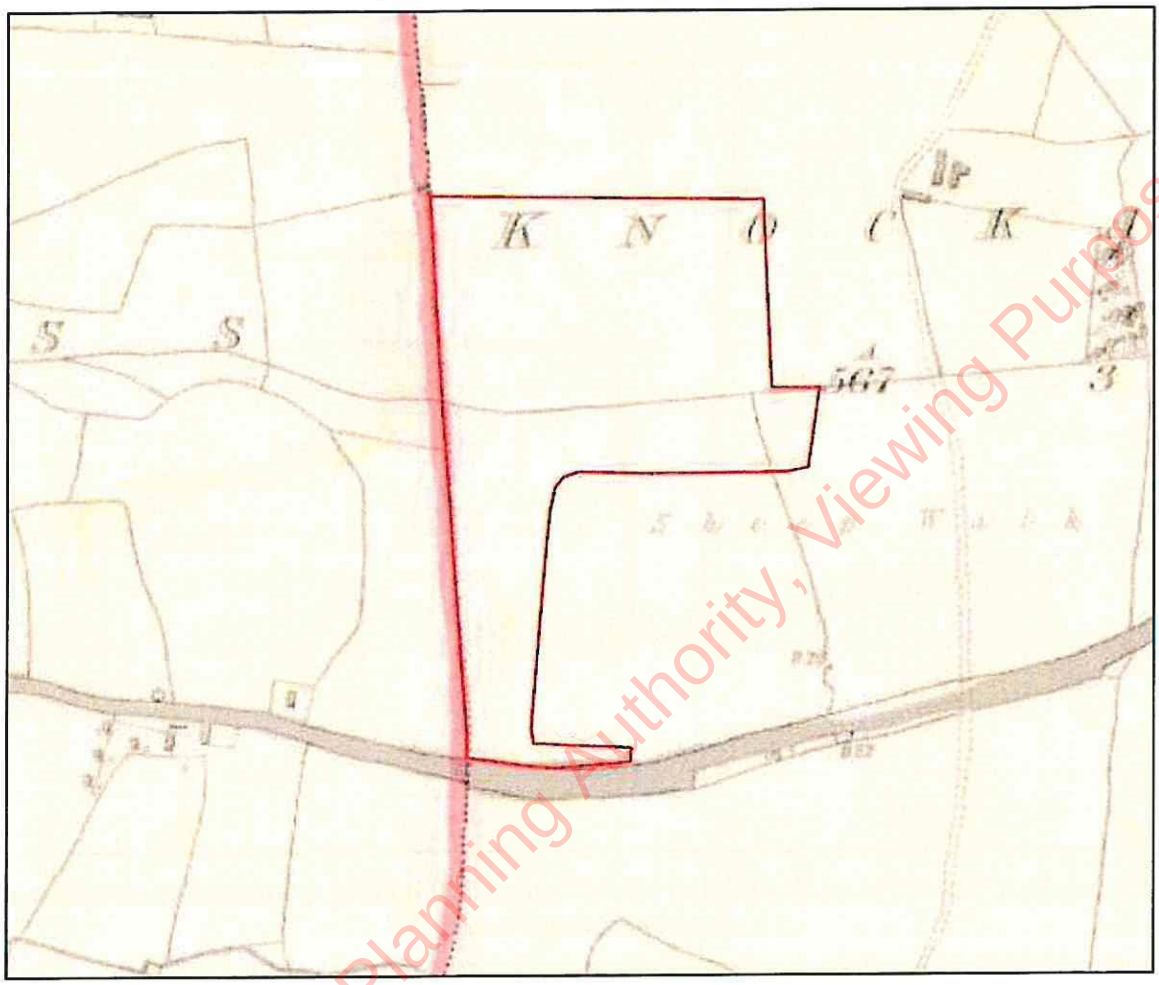

Figure 10.3: Extract from First Edition 1:10,560 map (1841), showing the proposed development area

10.4.3.2 Ordnance Survey Map First Edition 1:2,500 1906-1908 (**Figure 10.4**)

The "*Sheep Walk*" which was noted on the First Edition 1:10,560 map is not recorded on the First Edition 1:2,500 map. Four structures in a slightly wooded setting are recorded in the location where three small structures were shown on the First Edition 1:10,560 map, and these structures are recorded as "*Cooper's Buildings*" on the 1:2,500 map. A "*Spring*" is recorded immediately east of a north/south access track. A "*Spring*" is also recorded immediately south of the proposed substation footprint and is related to the Knockardagur stream (see **Chapter 7**).

There are no archaeological, architectural or cultural heritage features recorded on the First Edition 1:2,500 map within the proposed development area.

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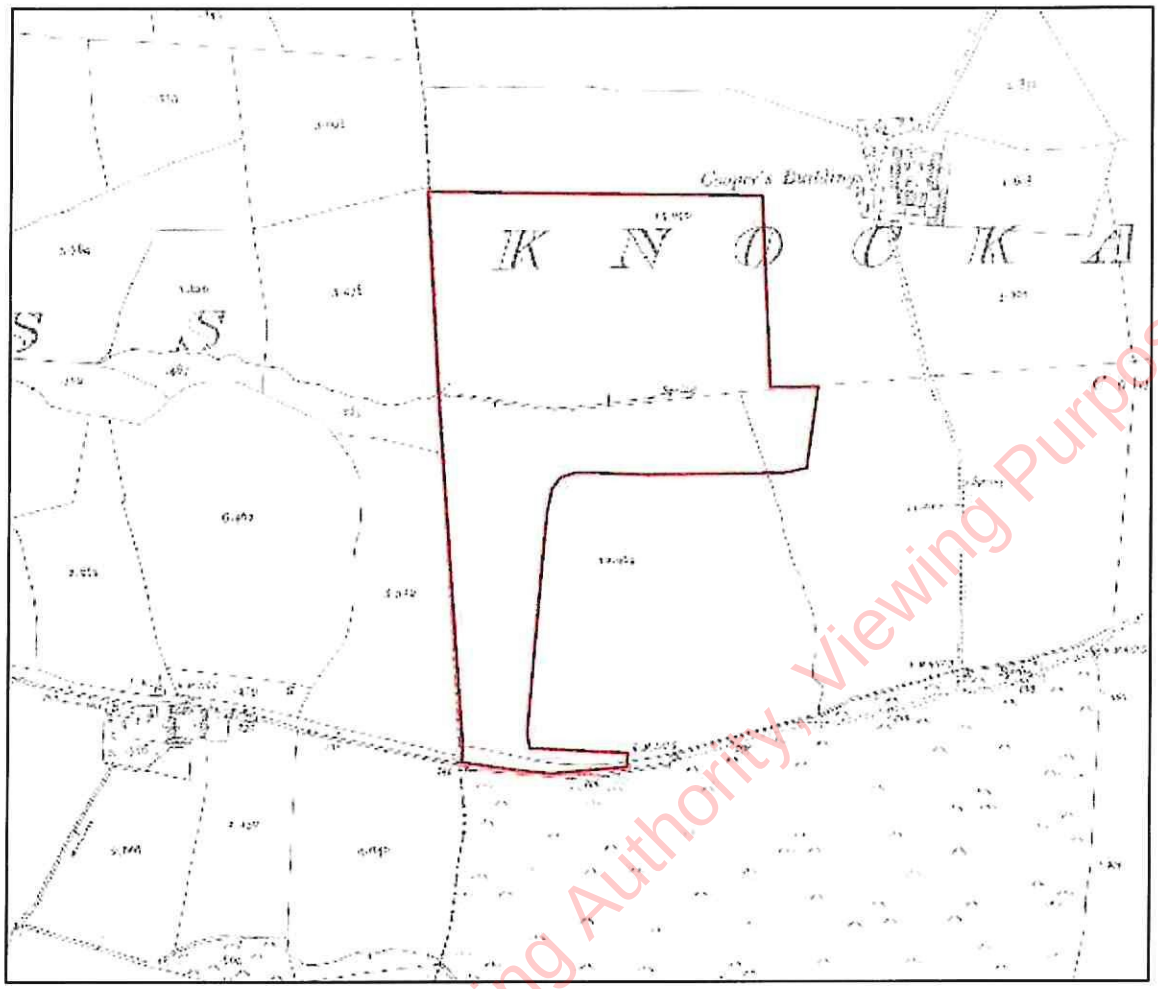

Figure 10.4: Extract from First Edition 1:2,500 map (1906-1908), showing the proposed development area

10.4.3.3 Ordnance Survey Map Third Edition 1:10,560 1908 (**Figure 10.5**)

There are no differences recorded within the proposed development area between Third Edition 1:10,560 map and the First Edition 1:2,500 map.

There are no archaeological, architectural or cultural heritage features recorded on the Third Edition 1:10,560 map within the proposed development area.

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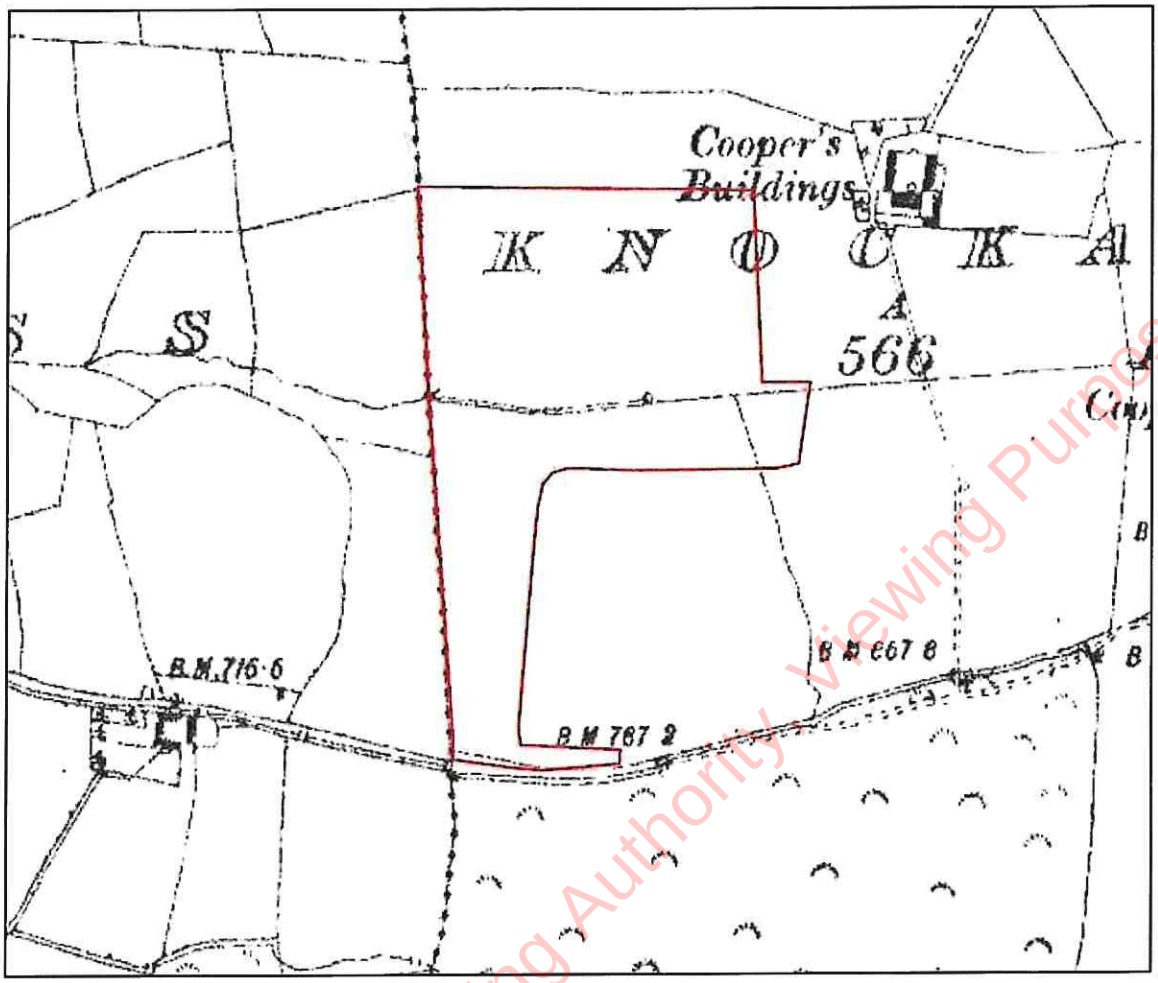

Figure 10.5: Extract from Third Edition 1:10,560 map (1908), showing the proposed development area

10.4.4 Aerial Photographs

Aerial photographs held by Ordnance Survey Ireland (map.geohive.ie) and Bing aerial photography (www.bing.com/maps) were consulted to look for the presence of archaeological and architectural remains within the land take of the proposed development.

Aerial photography records a similar landscape to that which was noted during the walkover survey, with the proposed development located in medium to large fields enclosed by mature field boundaries.

There was no evidence of any archaeological or architectural features recorded on aerial photography within the proposed development site.

10.4.5 Topographical Files of the National Museum of Ireland

Information on artefact finds and excavations from County Laois is recorded by the National Museum of Ireland. Location information relating to such finds is important in establishing prehistoric and historic activity in the study area. There is one entry recorded in the Topographical Files for Knockardagur townland.

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Ploughing, on a hillside in the townland of Knockardagur, in approximately 1910 revealed a large flagstone sealing a cist measuring approximately 1.5m long x 0.6m wide x 0.4m deep (no Topographical File reference). The sides of the cist were made of thin flags set on edge and the bottom was floored by small thin flags set on sand. It is noted that in the grave there was:-

> *"nothing at all but a little skin of dust on the floor and… an earthenware vessel".*

10.4.6 Previous Archaeological Fieldwork

Reference to Summary Accounts of Archaeological Excavations in Ireland (www.excavations.ie) confirmed that no fieldwork programmes have been carried out within the townland of Knockardagur or any surrounding townlands.

10.4.7 Toponyms

Townland names are an important source in understanding the archaeology, geology, land-use, ownership and cultural heritage of an area. The proposed development is located within the following townland:-

Name	Irish	Translation
Knockardagur	*Cnoc Ard Ó gCorra*	Possibly translates as *High hill of the turns*

Table 10.2: Toponyms

10.4.8 National Monuments

The Department of Culture, Heritage and the Gaeltacht[1] maintains a database on a county basis of National Monuments in State Care: Ownership and Guardianship. The term National Monument is defined in Section 2 of the National Monuments Act (1930) as:-

> *"a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto"* (www.archaeology.ie).

There are no National Monuments in State Care within the proposed development site, the 1km study area or the 3km study area.

The Department of Culture, Heritage and the Gaeltacht also maintains a database on a county basis of National Monuments with Preservation Orders or Temporary Preservation Orders.

There are no National Monuments with Preservation Orders or Temporary Preservation Orders within the proposed development site, the 1km study area or the 3km study area.

There are no World Heritage Sites or sites included in the Tentative List as being under consideration for nomination to the World Heritage List within the proposed development site, the 1km study area or the 3km study area.

10.4.9 County Development Plans

10.4.9.1 Archaeological Heritage

[1] Or as succeeded following reorganisation of Government Departments.

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Laois County Development Plan 2017 - 2023

It is an Objective (OBJ1) of Laois County Council to:-

> *"Secure the preservation (in-situ or by record) of all sites and features of historical and archaeological interest"* (Laois County Council 2017, 149).

It is also an Objective (OBJ3) of Laois County Council to:-

> *"Ensure that development in the vicinity of a site of archaeological interest shall not be detrimental to the character of the archaeological site or its setting by reason of its location, scale, bulk or detailing"* (*ibid.*).

Table 22 of the Laois County Development Plan (*ibid.*, 150) contains a list of *National Monuments in State Care in Laois*. There are no National Monuments in State Care within the proposed development site, the 1km study area or the 3km study area.

Table 23 of the Laois County Development Plan (*ibid.*) contains a list of *Monuments protected by Preservation Orders in County Laois*. There are no Monuments Protected by Preservation Orders within the proposed development site, the 1km study area or the 3km study area.

Section 7.9.3 of the Laois County Development Plan (*ibid.*, 151-152) contains a list of *Zones of Archaeological Potential* within the county. There are no Zones of Archaeological Potential within the proposed development site, the 1km study area or the 3km study area.

Mills of County Laois: An Industrial Heritage Survey was published by Laois County Council in 2005. There are no mills recorded in the Industrial Heritage Survey within the proposed development site or the 1km study area (www.heritagemaps.ie).

Bridges of County Laois: An Industrial Heritage Review was published by Laois County Council in 2009. There are no bridges recorded in the Industrial Heritage Review within the proposed development site or the 1km study area (www.heritagemaps.ie).

Kilkenny County Development Plan 2014 – 2020

The 3km study area extends into County Kilkenny and, as such, the Kilkenny County Development Plan (2014) was assessed for the presence of any statutorily protected archaeological features within the 3km study area.

There are no statutorily protected archaeological features recorded in the Kilkenny County Development Plan (2014) within the 3km study area.

10.4.9.2 Architectural Heritage

Laois County Development Plan 2017 - 2023

It is an Objective (OBJ4) of Laois County Council to:-

> *"Protect all structures listed in the Record of Protected Structures, that are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical character or interest in County Laois"* (*ibid.*, 144).

Appendix 1 of the Laois County Development Plan (2017) contains the Record of Protected Structures for the county. There are no Protected Structures within the proposed development site.

There is one Protected Structure within the 1km study area:-

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RPS No.	Description	Townland	Distance from proposed development site
883	Thatched house	Aghnacross	c. 600m west (although there is no precise location information provided for this structure in the Laois County Development Plan)

Table 10.3: Protected Structure within the 1km Study Site

There is one Protected Structure within the 3km study area:-

RPS No.	Description	Townland	Distance from proposed development site
374	Saint Lazerian's Catholic Church	Graiguenahown	c. 1.6km north east

Table 10.4: Protected Structure within the 3km Study Area

Appendix 2 of the Laois County Development Plan (2017) contains a list of Architectural Conservation Areas for the county. There are no Architectural Conservation Areas within the proposed development site, the 1km study area or the 3km study area.

There are no proposed Architectural Conservation Areas within the proposed development site, the 1km study area or the 3km study area.

Kilkenny County Development Plan 2014 – 2020

The 3km study area extends into County Kilkenny, and as such the Kilkenny County Development Plan (2014) was assessed for the presence of any statutorily protected architectural features within the 3km study area.

There are no Protected Structures recorded in the Kilkenny County Development Plan (2014) within the 3km study area.

There are no Architectural Conservation Areas or proposed Architectural Conservation Areas recorded in the Kilkenny County Development Plan (2014) within the 3km study area.

10.4.10 National Inventory of Architectural Heritage

10.4.10.1 Building Survey

The National Inventory of Archaeological Heritage (NIAH) maintains a non-statutory register of buildings, structures *etc.* recorded on a county basis (www.buildingsofireland.ie).

There are no structures recorded on the NIAH within the proposed development site or the 1km study area.

There is one structure recorded on the NIAH within the 3km study area:-

NIAH Reg. No.	Description	Townland	Distance from proposed development site
12802409	Saint Lazerian's Catholic Church	Graiguenahown	c. 1.6km north east

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Table 10.5: NIAH structure within the 3km Study Area

10.4.10.2 Historic Gardens and Designed Landscapes

There are no historic gardens or designed landscapes recorded on the NIAH within the proposed development site or the 1km study area.

10.4.11 Site Visit

Field inspection is necessary to determine the extent, character and condition of archaeological, architectural and cultural heritage features, and can also lead to the identification of previously unrecorded or suspected sites and portable finds through topographical observation and local information. The site visit took place on 14 May 2020, and weather conditions were dry and bright.

The footprint of the proposed substation was shown to be located in a large pasture field that slopes steeply downwards from north east to south west (see **Plates 10.1 – 10.3**). It will be situated near the base of the slope where the ground becomes wet underfoot. The location of the proposed substation overlooks the surrounding land to the south and west. An agricultural drain and hedgerow form the western field boundary, which is recorded as a townland boundary on historic cartographic sources. The proposed development will be located either side of an east/west field boundary, which is made up of a hedgerow, low earthen bank and a watercourse[2].

The location of the proposed access track is mostly flat, with the surrounding ground rising steeply to the north and east where it becomes known locally as Cooper's Hill (see **Plate 10.4**).

RMP LA030-016 (enclosure) is centred on a point approximately 140m north east of the proposed development (see **Plates 10.5** and **10.6**). Part of a large sub-circular enclosure is visible on aerial photography in this location, although no evidence for the monument survives above-ground. The site visit showed the location of the enclosure to be a steeply sloping pasture field, approximately halfway up the slope of Cooper's Hill. No above-ground evidence for the enclosure was noted during the walkover survey.

No archaeological, architectural or cultural heritage features were revealed within the footprint of the proposed development as a result of carrying out the walkover survey.

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[2] Known as the Knockardagur stream.

Plate 10.1: Location of substation, looking north

Plate 10.2: Location of substation, looking west

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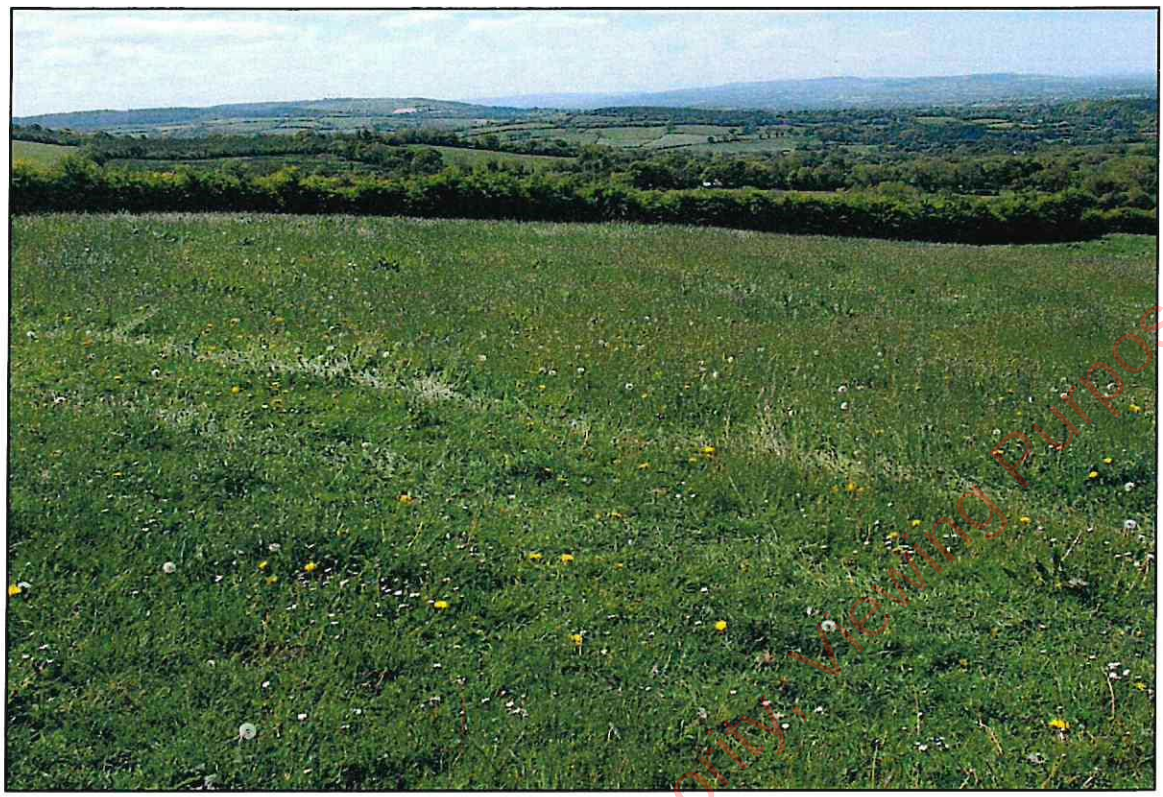

Plate 10.3: Location of substation, looking south

Plate 10.4: Location of access track, looking south

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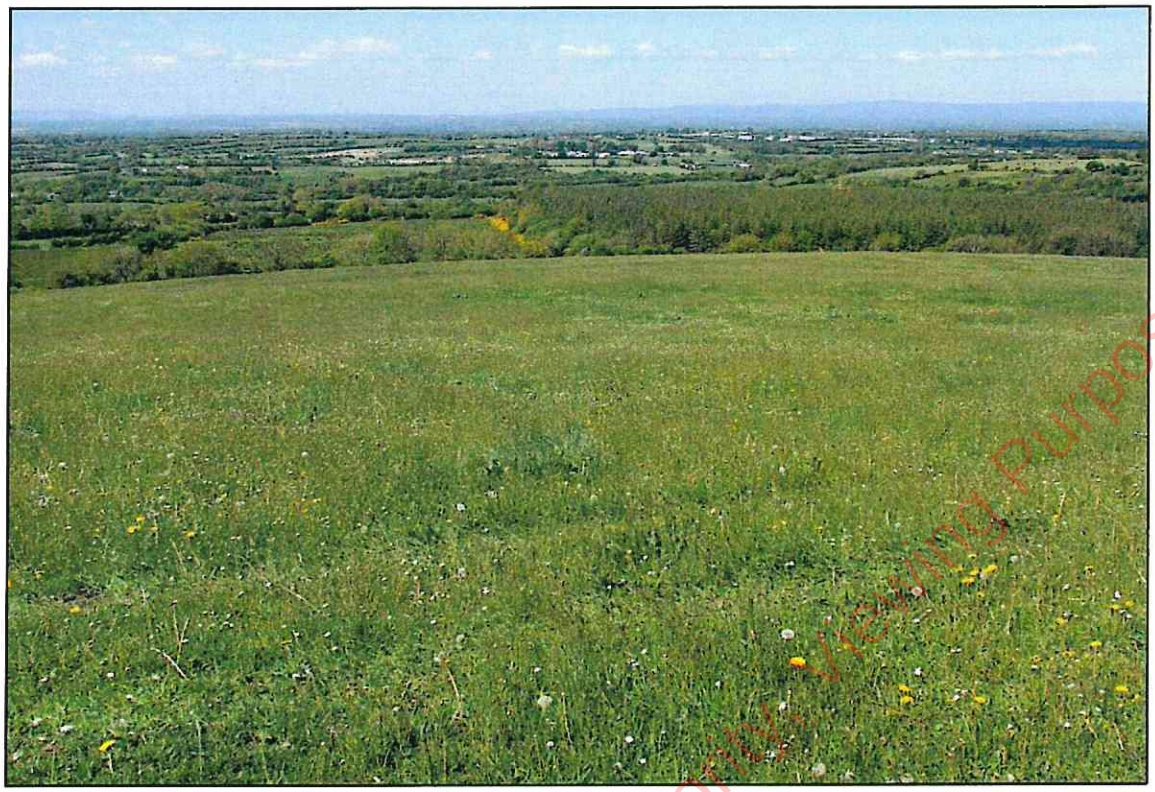

Plate 10.5: Location of RMP LA030-016 (enclosure), looking north west

Plate 10.6: Location of RMP LA030-016 (enclosure), looking north

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10.5 Description of Likely Effects

All elements of the proposed development are assessed as having the ability to affect or impact upon archaeological, architectural or cultural heritage features either during the construction phase through excavations, or through visual effects during the operational phase.

Construction phase effects may arise as a result of the construction of the proposed substation, access track and associated activities; each of which will involve the mechanical excavation of all topsoil and overburden down to and through geologically deposited strata at their identified locations. Operational phase effects may arise as a result of the visual effects resulting from the presence of the proposed substation in the landscape.

As a result of carrying out this assessment, the following likely archaeological, architectural and cultural heritage direct, indirect, construction, operational, cumulative, residual and decommissioning effects have been identified and assessed. The following sections undertake an assessment of all elements of the development described in **Chapter 3**.

10.5.1 Construction Phase

10.5.1.1 Archaeological Resource

There are no Recorded Monuments or any additional statutorily protected archaeological features within the footprint of the proposed development. As such, it is assessed that there will be no direct construction phase effect on the recorded archaeological resource.

It is assessed that there will be a likely permanent, direct and imperceptible construction phase effect on any previously unrecorded archaeological remains that may exist within the development site and which may be discovered during the construction phase.

There are two Recorded Monuments within 1km of the proposed development. It is assessed that there will be no direct construction phase effect on these Recorded Monuments.

Given the proximity of RMP LA030-016 (enclosure) to the proposed development site, it is likely that construction phase noise will be experienced at this feature. However, as this feature does not survive above-ground and given the temporary duration of the construction phase, it is assessed that there will be no significant adverse noise effects on this archaeological monument. Other features are considered to be sufficiently distant such that they will not experience any likely significant noise effects.

Similarly, as a result of construction activities, RMP LA030-016 (enclosure) may experience adverse visual effects. However, given that this feature does not survive above-ground, the short-term temporary nature of the construction phase and the reinstatement of the site following the completion of construction; any such effects are not assessed as likely to be significant.

RMP LA030-015 (enclosure) is considered to be sufficiently distant from the proposed development such that it will not experience any likely significant adverse construction phase effects.

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It is concluded, therefore, that the construction phase of the proposed development will not result in a likely significant adverse effect on the archaeological resource.

10.5.1.2 Architectural Resource

There are no protected architectural features within the footprint of the proposed development. Similarly, there are no protected architectural features proximate to the proposed development such that adverse visual or noise effects could be experienced during the construction phase. As such, it is assessed that there will be no significant direct or indirect construction phase effects on the architectural resource.

10.5.1.3 Cultural Heritage Resource

There are no protected cultural heritage features within the footprint of the proposed development. Similarly, there are no protected cultural heritage features proximate to the proposed development such that adverse visual or noise effects could be experienced during the construction phase. As such, it is assessed that there will be no significant direct or indirect construction phase effects on the cultural heritage resource.

10.5.2 Operational Phase

10.5.2.1 Archaeological Resource

RMP LA030-016 (enclosure) is centred on a point approximately 140m north east of the proposed development site. This monument is only recorded on aerial photography and does not survive above-ground. As such, and in consideration of the proposed landscaping and planting associated with the reinstatement of the proposed development site (see **Chapter 9**), it is assessed that there will be no likely significant operation phase visual effect on this Recorded Monument.

RMP LA030-015 (enclosure) is centred on a point approximately 780m west of the proposed development site. It is assessed that there will be a likely long-term, reversible and imperceptible operational phase visual effect on this Recorded Monument.

The low levels of noise predicted to be generated by the proposed development during its operational phase (see **Chapter 11**) are likely to result in a long-term, reversible and imperceptible operational phase effect on RMP LA030-016 (enclosure); however, this effect will not be significant. RMP LA030-015 (enclosure) is considered to be located sufficiently distant from the proposed development such that it will not experience any likely significant adverse noise effects.

There are no additional Recorded Monuments within the 1km study area.

There are no National Monuments in State Care, National Monuments with Preservation Orders or Temporary Preservation Orders, World Heritage Sites or sites included in the Tentative List as being under consideration for nomination to the World Heritage List within the proposed development site, the 1km study area or the 3km study area.

Therefore, it is assessed that the proposed development will not result in a likely significant operational phase effect on the archaeological resource.

10.5.2.2 Architectural Resource

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There are no Protected Structures within the proposed development site. There is one Protected Structure within the 1km study area and 1 no. additional Protected Structure within the 3km study area (which is also recorded on the NIAH). It is assessed that there will be a likely long-term, reversible and imperceptible operational phase visual effect on these Protected Structures. It is assessed that, due to the substantial separation distances involved, there will be no operational phase noise effect on these Protected Structures.

There are no Architectural Conservation Areas or any additional statutorily protected architectural features within the proposed development site, the 1km study area or the 3km study area.

Therefore, it is assessed that the proposed development will not result in a likely significant operational phase effect on the architectural resource.

10.5.2.3 Cultural Heritage Resource

There are no protected cultural heritage features within the footprint of the proposed development or the 1km study area. As such, it is assessed that there will be no likely significant direct or indirect operational phase effect on the cultural heritage resource.

10.5.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

10.5.4 Cumulative Effects

Cumulative effects are defined as:-

> *"The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects"* (Environmental Protection Agency 2017, 52).

10.5.4.1 Pinewoods Wind Farm

An Archaeological, Architectural and Cultural Heritage impact assessment was carried out by the writer in 2015 for the then-proposed, and now permitted, Pinewoods Wind Farm. As part of the current report, a re-evaluation of the cultural heritage environment surrounding the permitted Pinewoods Wind Farm site has been undertaken to ascertain if any new monuments or structures have been discovered or given additional protection in the intervening period or if there have been any changes to national, regional or local policies regarding the protection of designated monuments or structures.

The 2015 Archaeological, Architectural and Cultural Heritage impact assessment noted there were no recorded archaeological, architectural or cultural heritage features within the land take of the Pinewoods Wind Farm. The assessment found that:-

- There were two RMP sites within the 1km study area (around each turbine);
- There was one Protected Structure within the 1km study area;
- There were an additional 28 Protected Structures within the 5km study area;
- There were no Architectural Conservation Areas within the 1km study area;
- There was one proposed Architectural Conservation Area within the 5km study

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area;

- There was one NIAH structure within the 1km study area;
- There were no historic gardens or designed landscapes within the 1km study area;
- Reference to Summary Accounts of Archaeological Excavations in Ireland revealed that no fieldwork programmes had been carried out in townlands located within the proposed development site;
- There was one entry recorded in the Topographical Files of the National Museum of Ireland for a townland within the area of proposed land take. Reference to cartographic sources failed to identify any unrecorded archaeological features within the development site;
- No archaeological, architectural or cultural heritage features were identified through aerial photography; and
- No archaeological, architectural or cultural heritage features were revealed within any areas of land take as a result of carrying out the walkover surveys.

There are no newly designated RMP sites, National Monuments, sites with Preservation Orders or Temporary Preservation Orders, World Heritage Sites, sites included in the Tentative List as consideration for nomination to the World Heritage List, Protected Structures, Architectural Conservation Areas, Proposed Architectural Conservation Areas or NIAH sites within the permitted Pinewoods Wind Farm site or within the 1km study area since the time of preparing the Pinewoods Wind Farm EIAR/EIS.

Similarly, in the intervening period, there have been no finds added to the Topographical Files of the National Museum of Ireland, nor have there been any fieldwork exercises carried out in any townlands located within the permitted Pinewoods Wind Farm. An evaluation of the most recently available aerial photography (www.bing.com/maps) failed to reveal any previously unidentified archaeological or architectural features within the permitted Pinewoods Wind Farm site.

A walkover survey of the permitted Pinewoods Wind Farm site was carried out on 14 May 2020 to assess any likely cumulative effects between the proposed development and the permitted wind farm, as well as to look for the presence of any previously unrecorded built heritage features. The site walkover confirmed the findings of the review of aerial photography insofar as no additional archaeological, architectural or cultural heritage features were noted within the area of land take associated with the Pinewoods Wind Farm.

10.5.4.2 Other Existing, Permitted and Proposed Developments

The proposed development will be located in close proximity to a number of existing, permitted and proposed developments including forestry, residential dwellings and agricultural developments. While construction of the above-mentioned developments involve excavations, the fact that effects from the developments are unlikely to be experienced beyond their individual site boundary results in limited likelihood of cumulative effects. The construction of these developments and associated excavations may result in an imperceptible direct effect on previously unrecorded archaeological or culturally significant features; however, it is considered that the likelihood of cumulative effects is low.

10.5.4.3 Conclusion

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As discussed above, there have been no changes to the existing environment at the Pinewoods Wind Farm site since the preparation of the EIAR/EIS. Similarly, there have been no substantive changes to national, regional or local policy relating to the protection or management of archaeological, architectural or culturally significant features. Therefore, it is concluded that the findings and conclusions of the EIAR/EIS remain valid and fully applicable to the Pinewoods Wind Farm site.

Given that the EIAR/EIS and An Bord Pleanála concluded that the permitted wind farm would not result in any likely significant effects on the historical built environment, the fact that there have been no changes to the existing environment or policy context, and that effects resulting from the proposed development are unlikely to be significant; it follows that cumulative effects between the Pinewoods Wind Farm, the proposed development, and other existing, permitted and proposed developments are unlikely to occur. In the event that any effects do arise, they are highly unlikely to be significant.

10.5.5 Do Nothing Effects

If the proposed development were not to proceed, there would be no likely effect on the archaeological, architectural or cultural heritage resource.

10.5.6 Interactive Effects

The excavation of soil during the construction of the proposed development may result in the discovery of previously unrecorded archaeological features; and, therefore, it is considered that there is a likelihood of interactions between land and soil and archaeological heritage. However, on the basis of this assessment, it is concluded that the level of interaction will likely not be significant.

During the operational phase, it is assessed that the proposed development will likely result in imperceptible visual effects on built heritage features; and, therefore, will result in an interaction between built heritage and landscape. However, this assessment concludes that the level of interaction will not likely be significant.

10.5.7 Risk of Accidents

It is assessed that there will be no likely effects on the archaeological, architectural or cultural heritage resource as a result of any accidents which may occur during either the construction, operational or decommissioning phases.

10.5.8 Worst Case Effects

It is assessed that, under a 'worst-case' scenario, and in the absence of mitigation, there would be a likely permanent and direct construction phase effect on any previously unrecorded archaeological remains that may exist within the proposed development site.

10.6 Mitigation and Monitoring Measures

10.6.1 Mitigation Measures

Archaeological monitoring of all excavations associated with the construction of the proposed development shall be carried out. Monitoring will be carried out under licence to the Department of Culture, Heritage and the Gaeltacht and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring.

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10.6.2 Monitoring Measures

With the exception of the mitigation measures proposed in **Section 10.6.1** which will be implemented during the construction phase, there are no future monitoring requirements.

10.7 Residual Effects

Following implementation of the above-mentioned mitigation measure, it is concluded that there will be no likely residual effects during the construction or decommissioning phases of the proposed development. Residual effects during the operational phase are addressed below.

10.7.1 Archaeological Resource

It is assessed that there will be a likely residual, long-term, reversible and imperceptible operational phase visual effect on Recorded Monument RMP LA030-015 (enclosure), which is centred on a point approximately 780m west of the proposed development site.

It is assessed that there will be a likely residual, long-term, reversible and imperceptible operational phase noise effect on Recorded Monument RMP LA030-016 (enclosure).

10.7.2 Architectural Resource

It is assessed that there will be a likely residual, long-term, reversible and imperceptible operational phase visual effect on two Protected Structures (one of which is also recorded on the NIAH).

10.8 Summary

The results of this assessment, in relation to construction, operation, decommissioning and cumulative effects have been set out in the foregoing sections. This assessment has concluded that the likely effect on the archaeological, architectural and cultural heritage resource of the proposed development (substation, access track and associated activities) will in general be long-term, reversible and imperceptible.

There will be no likely significant direct or indirect construction or operational phase effect on the recorded archaeological, architectural and cultural heritage resource. However, there will be a likely long-term, reversible and imperceptible visual effect on one Recorded Monument located within the 1km study area, and a likely long-term, reversible and imperceptible noise effect on one Recorded Monument located within the 1km study area. In addition, there will be a likely long-term, reversible and imperceptible visual effect on two Protected Structures (one of which is also recorded on the NIAH).

Following the implementation of the mitigation measure outlined in this chapter, the likely residual effects of the proposed development remains imperceptible, including a likely residual long-term, reversible and imperceptible visual effect on one Recorded Monument located within the 1km study area, and a likely residual long-term, reversible and imperceptible noise effect on one Recorded Monument located within the 1km study area. In addition, there will be a likely residual long-term, reversible and imperceptible visual effect on two Protected Structures (one of which is also recorded on the NIAH).

This assessment has further concluded that the proposed development will not result

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in any likely significant cumulative effects with other existing, permitted or proposed developments, including those identified at **Chapter 1**.

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www.bing.com/maps	Bing aerial photography
www.buildingsofireland.ie	National Inventory of Architectural Heritage
www.excavations.ie	Database of Irish Excavation Reports
www.heritagemaps.ie	The Heritage Council
www.kilkennycoco.ie	Kilkenny County Council
www.laois.ie	Laois County Council
www.logainm.ie	Placenames Database of Ireland
www.map.geohive.ie	Ordnance Survey Ireland aerial photographs

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Pinewoods Wind Farm Substation & Grid Connection

Chapter 11: Noise & Vibration

Pinewood Wind Ltd

Galetech Energy Services
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www.galetechenergy.com

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Contents

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11.1 Introduction

11.1.1 Background and Objectives

This chapter describes the assessment undertaken of the likely noise and vibration effects arising from the proposed Pinewoods Wind Farm Substation and Grid Connection. A full description of the proposed development is provided in **Chapter 3** of this EIAR.

11.1.2 Statement of Authority

This chapter has been prepared by Mike Simms BE MEngSc MIOA MIET, Senior Acoustic Consultant at AWN Consulting Ltd. Mike has worked in the field of acoustics for over 19 years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, wind energy, industrial, commercial and residential.

The baseline noise monitoring was undertaken by Cormac McPhillips, Project Technician at Galetech Energy Services (GES). Cormac has extensive experience of undertaking noise monitoring programmes in accordance with relevant standards and best practice methods.

11.2 Methodology

11.2.1 Proposed Approach

The following methodology has been adopted for this assessment:-

- Review appropriate guidance in order to identify appropriate noise and vibration criteria for the site operations;
- Carry out baseline noise monitoring at a location representative of nearest sensitive properties to identify existing levels of noise in the vicinity; and,
- Comment on predicted noise levels against the appropriate construction and operational phase criteria and outline required mitigation measures (if any).

Annex 11.1 (**Volume II**) presents a glossary of the acoustic terminology used throughout this document. In the first instance it is considered appropriate to review some fundamentals of acoustics.

11.2.2 Fundamentals of Acoustics

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. To take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3 dB.

The frequency of sound, which is the rate at which a sound wave oscillates, is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as

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frequency falls below 250Hz. In order to rank the SPL of various noise sources, the measured level must be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. The 'A-weighting' system, defined in the international standard BS ISO 226:2003 Acoustics - Normal Equal-loudness Level Contours, has been found to provide the best correlations with human response to perceived loudness. SPLs measured using 'A-weighting' are expressed in terms of dB(A).

An indication of the level of some common sounds on the dB(A) scale is presented in **Figure 11.1** and shows a quiet bedroom at around 35 dB(A), a nearby (at 7m) noisy HGV at 90 dB(A) and a pneumatic drill (at 7m) at about 100 dB(A).

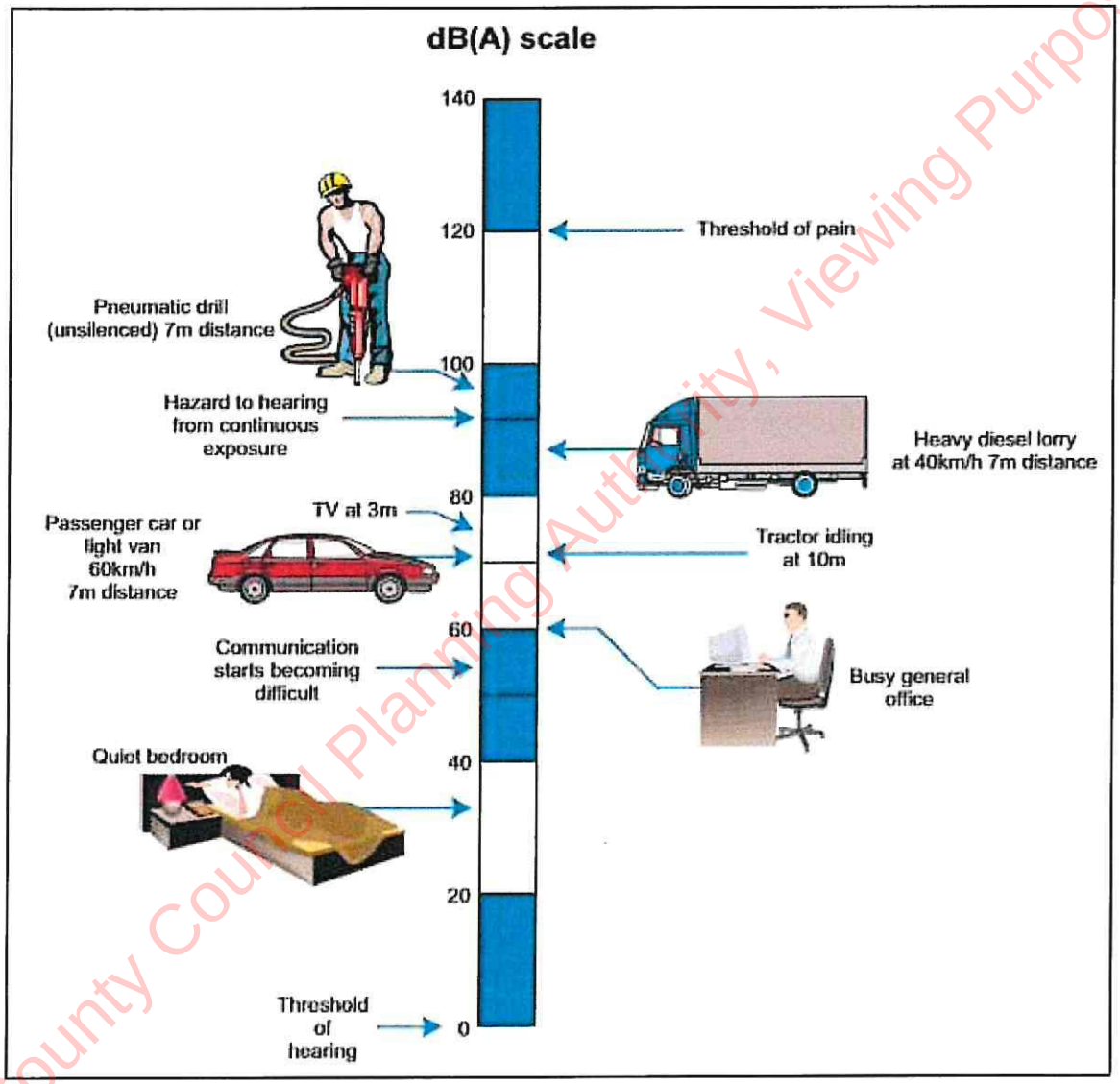

Figure 11.1: The level of typical common sounds on the dB(A) scale (NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004)

11.3 Guidance Documents and Assessment Criteria

The following sections review best practice guidance that is commonly adopted in relation to developments such as the subject proposed development.

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11.3.1 Construction Phase

11.3.1.1 Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and may consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded (construction noise only), may indicate that a significant noise impact is associated with the construction activities.

Table 11.1 sets out the values which, when exceeded, may signify a significant effect at the facades of residential receptors as recommended by *BS 5228 – 1*. These levels relate to construction noise only.

Assessment category and threshold value period (T)	Threshold values, $L_{Aeq,T}$ dB		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

Table 11.1: Example Threshold of Significant Effects at Dwellings

Note A Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
Note B Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
Note C Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
Note D 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

The following assessment method is only valid for residential properties.

For the appropriate period (e.g. daytime), the ambient noise level is determined and rounded to the nearest 5 dB. In this instance, given the rural nature of the site, properties near the proposed development have daytime ambient noise levels that typically range from 45 to 55 dB $L_{Aeq,1hr}$. Therefore, all properties will be afforded a Category A designation.

If the specific construction noise level exceeds the appropriate category value (i.e. 65 dB $L_{Aeq,T}$ during daytime periods) then a significant effect is assessed as likely to have occurred.

11.3.1.2 Vibration

Vibration standards come in two varieties; those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. With respect to the

Laois County Council Planning Authority Viewing Purposes Only!

proposed development, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:-

- *British Standard BS 7385 – Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (1993); and
- *British Standard BS 5228 – Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (2009+A1:2014).

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical or sensitive buildings.

BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies greater than 15 Hz.

Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (NRA, 2004) also contains information on the permissible construction vibration levels during the construction phase, as shown in **Table 11.2**.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

Table 11.2: Allowable Transient Vibration at Properties

11.3.2 Operational Phase

11.3.2.1 Noise

Laois City Council Guidance

Laois County Council Noise Action Plan 2019-2022 gives general advice in relation to environmental noise, although it does not provide specific noise criteria or limits for individual developments. Relevant extracts from the Noise Action Plan are reproduced below:-

> *"It is the policy of the Council to:*
>
> *ES12 Require an assessment of impact of the developments on noise levels, having regard to the provisions of the Environmental Protection Agency (EPA) Acts 1992 and 2003 and the EPA Noise Regulations 1994 when assessing planning applications;*
>
> *ES13 Ensure that relevant planning applications comply with the provisions of any Noise Action Plan or noise maps relating to the area;*
>
> *ES14 Restrict development proposals causing noise pollution in excess of best practice standards;*
>
> *ES15 Regulate and control activities likely to give rise to excessive noise, other than those activities which are regulated by the EPA;*

Laois County Council Planning Authority Viewing Purposes Only!

ES16 Ensure new development does not cause an unacceptable increase in noise levels affecting noise sensitive properties. Proposals for new development with the potential to create excessive noise will be required to submit a construction and/or operation management plan to control such emissions;

ES17 Require activities likely to give rise to excessive noise to install noise mitigation measures and monitors. The provision of a noise audit may be required where appropriate."

As such, specific guidance on appropriate noise limits in relation to infrastructural developments (such as the proposed development) are not provided in the Noise Action Plan. In the absence of specific local guidance, reference is made to other recognised methodologies for the rating and assessment of environmental noise.

Other Guidance

British Standard BS 8233:2014 provides guideline values for internal noise levels within residential dwellings. The following guideline values for indoor noise levels are presented in the standard:-

Activity	Location	Daytime	Night-time
Resting	Living room	35 dB $L_{Aeq,\ 16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,\ 16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,\ 16hour}$	30 dB $L_{Aeq,\ 8hour}$

Table 11.3: BS 8233 Indoor Noise Levels

Notes *Daytime assessment period – 07:00 to 23:00hrs*
Night-time assessment period – 23:00 to 07:00hrs

The BS 8233:2014 values are broadly in-line with the values as presented in the WHO *Guidelines for Community Noise 1999*, which are also presented below:-

Specific Environment	Critical Health Effect(s)	dB LAeq, T	dB LAmax, F
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35 dB $L_{Aeq,\ 16hour}$	-
Inside bedrooms	Sleep disturbance, night-time	30 dB $L_{Aeq,\ 8hour}$	45

Table 11.4: WHO Indoor Noise Levels

The 45 dB L_{AFmax} criterion applies to "single sound events" within bedrooms at night. This guideline is generally interpreted as the value that individual noise events should not normally exceed.

Making reference to the above documents, the following daytime and night-time internal noise criteria are proposed for residential dwellings in the vicinity of operational phase plant items:-

- 35 dB $L_{Aeq,\ 16\ hr}$ within living rooms and dining rooms during daytime periods (07:00 to 23:00hrs);
- 30 dB $L_{Aeq,\ 8\ hr}$ within bedrooms during the night-time period (23:00 to 07:00hrs), and;
- A value of 45 dB L_{AFmax} is not normally exceeded in bedrooms at night.

Laois County Council Planning Authority Viewing Purposes Only!

It is appropriate to derive external noise limits based on the internal criteria noted above. This is carried out by factoring in the degree of noise reduction afforded by a partially open window. Annex G in BS 8233:2014 comments that, if partially open windows were relied upon for background ventilation, the noise insulation would be reduced to approximately 15 dB.

Recommended Criteria

Following the evaluation of relevant guidance, the following noise criteria are proposed at the façades of residential properties in the vicinity of the proposed development:-

- Daytime (07:00 to 23:00 hours): 50 dB $L_{Aeq, 16hr}$;
- Night time (23:00 to 07:00 hours): 45 dB $L_{Aeq, 8hr}$; and
- Night time (23:00 to 07:00 hours): 60 dB L_{AFmax}.

It should be noted that equipment and plant noise emissions are designed such that they are not tonal and do not have impulsive characteristics at noise sensitive locations.

11.3.2.2 Additional Vehicular Traffic Activity on Public Roads

Once operational, the proposed development will be visited periodically for maintenance purposes, with a total of 1-2 trips per week. The vehicle used will typically be a light goods vehicle (LGV) or van. The number of vehicles trips is not such that any likely significant additional noise would be generated.

11.3.2.3 Vibration

Reference is made to British Standard BS 6472-1:2008 which provides the following vibration dose value (VDV) ranges which result in various probabilities of adverse comment within residential buildings.

Place and Time	Low probability of adverse comment m s $^{-1.75}$ (Note 1)	Adverse comment possible m s $^{-1.75}$	Adverse comment probable m s $^{-1.75}$ (Note 2)
Residential buildings, 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings, 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 11.5: BS 6472 VDV Ranges and associated Probabilities

Note 1 Below these ranges adverse comment is not expected.
Note 2 Above these ranges adverse comment is very likely.

Any vibration emissions from operational phase plant items, while considered highly unlikely, will be designed so as not to exceed the VDV values that result in low probability of adverse comment i.e. VDV ≤0.2 m $s^{-1.75}$ (daytime) and ≤0.1 m $s^{-1.75}$ (night-time).

11.3.2.4 EPA Description of Effects

The significance of effects of the proposed development shall be described in accordance with the EPA guidance document *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports Draft, August 2017*. Details of the methodology for describing the significant of the effects are provided in **Chapter 1**.

Laois County Council Planning Authority Viewing Purposes Only!

11.4 Description of the Existing Environment

As outlined above, prior to undertaking noise prediction modelling, it is crucial to understand the typical background noise levels at the nearest NSLs to the development site. The background noise survey was conducted by installing an unattended sound level meter at a location representative of the quiet noise environment of the noise-sensitive receptor locations.

The installation, retrieval and management of all measurement instrumentation detailed in this section has been carried out by GES. GES has confirmed that all measurement data collected during the baseline noise surveys has been carried out in accordance with ISO 1996-2:2007 "*Acoustics -- Description, measurement and assessment of environmental noise -- Part 2: Determination of environmental noise levels*".

The analysis and assessment of the survey data has been carried out by AWN Consulting.

11.4.1 Noise Measurement Location

The noise measurement location was selected by AWN Consulting. As the proposed electricity substation operates continuously, it is important to capture the quietest daytime and night-time periods, free of influence from noise generated at the noise-sensitive locations themselves, for example by heating systems. The selected noise monitoring location was chosen to reflect the noise environment at the nearest dwelling, located to the east and being a similar distance from the local road. Coordinates for the noise monitoring location are detailed in **Table 11.6**.

Coordinates (ITM)	
Easting	Northing
650377	682450

Table 11.6: Measurement Location Coordinates

Significant noise sources in this area were noted to be distant traffic movements and wind generated noise from local foliage and other typical anthropogenic sources typically found in such rural settings. There was no perceptible source of vibration noted at the survey location.

Figure 11.2 illustrates the installed noise monitoring apparatus. The location of the unattended noise monitor is shown in **Figure 11.3**

Laois County Council Planning Authority Viewing Purposes Only!

Figure 11.2: Noise Measurement Equipment

Laois County Council Planning Authority - Viewing Purposes Only!

Figure 11.3: Noise Survey Location

11.4.2 Measurement Period

Noise measurements were conducted over the period outlined in **Table 11.7**

Start Date	End Date
19:40hrs on 19 March 2020	11:30hrs on 27 March 2020

Table 11.7: Measurement Period

Wind speeds were generally low and the lowest background noise levels are selected as the basis for assessment as discussed at **Section 11.4.6**

11.4.3 Personnel and Instrumentation

All noise monitoring apparatus was installed and removed by, with the following instrumentation being used:

Equipment	Serial Number
Svantek 977	46437

Table 11.8: Instrumentation Details

Prior to and after the survey, the measurement apparatus was checked and calibrated using a sound level calibrator where appropriate. Relevant calibration

Laois County Council Planning Authority - Viewing Purposes Only!

certificates are presented in **Annex 11.2**.

11.4.4 Procedure

Measurements were conducted at the measurement location outlined in **Table 11.6** and over the time period outlined at **Table 11.7**. Noise levels were logged continuously at 10-minute interval periods for the duration of the survey.

11.4.5 Measurement Parameters

Several parameters were measured in order to interpret the noise levels. These included the following:-

- L_{Aeq}: This is the equivalent continuous A weighted sound pressure level. It is an average of the total sound energy (noise) measured over a specified time period;
- $L_{Aeq\,T}$: This is the equivalent continuous sound pressure level over a time interval;
- L_{A90}: Noise level exceeded for 90% of measurement period (steady underlying noise level);
- L_{A10}: Noise level exceeded for 10% of measurement period. It is typically a descriptor of traffic noise;
- L_{Amax}: Maximum A weighted noise level measured; and
- L_{Amin}: Minimum A weighted noise level measured.

The "A" suffix denotes that the sound levels have been "A-weighted" to account for the non-linear nature of human hearing. The "F" suffix denotes that the parameter has been measured with 'Fast' time-weighting applied. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pascal (pa).

11.4.6 Results of Unattended Noise Survey

On review of the measured data, it is confirmed that the typical noise levels were as follows:-

- Daytime ambient noise levels of between 29 and 48dB $L_{Aeq,T}$;
- Daytime background noise levels of between 23 and 38dB $L_{A90,T}$;
- Night time ambient noise levels of between 31 and 45dB $L_{Aeq,T}$; and
- Night time background noise levels of between 22 and 35dB $L_{A90,T}$.

Date	LAeq,16hr	LA90 (Arithmetic Average)
Thu 19 March	29	23
Fri 20 March	38	29
Sat 21 March	38	29
Sun 22 March	37	27
Mon 23 March	41	34
Tue 24 March	48	38
Weds 25 March	39	30
Thu 26 March	40	28
Fri 27 March	38	29

Table 11.9: Daytime Measured Noise Levels

Laois County Council Planning Authority Viewing Purposes Only!

Date	LAeq,8hr	LA90 (Arithmetic Average)
Thu 19 March to Fri 20 March	31	24
Fri 20 March to Sat 21 March	35	27
Sat 21 March to Sun 22 March	38	28
Sun 22 March to Mon 23 March	45	35
Mon 23 March to Tue 24 March	39	32
Tue 24 March to Weds 25 March	36	22
Weds 25 March to Thu 26 March	33	22

Table 11.10: Night-time Measured Noise Levels

11.4.7 Vibration

There are no significant sources of vibration present in the receiving environment and, therefore, it is not necessary to measure baseline vibration as part of this assessment.

11.5 Description of Likely Effects

11.5.1 Do Nothing Scenario

If the proposed development is not progressed, the existing noise environment in the vicinity of the subject site and noise sensitive receptors will remain unchanged.

11.5.2 Construction Phase

A variety of items of plant and machinery will be in use for the purposes of site preparation and construction of the proposed development. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, the generation of significant levels of noise is possible.

11.5.2.1 Noise

As per TII guidance, noise levels associated with construction may be calculated in accordance with the methodology set out in BS 5228-1:2009+A1:2014. This standard sets out sound power and sound pressure levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations. However, it is often not possible to conduct detailed prediction calculations for the construction phase of a project due to the fact that the noise emission levels for the assumed plant items are indicative, the programme for construction works has not been established fully and may change as the project develops (i.e. in the event that the construction contractor identifies alternative working methods or procedures). Noise predictions are therefore presented in outline form to highlight typical expected noise levels at noise sensitive receivers and to discuss the typical noise mitigation measures that can be utilised to reduce effects as far as is reasonably practicable.

The anticipated construction hours are 08:00 to 20:00hrs Monday to Friday and 08:00 to 18:00hrs on Saturday.

Table 11.1 of **Section 11.3.1.1** identifies appropriate construction noise criteria for the proposed development site. With reference to the measured noise levels at the nearest NSL's discussed in **Section 11.4.6**, ambient noise levels were in the range of 29 and 48dB $L_{Aeq,T}$. In accordance with the relevant criteria, if the specific

Laois County Council Planning Authority, Viewing Purposes Only!

construction noise level exceeds the appropriate category threshold value of 65dB $L_{Aeq,T}$ during daytime periods then a significant effect is deemed to occur.

Several noise sources that would be expected on a construction site of this nature have been identified and predictions of the likely noise emissions calculated at the closest sensitive receptor. In this scenario, the closest sensitive receptor is located approximately 100m east of the proposed development.

Table 11.11 presents outline noise calculations, considering the anticipated methods of construction. The calculations assume that plant items are operating for 66% of the time and that there is no acoustic screening (i.e. barriers) in place between the site works and the NSL.

Plant Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Noise Level at 100 m (dB $L_{Aeq,T}$)
HGV Movement (C.2.30)	Removing spoil and transporting fill and other materials.	79	56
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	77	54
General Construction (Various)	All general activities plus deliveries of materials and plant	84	61
Mobile Telescopic Crane (C4.64)	Lifting	75	54
Dewatering Pumps (D.7.70)	If required.	80	57
JCB (D.8.13)	For services, drainage and landscaping.	82	59
Vibrating Rollers (D.8.29)	Road surfacing.	77	54
Combined L_{Aeq} from all works			65

Table 11.2 Indicative Noise Calculations for Construction of Substation

The predicted noise levels at the nearest dwelling are just within the criterion of 65dB $L_{Aeq,T}$. Following a similar method of calculation the next nearest dwellings, at 180m and 390m southwest of the proposed development, are predicted to experience noise levels of 62dB $L_{Aeq,T}$ and 55dB $L_{Aeq,T}$ respectively.

With respect to guidance for the description of effects, the likely worst-case effect at the nearest NSL is assessed to be negative, temporary and not significant.

11.5.2.2 Vibration

While there are some activities proposed to be undertaken during the construction phase which will result in the generation of vibration effects (e.g. compaction of access track aggregates), due to the localised nature of these works and the distance to nearby receptors, there are no vibration effects anticipated at sensitive locations during the construction phase. Notwithstanding the above, all construction activities undertaken on the site will be required to operate below the

Laois County Council Planning Authority, Viewing Purposes Only!

recommended vibration criteria set out in **Table 11.2.**

11.5.3 Operational Phase

11.5.3.1 Noise

The following extract from the *EirGrid Evidence Based Environmental Studies Study 8: Noise – Literature review and evidence-based field study on the noise effects of high voltage transmission development* (May 2016) states the following in relation to noise effects associated with 110kV substation installations:-

> *"The survey on the 110kV substation at Dunfirth indicated that measured noise levels (LAeq) were less than 40dB(A) at 5m from each of the boundaries of the substation. This is below the WHO night-time free-field threshold limit of 42dB for preventing effects on sleep and well below the WHO daytime threshold limits for serious and moderate annoyance in outdoor living areas (i.e. 55dB and 50dB respectively). Spectral analysis of the data recorded at this site demonstrated that there were no distinct tonal elements to the recorded noise level. To avoid any noise impacts from 110kV substations at sensitive receptors, it is recommended that a minimum distance of 5m is maintained between 110kV substations and the land boundary of any noise sensitive property."*

The proposed development has comparable noise emissions to the 110kV unit discussed above and considering the distance between the proposed development and the nearest noise sensitive location (i.e. 100m), noise from the proposed substation is not assessed as likely to result in significant adverse noise effects. It is predicted, therefore, that the expected noise levels experienced at the nearest dwelling will be less than 25dBA.

It is concluded, therefore, that there will be no significant noise emissions from the operation of the proposed development.

With respect to the EPA's guidance for description of effects, likely effects at the nearest NSL as a result of the operation of the proposed development are assessed to be negative, not significant and long term.

11.5.4 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

11.5.5 Cumulative Effects

This assessment has considered the likely cumulative effects for the construction, operational and decommissioning phases of the proposed development in combination with the permitted Pinewoods Wind Farm. Following a detailed evaluation, it is considered that there are no other existing, permitted or proposed developments in the local area capable of contributing to cumulative noise or vibration effects. Other developments have been discounted from further assessment due to their specific type or nature or due to the separation distances involved.

Construction Phase

It is anticipated that the proposed development will be constructed concurrently with the permitted Pinewoods Wind Farm. With reference to the predicted noise levels associated with the construction of the proposed development outlined in **Section 11.5.2.1.** (i.e. 65 dB L_{Aeq} at the nearest NSL), given the similarities between the

Laois County Council Planning Authority Viewing Purposes Only!

plant and machinery to be used in the construction of the proposed and permitted developments and the increased separation distance between receptors and Pinewoods Wind Farm construction activities, there is no likelihood of the total construction noise level increasing.

Therefore, should construction of the proposed development occur simultaneously with the construction of the Pinewoods Wind Farm, it is assessed that there will be no cumulative effects that would give rise to significant effects at the nearest NSL's.

Operational Phase

Once the proposed development is completed, the likelihood of noise effects in the surrounding environment is not significant. The operation of the proposed development is not expected to generate any noise over or above the existing background noise environment at the nearest NSL.

The local environment has been re-evaluated to assess for any alterations to baseline conditions since the preparation of the Pinewoods Wind Farm EIAR/EIS (see **Chapter 10, Volume III**). The evaluation confirms that no significant noise-generating developments have been introduced to the local environment which could alter the findings and conclusions of the EIAR/EIS previously prepared or which could conflict with the EIA undertaken by An Bord Pleanála or the conclusions reached therein.

The evaluation of the existing baseline environment also indicates that 3 no. dwellings have been permitted (and/or constructed) since the preparation of the EIAR/EIS. To fully evaluate the likelihood of significant noise effects resulting from the entire development, it has been considered prudent to re-assess predicted noise levels at all existing, permitted and proposed dwellings within 1,030m of a permitted wind turbine.

Table 11.12 presents the predicted noise levels at all dwellings based on the results of the assessment undertaken in respect of the then-proposed, and now permitted, Pinewoods Wind Farm (see **Chapter 10, Volume III**) (totalling 33 no. dwellings) and also presents a full evaluation of all 36 no. dwellings currently located within 1,030m of a permitted wind turbine (see **Annex 11.3, Volume II**).

Dwelling ID	Predicted Noise Levels (dB(A) L_{90})		
	2016 EIAR/EIS Predictions	2020 EIAR Predictions	Difference (+/-)
H001	36.5	36.5	0.0
H002	37.9	37.9	0.0
H003	38.7	38.7	0.0
H004	40.5	40.5	0.0
H005	38.7	38.7	0.0
H006	39.8	39.8	0.0
H007	39.2	39.2	0.0
H008	39.2	39.2	0.0
H009	39.0	39.0	0.0
H010	40.0	40.0	0.0
H011	38.6	38.6	0.0

Laois County Council Planning Authority. Viewing Purposes Only!

H012	39.1	39.1	0.0
H013*	43.5	43.5	0.0
H014*	43.3	43.3	0.0
H015	39.9	39.9	0.0
H016	39.9	39.9	0.0
H017	38.7	38.7	0.0
H018	38.5	38.5	0.0
H019	37.6	37.6	0.0
H020	36.8	36.8	0.0
H021	37.2	37.2	0.0
H022	40.8	40.8	0.0
H023	37.9	37.9	0.0
H024	36.6	36.6	0.0
H025*	38.0	38.0	0.0
H026*	40.2	40.2	0.0
H027*	41.4	41.4	0.0
H028	39.4	39.4	0.0
H029	38.7	38.7	0.0
H030	40.6	40.6	0.0
H031	41.2	41.2	0.0
H032	37.9	37.8	0.0
H033	38.6	38.6	0.0
H034	-	41.4	-
H035	-	43.6	-
H036	-	38.1	-

Table 11.12: Noise Prediction Model Results

**Economically Involved Dwellings/Landowners*

It should be noted that no changes are proposed to the permitted Pinewoods Wind Farm in terms of turbine positions, turbine type, dimensions or sound power levels, i.e. no change to the inputs to the noise model.

In completing the above evaluation, regard has also been had to Condition No. 19 of An Bord Pleanála's Decision Order for the Pinewoods Wind Farm specifying noise limits to which the permitted wind farm must comply. It is noted that H035 exceeds the specified limit of 43db(A), by 0.6dB; however, mitigation measures, which may include the implementation of noise reduced operations, will ensure that the prescribed noise limit will not be exceeded. On the basis of the above assessment and following the implementation of noise mitigation measures where necessary, it can be confirmed that the permitted development remains fully capable of complying with all prescribed noise limits.

Therefore, given the assessments undertaken in the preceding sections, it is

Laois County Council Planning Authority, Viewing Purposes Only!

concluded that any cumulative effects with the operational Pinewoods Wind Farm will not be significant.

Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, cumulative decommissioning phase effects will not occur.

11.6 Mitigation and Monitoring Measures

11.6.1 Construction Phase

Typical construction noise thresholds are not expected to be exceeded and therefore no specific mitigation measures are proposed. Notwithstanding this, the contractors completing the construction works will be required to undertake noise abatement measures where necessary and comply with the recommendations of *BS5228-1:2009+A1:2014*.

It is proposed that various practices will be adopted during construction as required, including the following:-

- Limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- Establishing channels of communication between the contractor/developer, local authority and residents;
- Appointing a site representative responsible for matters relating to noise and vibration;
- Monitoring typical levels of noise and vibration during critical periods and at sensitive locations; and
- Keeping site access tracks even to mitigate the likelihood of vibration from HGVs.

Furthermore, a variety of practical noise control measures will be employed. These include:-

- Selection of plant with low inherent likelihood of generation of noise and/or vibration;
- Placing of noisy/vibratory plant as far away from sensitive properties as permitted by site constraints, and;
- Regular maintenance and servicing of plant items.

11.6.1.1 Noise

The contractors involved in the construction phase will be obliged, under contract, to undertake specific noise abatement measures and comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*. The following list of measures will be implemented, as relevant, to ensure compliance with the relevant construction noise criteria:-

- No plant or machinery will be permitted to cause a public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use

Laois County Council Planning Authority, Viewing Purposes Only!

and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- Any plant, such as generators or pumps, which may be required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen;
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in **Table 11.1** using methods outlined in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*;
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 08:00 and 20:00 Monday to Friday and between 08:00hrs and 18:00hrs on Saturdays, with no operations on Sundays or public holidays.

Based on assessment of the geological composition of the site, it is concluded that rock-breaking will not be required. In the unlikely event that rock breaking is necessary, the following measures will be implemented to mitigate noise emissions:-

- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency;
- Ensure all air lines are sealed;
- Use a dampened breaking bit to eliminate a 'ringing' sound; and
- Erect an acoustic screen around breaking activities. Where possible, line of sight between top of machine and reception point should be obscured.

11.6.1.2 Vibration

Vibration from construction activities shall be limited to the values set out in **Table 11.3**. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Considering the substantial distances between locations where vibration may be generated and the nearest sensitive locations, no likely significant effect will be experienced. Therefore, no mitigation measures are proposed.

11.6.2 Operational Phase

Noise emissions associated with the proposed development during the operational phase will not be significant and are predicted to be well within the criteria set out in **Section 11.3.2**. Therefore, no mitigation measures are required.

11.6.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

11.6.4 Monitoring

11.6.4.1 Construction Phase

No monitoring of noise levels during the construction phase is proposed.

Laois County Council Planning Authority Viewing Purposes Only!

11.6.4.2 Operational Phase

No monitoring of noise levels during the operational phase is proposed.

11.6.4.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase monitoring is required.

11.7 Residual Effects

This section outlines the likely residual noise and vibration effects associated with the proposed development taking account of the proposed mitigation measures.

11.7.1 Do Nothing Scenario

If the proposed development were not to proceed then the existing noise environment will remain unchanged.

11.7.2 Construction Phase

During the construction phase, there will likely be some effect on nearby noise sensitive locations due to noise emissions from site traffic and other activities. However, given that the construction phase of the development is temporary in nature and the distances between the main construction works and nearby noise sensitive properties, it is assessed that the noise generated will not be excessively intrusive. Furthermore, the application of noise limits, in accordance with best practice standards, and construction hours, along with implementation of appropriate noise and vibration mitigation measures, will ensure that noise and vibration effects are unlikely to be significant. The residual effects are assessed to be likely, negative, slight, temporary; and unlikely to be significant.

11.7.3 Operational Phase

11.7.3.1 Noise

The effects of the day to day operation of the proposed development, in combination with the operational Pinewoods Wind Farm, have been assessed and no likely significant residual effects are assessed as likely.

11.7.3.2 Vibration

There is no anticipated source of vibration related with the operational phase of the proposed development and therefore no residual effect is assessed as likely.

11.7.4 Cumulative Effects

There are no existing, permitted or proposed developments which have the likelihood of resulting in a significant cumulative effect on the noise sensitive locations in the study area.

11.8 Summary

This noise and vibration impact assessment of the proposed development has been undertaken for both the long-term operational and short-term construction phases.

The predicted noise and vibration levels associated with the construction phase are expected to be well within criteria thresholds. Notwithstanding the above, all construction activities will incorporate noise abatement measures where necessary and comply with the recommendations of *BS5228-1:2009+A1:2014*.

The assessment has concluded that there are no likely significant noise and vibration

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effects associated with the operational phase of the proposed development.

The likely cumulative effects for both the construction and operational phases of the proposed development with the permitted Pinewoods Wind Farm have been assessed and have been determined not to be significant.

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Pinewoods Wind Farm Substation & Grid Connection

Chapter 12: Shadow Flicker

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Contents

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12.1 Introduction

This chapter addresses the likely effects of shadow flicker on nearby properties within the vicinity of the proposed development. The proposed development is, of itself, not a type of development which can cause shadow flicker to occur due to the absence of moving parts. However, given that he proposed development forms part of the overall Pinewoods Wind Farm, which comprises 11 no. permitted wind turbines, it has been considered appropriate to re-evaluate the likelihood of significant shadow flicker effects to arise as a result of the entire project.

In addition to the absence of moving parts, the proposed development does not comprise particularly tall structures. The tallest structures associated with the proposed development are the strain towers which, at 20.75m, are substantially smaller than the permitted wind turbines, at 136.5m.

As with all tall structures, wind turbines can cast long shadows on neighbouring areas when the sun is low in the sky. During sunny conditions and under certain combinations of geographical position, weather conditions and the time of day, the sun may pass behind the moving wind turbine blades and cause a shadow to flicker on and off of neighbouring properties. This is phenomenon known as shadow flicker.

Dwellings and buildings may be affected by shadow flicker (i.e. when a turbine blade shadow passes an open door or window within a flicker zone) as the sunlight comes from one source. Shadow flicker is not as obvious outside as sunlight comes from all directions.

Shadow flicker generally lasts only for a short period and happens only in certain specific combinations of weather and geographic conditions such, as follows:

- The sun is shining and is at a low angle in the sky (after dawn and before sunset);
- The turbine is located directly between the sun and the affected property;
- The wind speed is high enough to move the turbine blades, and
- The turbine blades are orientated such that they are horizontal to the sun.

Given the very low likelihood of such conditions occurring simultaneously, the likelihood of significant shadow flicker effects is low.

12.1.1 Description of the Proposed Development

In summary, the proposed development comprises the following main components:-

- 1 no. 110kV 'loop in-loop out' air-insulated switchroom (AIS) substation including control buildings, transformers and all ancillary electrical equipment; and
- All associated site development, access and reinstatement works.

The entirety of the proposed development is located within the administrative area of County Laois; while overall Pinewoods Wind Farm project is partly located within County Laois and County Kilkenny. Additionally, candidate quarries which may supply construction materials are also located within County Kilkenny and Carlow.

A full description of the proposed development is presented in **Chapter 3**.

12.2 Statement of Authority

This chapter has been prepared by members of the GES Environment & Planning Team, with specialist technical input provided by Cormac McPhillips, Project

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Technician at GES. Cormac has significant experience of preparing shadow flicker prediction models for a number of existing and permitted wind energy developments, including for a number of operational phase shadow flicker monitoring programmes, and has carried out visual inspections to confirm the efficacy of the prediction models and mitigation measures.

12.3 Assessment Methodology

Given that the proposed development forms part of an overall project which includes wind turbines, it is considered prudent to re-assess the development, as a whole, to account for any changes to baseline conditions since the completion of the Pinewoods Wind Farm shadow flicker assessment (see **Volume III Chapter 11**).

However, as no part of the proposed development; substation, site access tracks, site entrance and construction material haul routes; can generate shadow flicker, these elements have been screened out from further analysis and the following assessment will focus on the likelihood of significant shadow flicker effects arising from the permitted wind turbines in the context of current baseline conditions.

Concerns raised by local residents and consultees in previous submissions related to the Pinewoods Wind Farm as they relate to shadow flicker were also assessed in the preparation of this chapter.

12.3.1 Wind Energy Development Guidelines for Planning Authorities

The assessment has been carried out in accordance with all statutory guidelines and uses techniques which are recognised as best practice by the relevant environmental health organisations. The Wind Energy Development Guidelines for Planning Authorities 2006 state:-

> *"Careful site selection, design and planning, and good use of relevant software, can help avoid the possibility of shadow flicker in the first instance. It is recommended that shadow flicker at neighbouring offices and dwellings within 500m should not exceed 30 hours per year or 30 minutes per day. 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"*

Given that the guidelines state that the likelihood of shadow flicker at distances greater than 10 no. rotor diameters from a turbine is low, all existing and permitted dwellings within 10 no. rotor diameters of a permitted wind turbine have been assessed.

12.3.2 Passing Frequency

A periodic change in the light produced by the sun occurs at a particular location because of the rotating wind turbine rotor. This is referred to as a pulsating light level. Research has shown that the consequences of the pulsating light level are dependent on the frequency. The frequency is determined by the speed of the rotor and the number of rotor blades in the case of wind turbines.

From this research, including research done into the lighting of traffic tunnels, most people tested who experienced frequencies between 5 and 10 Hz (Hertz) were subject to virtually no nuisance. The candidate turbine (see above) has a typical rotational speed of 10rpm (revolutions per minute) and three rotor blades. The

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maximum passing frequency is, therefore 0.5Hz (30 times per minute), which is well below nuisance level. The effects of passing frequencies have, therefore, not been considered in this assessment.

12.3.3 Wind Turbine Model

As outlined in **Volume III Chapter 2**, a specific wind turbine model has not yet been selected and will only be confirmed following a pre-construction tendering process. The primary dimension of the wind turbines to be installed will be 136.5m (up to) and this will not be altered by the turbine model ultimately erected.

The shadow flicker prediction model (**Volume III Chapter 11**) was undertaken on the basis of a candidate wind turbine (the General Electric GE3.2-103) with a hub height of 85m and a rotor diameter of 103m. While an alternate turbine may be installed at the site, it is considered appropriate to utilise the General Electric GE3.2-103 to re-evaluate the development to ensure consistency of results and allow for a comparative analysis.

12.3.4 Receptor Survey

The location of all properties near the proposed development was recorded using Ordnance Survey Ireland (OSI) data, a detailed planning registry search and a physical survey of the area. The topography of the local area, the proposed development site and the elevation of nearby receptors was also modelled using OSI data.

A total of 36 no. receptors within 1,030m radius (10-times overall tip height of the candidate turbine) were identified. This represents an increase of 3 no. additional permitted/existing dwellings compared to the shadow flicker assessment undertaken in respect of the permitted Pinewoods Wind Farm. All 36 no. dwellings, the locations of which are illustrated at **Annex 12.1**, have been assessed for the effects of shadow flicker at **Section 12.5.2** below.

12.3.5 Impact Prediction Model

WindPro software, a detailed computer model which can estimate the occurrence of shadow flicker, was used to predict the likely impact of the permitted development. The prediction model assesses the likelihood of shadow flicker occurring at receptor locations relative to the wind turbine locations and with long term average sunshine hours.

12.3.6 Model Assumptions

It is important to note that shadow flicker is a relatively minor and short-lived phenomenon which only occurs in the very rare instances when a combination of a number of very specific meteorological and physical conditions happen concurrently, as follows:-

- the sun is shining and is at a low angle (after dawn and before sunset);
- there is sufficient direct sunlight to cause shadows (i.e. no cloud, mist, fog);
- the turbine is directly between the sun and the receptor, and within a distance that the shadow has not diminished below perceptible levels;
- there is no screening vegetation or other structures between the turbine and the receptor which would diminish shadow below perceptible levels; and
- there is enough wind energy to ensure that the turbine blades are moving.

The concatenation of these conditions to cause shadow flicker at any receptor is highly unusual and even the occasional events that do occur usually go entirely

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unnoticed.

Sunshine Hours & Angle

Shadow flicker cannot occur if the sun is not shining, therefore the probability of sunshine must be considered as part of this assessment. Historical metrological data from 1978 to 2007 from Kilkenny Meteorological Station was used to assess the number of sunshine hours (c. 20km from the permitted wind turbines) (see **Table 12.1**).

Mean Daily Duration (hours/day)										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.8	2.3	3.2	4.9	5.6	4.9	4.7	4.7	4.0	3.0	2.2	1.6

Table 12.1: Average Daily Sunshine Hours (Kilkenny Station 1978-2007)

A simple calculation using the above recorded data shows that the probability of sunshine is approximately 3.58 hours per day when averaged over a 12 month period. The absence of a high mean daily duration of sunshine will result in a significant decrease in the possibility of shadow flicker effects when the 'worst case' scenario is adjusted.

There is a great difference in light levels between a shadow at a short distance and a shadow at a long distance. The likely effects are greatest at a short distance from the wind turbine since the rotor blade screens the whole of the sun at a short distance. Shadows at a greater distance from the wind turbine have a low intensity since the blades no longer cover the sun completely and, therefore, the light contrast is strongly reduced. If an observer experiences shadow from the sun when it is lower than three degrees above the horizon, the distance to the wind turbine will be of such a length that it is likely that the consequences of the intensity of the shadow can be ignored. Sunshine is, moreover, generally tempered by mist, cloud cover, vegetation growth or buildings in the surrounding area when the position of the sun is lower than three degrees. To account for this, the sun's minimum angle has been set at three degrees in the shadow flicker model.

Greenhouse Mode

Each receptor is modelled in 'greenhouse' mode. This effectively assumes a conservative 'worst case' impact where each receptor is constructed entirely of glass (windows on all elevations) and that no intervening screening is afforded by walls, vegetation or other opaque objects between the receptor and the wind turbine

Turbine Rotation

The candidate wind turbine, a General Electric GE3.2-103, has a cut-in wind speed of 3m/s and cut out of 25m/s. According to the wind atlas and data obtained from the on-site meteorological mast, the average adjusted wind speed over the proposed development site is approximately 8.25m/s at 85m. Typically in Ireland, wind speed is between 3m/s and 25m/s for 85% of the time (based on an average of 8m/s). Therefore the turbines are likely to be operational for 85% of the year.

The shadow flicker model, however, assumes that turbine rotors are rotating 100% of the time. Therefore, the model is highly conservative, precautionary and does not account for the turbines being non-operational for a variety of reasons including grid

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unavailability, turbine maintenance and turbine breakdown. The turbine is likely to be non-operational for 15% of the time due to the above factors.

Wind Direction & Rotor Orientation

Wind direction plays a crucial role in determining the likelihood of shadow flicker. A wind turbine directs the rotor at right angles to the wind direction (turns the rotors to 'attack' the wind in order to generate power) when there is sufficient wind. The wind direction is, therefore, the critical determining factor for the orientation of the rotor and also for the position of the rotor in relation to the sun.

Given weather variability, it is not possible that that sunshine will always coincide with wind turbines facing parallel the sun such that the blades are orientated in a horizontal position (directly or indirectly) to cause shadow flicker at any receptor. However, it is assumed for the purposes of the model that, when the sun is shining, wind direction is such that shadow flicker can be caused at all receptors simultaneously.

Summary of Assumptions

In summary, the 'worst case' shadow flicker model calculation is based on a number of conservative and highly precautionary assumptions, as follows:-

- It is assumed that the sun is always shining, there is constant adequate wind speed such that each turbine is always rotating and that the turbine rotor tracks the sun by orientating the turbine exactly as the sun moves, such that shadow flicker is caused at receptors;
- Ordnance Survey Ireland digital data is used as the only topographical reference. Simulations are run on a 'lunar landscape' without allowing for the obscuring effect of any vegetation or other structures between the location of receptors and the position of the sun in the sky;
- Each receptor is constructed entirely of glass (i.e. windows on all elevations), all the rooms are occupied and that the curtains or blinds, if present, are always open; and
- There will be no downtime for any of the turbines as a result of a mechanical fault, grid availability or routine maintenance.

12.3.7 Assumed v. Expected Shadow Flicker

The *Wind Energy Development Guidelines for Planning Authorities 2006*[1] require shadow flicker to be limited to 30 minutes per day and 30 hours per year at sensitive receptors. The guidelines provide that applicants should present calculations to quantify the effect of shadow flicker. As a consequence, and in order to demonstrate compliance with the guidelines, the modelling analysis and calculations are presented in 'minutes per day' and 'hours per year'. The requirement to present the data in this manner is problematic and can often result in a misunderstanding of the actual impact.

This is due to the fact that the long-run accurate modelling of shadow flicker in 'minutes per day' is not possible as weather conditions on a daily basis are inherently changeable over such a short timeframe and evidently cannot be predicted in advance. For example, over the course of a year, the model can assume that it will be sunny for a percentage of the year (based on historic meteorological data) and

[1] The draft *Revised Wind Energy Development Guidelines 2019* propose to eliminate the occurrence of shadow flicker at dwellings. However, as the revised guidelines remain in draft format, the *Wind Energy Development Guidelines for Planning Authorities 2006 are the* applicable guidelines under which to carry out this assessment.

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the 'worst case' predictions can be adjusted accordingly to find the 'expected' shadow flicker hours. However, over the course of a day, it cannot be assumed that it will only be sunny for a percentage of the day (it may be sunny all day or not at all). As a result, the model significantly overestimates the predicted minutes of shadow flicker which will likely be experienced at any receptor on any given day and the 'minutes per day' criterion is not, therefore, representative of actual shadow flicker which will be experienced. Most dwellings will experience considerably less shadow flicker, if any at all. This approach is in full accordance with the precautionary principle.

On the other hand, modelling over a longer timeframe of one year, the 'expected' values ('hours per year') consider the probability of sunshine and predominant wind direction based on historic meteorological data. Modelling over such a longer time span is therefore more accurate and more representative of the actual levels of shadow flicker which are likely to be experienced. However, while more accurate, given the assumptions inherent to the prediction model, as set out at **Section 12.3.6**, even the 'hours per year' criterion represents a conservative approach.

Therefore, and as is best practice, the values presented in this chapter are conservative 'worst case' hours per day (in accordance with a precautionary approach) and 'expected' hours per year.

12.4 Description of the Existing Environment

The receiving baseline environment is rural and relatively remote and, as a result, the area is sparsely populated. The study area (i.e. 10-times rotor diameter from a permitted wind turbine) is characterised by one-off dwellings, often accompanied by agricultural buildings.

A total of 36 no. receptors have been identified within 1,030m of a permitted wind turbine (10-times rotor diameter) as illustrated at **Annex 12.1**.

12.5 Description of Likely Effects

As discussed at **Section 12.3**, given the absence of tall structures or moving parts, there is no possibility for shadow flicker to be generated from the proposed development during the construction, operational or decommissioning phases. The following assessment of likely effects will, therefore, re-evaluate the likelihood of shadow flicker occurring from the permitted Pinewoods Wind Farm.

12.5.1 Construction Phase

As the permitted wind turbines will not be operational during the construction phase, there is no likelihood of shadow flicker occurring.

12.5.2 Operational Phase

Table 12.2 presents the level of shadow flicker which was predicted to occur at dwellings in the Pinewoods Wind Farm EIAR/EIS (i.e. H001-H033) (see **Volume III Chapter 11**) and also the predicted effects at dwellings H034 to H036 which were not permitted/constructed at the time of preparing the Volume III EIAR/EIS (see **Annex 12.2 (Volume II)**.

The 'worst case' model results[2] indicate that 22 no. receptors are predicted to experience shadow flicker in excess of 30-minutes per day. However, it is again reiterated that this calculation is a 'worst case' scenario and is not representative of

[2] The results of the 2020 prediction model are identical to those of the 2016 prediction.

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likely shadow flicker. As explained above in **Section 12.3.7**, the 'worst case' scenario can only occur under rare, specific combination of circumstances occurring simultaneously i.e. when the sun is at a certain position in the sky, the sun is shining, the turbines rotor is rotating and rotating parallel (directly or indirectly) to the shadow receptor.

The 'expected results' over the course of a year are also presented in **Table 12.2** (reproduced from **Volume III Chapter 11** and **Volume II Annex 12.2**). Of the 3 no. additional dwellings assessed, no receptor is likely to experience shadow flicker in excess of 30-hours per annum. Therefore, it can be confirmed that no dwelling within 1,030m of a permitted wind turbine will experience shadow flicker in excess of the 30-hours per year limit prescribed in the *Wind Energy Development Guidelines for Planning Authorities 2006*.

It is noted that the updated model predicts an additional 1-minute of shadow flicker, over the course of a year, at dwellings H13 and H26 while H028 is predicted to experience a 1-minute reduction in shadow flicker when compared to **Volume III Chapter 11**. Notwithstanding these imperceptible differences over the course of a year, which are solely the result of technological advances in shadow flicker prediction modelling software and which will not be perceptible to residents over the course of a year, predicted levels remain within the prescribed limit and are not contrary to the conclusions reached in the EIAR/EIS or the findings of the Board regarding the absence of likely significant effects.

The highest prediction of shadow flicker effects relates to H026, which is predicted to experience 18:08 (hh:mm) hours per year. Notably, this receptor is economically involved in the Pinewoods Wind Farm. All remaining receptors will experience less than 16-hours of shadow flicker per year.

It should be noted that even the 'expected' results are subject to the precautionary model assumptions as set out in **Section 12.3.7** and therefore likely to significantly overestimate the actual shadow flicker impact.

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Dwelling ID	Predicted Hours per Day (Worst Case) (hh:mm))			Predicted Hours per Year (Expected) (hh:mm))		
	2016 EIAR/EIS Predictions	2020 EIAR Predictions	Difference (+/-)	2016 EIAR/EIS Predictions	2020 EIAR Predictions	Difference (+/-)
H001	00:15	00:15	00:00	00:24	00:24	00:00
H002	00:33	00:33	00:00	04:54	04:54	00:00
H003	00:50	00:50	00:00	06:25	06:25	00:00
H004	00:42	00:42	00:00	12:11	12:11	00:00
H005	00:30	00:30	00:00	08:16	08:16	00:00
H006	00:48	00:48	00:00	10:56	10:56	00:00
H007	00:36	00:36	00:00	08:48	08:48	00:00
H008	00:36	00:36	00:00	08:46	08:46	00:00
H009	00:36	00:36	00:00	08:22	08:22	00:00
H010	00:46	00:46	00:00	11:35	11:35	00:00
H011	00:30	00:30	00:00	07:48	07:48	00:00
H012	00:41	00:41	00:00	12:01	12:01	00:00
H013*	00:31	00:31	00:00	15:49	15:50	00:01
H014*	00:31	00:31	00:00	14:46	14:46	00:00
H015	00:32	00:32	00:00	08:23	08:23	00:00
H016	00:33	00:33	00:00	10:12	10:12	00:00
H017	00:30	00:30	00:00	08:34	08:34	00:00
H018	00:30	00:30	00:00	06:33	06:33	00:00
H019	00:27	00:27	00:00	05:32	05:32	00:00
H020	00:25	00:25	00:00	04:47	04:47	00:00

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H021	00:27	00:27	00:00	06:07	06:07	00:00
H022	00:00	00:00	00:00	00:00	00:00	00:00
H023	00:00	00:00	00:00	00:00	00:00	00:00
H024	00:20	00:20	00:00	02:33	02:33	00:00
H025*	00:21	00:21	00:00	03:00	03:00	00:00
H026*	01:04	01:04	00:00	18:07	18:08	00:01
H027*	00:47	00:47	00:00	13:45	13:45	00:00
H028	00:48	00:48	00:00	08:43	08:42	00:01
H029	00:40	00:40	00:00	13:02	13:02	00:00
H030	00:44	00:44	00:00	09:12	09:12	00:00
H031	01:06	01:06	00:00	10:22	10:22	00:00
H032	00:25	00:25	00:00	08:15	08:15	00:00
H033	00:42	00:42	00:00	06:30	06:30	00:00
H034	-	00:48	-	-	14:11	-
H035	-	00:31	-	-	14:42	-
H036	-	00:29	-	-	06:15	-

Table 12.2: Shadow Flicker Prediction Model Results

**Economically Involved Dwellings/Landowners*

12.5.3 Decommissioning Phase

As the permitted wind turbines will not be operational during the decommissioning phase, there is no likelihood of shadow flicker arising.

12.5.4 Cumulative Effects

Prior to undertaking the impact assessment modelling presented in this chapter, an appraisal of the wider area was undertaken to determine if any cumulative effects could arise with other wind farm developments. Other than the permitted Pinewoods Wind Farm, there are no wind energy developments within 4km of the proposed development. Therefore, it is assessed that there is no likelihood of in-combination effects occurring.

12.6 Mitigation & Monitoring Measures

12.6.1 Construction Phase

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

12.6.2 Operational Phase

Mitigation measures proposed by the Applicant in respect of the Pinewoods Wind Farm were accepted by the Board[3]; and given that a significant increase in shadow flicker effects will not occur, it is assessed that these mitigation measures remain an appropriate means to avoid likely significant shadow flicker effects. It can be confirmed, therefore, that all measures proposed (discussed below) and set out in the Board Order[4] will be implemented in full.

Technological mitigation is available, and widely implemented, on wind farm developments where shadow flicker levels are proven to be in excess of the recommended limits. These mitigation measures effectively limit the operation of turbines during the infrequent and rare periods when shadow flicker occurs. In short, if a particular turbine is creating shadow flicker effects at a particular receptor, then that turbine may be temporarily curtailed. This is usually achieved by turning off the turbines at predetermined times, as predicted by the shadow flicker model, when shadow flicker is proven to occur.

The wind turbines will each be fitted with shadow flicker curtailment software to facilitate their shut down as required. If the sun is shining, the software will turn off the turbine at the predetermined times when shadow flicker is predicted to occur based on the prediction model. This approach will be implemented, as necessary, to ensure that actual levels of shadow flicker do not exceed either of the relevant limits. In particular, the operation of the permitted wind turbines will be curtailed to ensure that no dwelling experiences shadow flicker in excess of 30 minutes on any given day.

Shadow flicker will not be generated by the proposed development and, therefore, further mitigation measures are not required.

12.6.3 Decommissioning Phase

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

[3] Section 7.5.3 of Inspector's Report pursuant to An Bord Pleanála Reference PL11.248518.

[4] Condition 20 of Board Order pursuant to An Bord Pleanála Reference PL11.248518.

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12.7 Residual Effects

The above mitigation measures will ensure that any residual effects which arise following their implementation will not result in any likely significant effects on any receptor. Technological mitigation can effectively exclude any likely significant effects as a consequence of shadow flicker.

The proposed mitigation measures will, where necessary, ensure that shadow flicker levels which may be experienced at receptor locations fall below the prescribed limits of the *Wind Energy Development Guidelines for Planning Authorities 2006*, while the required monitoring programme will confirm the efficacy of the mitigation measures.

12.8 Summary

No part of the proposed development; substation, site access tracks, site entrance and construction material haul routes; has the ability to generate shadow flicker and, therefore, these elements were screened out from further analysis in this chapter. However, given that the proposed development forms part of an overall project which includes wind turbines, it was considered prudent to re-assess the development, as a whole, to account for any changes to baseline conditions since the completion of the Pinewoods Wind Farm shadow flicker assessment (see **Volume III Chapter 11**).

This chapter has assessed the likelihood of shadow flicker effects at all existing, permitted and proposed dwellings (36 no.) located within 10-times rotor diameter (1,030m) of the permitted turbines using a shadow flicker model. This represents an increase of 3 no. additional permitted/existing dwellings compared to the shadow flicker assessment undertaken in respect of the permitted Pinewoods Wind Farm.

Shadow flicker is a rare phenomenon and can only occur during the infrequent coincidence of a number of specific, variable meteorological and geographic factors. The shadow flicker model is also based on a number of precautionary assumptions which significantly overestimate the likely shadow flicker effect at any receptor.

There is no likelihood of any significant effects during the construction or decommissioning phases as the permitted wind turbines will not be operational.

During the operational phase, 22 no. receptors are predicted to exceed the 30-minutes per day criterion in a 'worst case' modelled scenario, in the absence of mitigation. The 'expected' shadow flicker hours per year is not predicted to exceed the 30 hours per year criterion at any dwelling.

Technological mitigation measures are available, and widely implemented, to exclude the likelihood of significant shadow flicker effects. The implementation of such mitigation is required by Condition 20 of the permitted Pinewoods Wind Farm planning permission (PL11.248518). These measures will ensure that no dwelling experiences shadow flicker levels in excess of either of the 30-minutes per day or 30-hours per year criterion. Therefore, it is concluded that the proposed development will not result in any likely significant shadow flicker effects, either individually or in combination with other existing, permitted or proposed developments including the permitted Pinewoods Wind Farm.

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Pinewoods Wind Farm Substation & Grid Connection

Chapter 13: Material Assets

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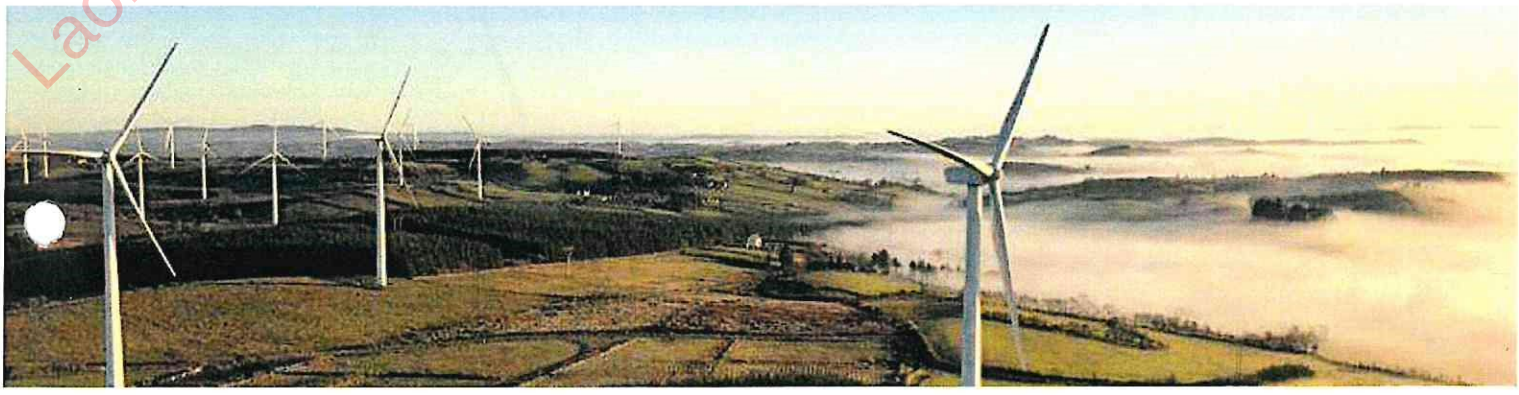

Laois County Council Planning Authority, Viewing Purposes Only!

Contents

Laois County Council Planning Authority, Viewing Purposes Only!

13.0 Introduction

Material Assets are defined as *"resources that are valued and that are intrinsic to specific places"* which can be of human or natural origin[1]. While the meaning is less clear than other environmental factors, Material Assets are taken to mean *"built services and infrastructure"*[2]. The majority of assets of natural origin are assessed elsewhere within this EIAR such as biodiversity, water quality, air quality and landscape. This chapter addresses, therefore, assets which are of intrinsically human origin, including transport, access, aviation, telecommunications, and resources & utility infrastructure. Another material asset of human origin, archaeology and cultural heritage, is addressed in **Chapter 10.**

13.0.1 Description of Proposed Development

In summary, the proposed development comprises the following main components:-

- 1 no. 110kV 'loop in-loop out' air-insulated switchroom (AIS) substation including control buildings, transformers and all ancillary electrical equipment; and
- All associated site development, access and reinstatement works.

The entirety of the proposed development is located within the administrative area of County Laois; while the overall Pinewoods Wind Farm project is partly located within County Laois and County Kilkenny. Additionally, candidate quarries which may supply construction materials are also located within County Kilkenny and Carlow.

A full description of the proposed development is presented in **Chapter 3**

13.1 Transport & Access

13.1.1 Introduction

13.1.1.1 Background and Objectives

The following section provides an assessment of the likely significant effects on transport and access resulting from the construction, operation and decommissioning of the proposed development. Full details of the proposed development are provided in **Chapter 3**.

This section provides an assessment of the local road network for construction, operational and decommissioning traffic and reviews the site access arrangements for construction, operational and decommissioning phases of the proposed development.

It should be noted that the likely effects of the construction and operation of a 110kV electricity substation have previously been fully assessed by An Bord Pleanála at this general location and were found not to be significant. However, due to alterations to the precise design of the proposed development versus that previously assessed and to ensure that the proposed development is fully evaluated within this Volume I EIAR; the likelihood of significant effects, both individually and cumulatively with other developments, has been fully assessed in this chapter.

[1] Draft Advice Notes for preparing Environmental Impact Statements (EPA, 2015)
[2] Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2017)

Laois County Council Planning Authority Viewing Purposes Only!

13.1.1.2 Statement of Authority

This section has been prepared by members of the GES Environment & Planning Team. GES has substantial experience having prepared Material Asset (Transport & Access) chapters for multiple EIAR developments.

13.1.2 Methodology

13.1.2.1 Assessment Methodology

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

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

13.1.2.2 Planning Policy & Guidelines

This assessment has been prepared and carried out in accordance with guidance contained in the following published documents:-

- Draft Advice Notes on Current Practice (in the preparation on Environmental Impact Statements) (EPA, 2015);
- Draft Revised Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2017);
- Advice Notes on Current Practice (in the Preparation on Environmental Impact Statements) (EPA 2003);
- Guidelines on the Information to be Contained in Environmental Impact Statements (EPA 2002);
- Laois County Council Development Plan 2017-2023 ('the CDP');
- The Design Manual for Urban Roads and Streets ('DMURS')[3];
- The Design Manual for Roads and Bridges ('DMRB') published by Transport Infrastructure Ireland ('TII'); and
- Traffic and Transport Assessment Guidelines (TII, 2014[4]).

An assessment of the relevant transport policies and objectives of the CDP are set out in **Table 13.1** below.

Planning Objective	Assessed	Comment
OBJECTIVE TRANS 1: Support the sustainable transport principles outlined in Smarter Travel: A Sustainable Transport Future (Department of Transport, 2009).	Yes	The implementation of this objective will be assessed at **Section 13.1.4.1** and **Section 13.1.4.2**
OBJECTIVE TRANS 2: Upgrade and improve the hierarchy of road transportation links between town and villages to cater for existing trip generation numbers and patterns and provide for anticipated trip generation numbers and patterns as	No	Improvement of transportation links between towns and villages is not relevant to this proposed development.

[3] http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C32669%2Cen.pdf
[4] https://www.tiipublications.ie/library/PE-PDV-02045-01.pdf

Laois County Council Planning Authority, Viewing Purposes Only!

envisaged by the settlement strategy and economic development strategy.		
OBJECTIVE TRANS 3: Where roads are being improved and upgraded the opportunity will be taken where possible to address inadequate existing mitigation measures or impeded passage, for example the inclusion of mammal underpasses or dry ledges where there is poor culvert design.	No	The proposed development does not propose improvements or upgrades to public roads
OBJECTIVE TRANS 4: To integrate land use policies and transportation in a manner which reduces reliance on car based travel and promotes more sustainable transport choices.	No	The proposed development does not require the integration of land use policies.
OBJECTIVE TRANS 5: To guide development to ensure that it is positioned in a location which minimises the need to travel and co-ordinates particular land uses with their accessibility requirements.	Yes	The proposed development has been located adjacent to the Laois-Kilkenny Grid Reinforcement Project and the Pinewoods Wind Farm to minimise travel between these associated developments.
OBJECTIVE TRANS 6: Ensure that all proposed plans or projects relating to transportation (including walking, cycling, rail, bus and roads) and any associated improvement works, individually or in combination with other plans or projects, are subject to Appropriate Assessment Screening to ensure there are no likely significant effects on the integrity (defined by the structure and function) of any Natura 2000 site(s) and that the requirements of Articles 6(3) and 6(4) of the EU Habitats Directive are fully satisfied. Where the plan or project is likely to have a significant effect on a Natura 2000 site, or there is uncertainty with regard to effects, it shall be subject to Appropriate Assessment. The plan or project will proceed only after it has been ascertained that it will not adversely affect the integrity of the site or where in the absence of alternative solutions, the project is deemed imperative for reasons of overriding public interest, all in accordance with the provisions of Articles 6(3) and 6(4) of the EU Habitats Directive.	Yes	The proposed development has been fully assessed in the accompanying Natura Impact Statement.
Planning Policy	**Assessed**	**Comment**
TRANS 7: Avoid the creation of any new direct access points from development or the generation of increased traffic from existing direct access/egress points to the national road network to which speed limits	No	The proposed development does not provide for the creation of access points from the national road network.

Laois County Council Planning Authority, Viewing Purposes Only!

greater than 60kmh apply.		
TRANS 8: Support and provide for improvements to the national road network, including reserving corridors for proposed routes, free of development, so as not to compromise future road schemes.	No	The proposed development does not provide for any improvements to the national roads network nor does it impact upon any future national road network schemes.
TRANS 9: Prevent inappropriate development on lands adjacent to the existing national road network, which would adversely affect the safety, current and future capacity and function of national roads and having regard to possible future upgrades of the national roads and junctions.	No	The proposed development is not located adjacent to or in the vicinity of the national roads network.
TRANS 10: Ensure that any development permitted along national roads is in accordance with the Spatial Planning and National Roads – Guidelines for Planning Authorities (DoECLG, 2012) or any updated version.	No	The proposed development is not located adjacent to or in the vicinity of the national roads network.
TRANS 11: Facilitate a limited level of new accesses or the intensified use of existing accesses to the national road network on the approaches to or exit from urban centres that are subject to a speed limit zone between 50kmh and 60kmh otherwise known as the transition zone. Such accesses will be considered where they facilitate orderly urban development and would not result in a proliferation of such entrances, leading to a diminution in the role of these transitional zones. The Council will have regard to the nature of the proposed development and the volume of traffic to be generated by it and the implications for the safety, capacity and efficient operation of the national road. A Road Safety Audit, prepared in accordance with the Design Manual for Roads and Bridges (NRA, 2010), shall be submitted where appropriate.	No	The proposed development does not provide for the creation of access points from the national roads network.
TRANS 12: Control the signage on and adjoining national roads in accordance with the Spatial Planning and National Roads Guidelines for Planning Authorities (DoECLG, 2012) and the National Roads Authority's policy statement on the Provision of Tourist and Leisure Signage on National Roads (March 2011) and any updated versions of these documents.	No	The proposed development does not provide for the erection of any signage along the national road network.
TRANS 13: Support all measures to ensure HGVs use the motorway network.	Yes	The implementation of this policy is assessed at **Section**

Laois County Council Planning Authority, Viewing Purposes Only!

		13.1.4.1.
TRANS 14: Consider permitting access for replacement dwellings for persons who [or their families] own the original house and site for a minimum of 10 years [documentary evidence in this regard to be submitted] subject to the following provisions: • The original dwelling is in-situ and is habitable; • The cost of refurbishment of and/or extension to the original dwelling is prohibitive; • The applicant complies with the provisions of the local need factor of the rural housing policy as outlined in Section2.6.1; • An alternative site with access onto a minor road is not available; • The proposed development can be accommodated without the creation of a specific traffic hazard; • Where possible an existing entrance is used; • The Councils road standards are fully met; • The site is of minimum size of 0.202 hectares[0.5acres]; • If necessary, a replacement septic tank drainage system in accordance with the requirements of the EPA Code of Practice: Waste Water Treatment and Disposal Systems Serving Single Houses (p.e ≤10) 2009 shall be installed on the site.	No	The proposed development does not provide for the creation of access points from the national roads network.
TRANS 20: Encourage and facilitate investment in the local road network.	No	The proposed development does not provide for any upgrade to the local roads network.
TRANS 21: Subject to availability of resources, provide for and carry out improvements to sections of local roads that are deficient in respect of realignment, structural condition or capacity, and to maintain that standard thereafter.	No	The proposed development does not provide for any upgrade to the local roads network.
TRANS 22: Require development proposals accessing onto local roads to comply with the Council's road standards contained in the Road Design Section document titled Roads and Parking Standards (2007) and to any subsequent revisions thereto.	Yes	The implementation of this objective will be assessed at **Section 13.1.4.1** and **Section 13.1.4.2.**
TRANS 23: In retrofitting and developing	No	The proposed development

Laois County Council Planning Authority, Viewing Purposes Only!

new roadways the planning authority and developers shall have regard to Design Manual for Urban Roads and Streets (DTTS and DECLG,2013].		does not provide for the retrofitting of existing roadways or development of new roadways.
TRANS 24: Ensure that the Council's own development and those of other developers and agencies has regard to the Design Manual for Urban Roads and Streets (DTTS and DECLG, 2013). Proposals shall: a. Consider the needs of pedestrians, cyclists and public transport users ahead of the needs of private car drivers; b. Seek to create more attractive places on roads/streets which communities can understand and enjoy; c. Seek to ensure that the design of the road/street is influenced by its function and the contexts of the places that road/street passes through, and that permeable and legible street networks are promoted; d. Have regard to the detailed advice and standards within the Manual including: i. Speed limits and traffic and congestion management; ii. Street landscaping; iii. Active street edges; iv. Control of traffic noise and pollution; v. Signage and linemarking; vi. Street furniture and lighting; vii. Material and finishes; viii. Historical contexts; ix. Pedestrianised and shared surface areas.	No	The proposed development does not propose works in an urban setting.

Table 13.1: Relevant Transport Objectives & Policies from Laois County Development Plan 2017-2023

The R430, which will be used as a haul route for construction materials, is identified as a Strategic Regional Route in the CDP. This route provides a strategic link to main settlements in the county and carries substantial volumes of traffic.

Thresholds relating to traffic impact assessments for new developments are detailed in the TII publication *Traffic and Transport Assessment Guidelines*. The thresholds for the mandatory preparation of a traffic impact assessment, set out at Tables 2.1, 2.2 and 2.3 of the guidelines, have not been exceeded by the proposed development.

13.1.2.3 Desk Study

A desk study of the proposed development site, haul routes and the surrounding area was undertaken. The sources of information included documentary sources, such as those outlined at **Section 13.1.2.2** and an evaluation of aerial imagery and visualisations (e.g. Google Maps and Streetview) to assess the nature and condition

Laois County Council Planning Authority, Viewing Purposes Only!

of the local road network.

Concerns raised by local residents and consultees in previous submissions related to the Pinewoods Wind Farm as they relate to transport and access were also assessed in the preparation of this chapter.

13.1.2.4 Field Work

A site visit, including a walkover survey of the site and a windshield survey of the local road network, was undertaken on 27 March 2020. The site visit was used to verify information obtained as part of the desk study and to visually assess the site entrance location and associated vehicle visibility splays. In addition to data collection with regards the proposed development, this site visit was used to evaluate the findings and conclusions of the Pinewoods Wind Farm EIAR/EIS in respect of transport and access.

13.1.2.5 Evaluation of Likely Effects

Following the assessment of the baseline environment, the available data was used to identify and categorise effects likely to affect the local road network used for the delivery of construction materials and movement of staff and personnel.

The statutory criteria (EPA, 2017; EPA, 2003) for the assessment of impacts require that likely impacts are described with respect to their magnitude, nature (i.e. negative, positive or neutral), transboundary nature (if applicable), intensity and complexity, probability, duration, frequency, reversibility, cumulation and possibility of reducing the effects). The descriptors used in this chapter are those set out in EPA (2002) 'Glossary of Impacts'.

Impacts may be categorised as follows:-

- Direct: where the existing traffic and transport environment in proximity to the proposed development is altered, in whole or in part;
- Indirect: where the traffic and transport environment beyond the proposed development is altered by activities related to the construction or operation of the proposed development; and
- No Impact: Where the proposed development has neither negative nor a positive impact upon the traffic and transport environment.

Sensitivity

The sensitivity of the local transport infrastructure has been identified using the criteria outlined within the TII Guidance. These criteria are outlined in **Table 13.2** below.

Importance	Criteria
Very High	Attribute has a high quality, significance or value on a regional or national scale.
High	Attribute has a high quality, significance or value on a local scale.
Medium	Attribute has a medium quality, significance or value on a local scale.
Low	Attribute has a low quality, significance or value on a local scale.

Table 13.2: Criteria for Rating Site Attributes

Magnitude

The magnitude of likely effects has been defined in accordance with the criteria

Laois County Council Planning Authority: Viewing Purposes Only!

provided in the 2017 EPA publication *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports* as outlined within **Table 13.3** below.

Magnitude of Impact	Description
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics

Table 13.3: Impact Assessment Criteria

Significance Criteria

The significance of the likely effects of the proposed development have been classified by taking into account the sensitivity of receptors and the magnitude of the impacts on them, combined with the likelihood of an event occurring as defined in **Table 13.4**.

Importance of Attribute	Magnitude of Impact			
	Negligible	Small	Moderate	Large
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Severe/ Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/ Moderate

Table 13.4: Rating of Significant Environmental Impacts

13.1.3 Description of Existing Environment

13.1.3.1 Local Road Network

The road network in the vicinity of the proposed development site generally comprises regional and local roads, with the R430, which is designated as a strategic regional route in the CDP, located c. 1.5km north of the site. The R432 is located approximately 3.5km west of the proposed development site, while the R426 is located c. 6km to the southeast. In addition, the N80 National Secondary Road is

Laois County Council Planning Authority Viewing Purposes Only!

located approximately 13km to the northeast of the proposed development site and the N78 is located approximately 9km to the southeast. Many of these roads will be utilised as possible haul routes to transport construction materials to the proposed development site.

Access to the proposed development site will be provided by the national (including motorway) and regional road networks to within approximately 3km of the site. From this point (i.e. junction of the R430 and L7800), access to the site will be via local roads and private access tracks associated with the permitted Pinewoods Wind Farm.

13.1.3.2 Access to the Proposed Development Site

As set out above, access to the proposed development site will largely be via the national and regional road network, with the final c. 3km being via local roads and private access tracks. Where construction materials are being delivered from further afield, suppliers will be actively encouraged to utilise the motorway network, where possible, followed by the national and regional network and, finally, the local road network to access the proposed development site itself.

While the final selection of a haul routes to the site will be dependent on the chosen material supplier(s), suppliers will only be permitted to access the proposed development via the R430, L7800, L78001 and the L77951. Additionally, construction traffic will utilise short sections of private access track associated with the Pinewoods Wind Farm, between the L7800 and L78001 and between the L78001 and L77951. The haul routes from a range of candidate quarries which may be selected to provide construction materials to be the proposed development are illustrated at **Annex 13.1 (Volume II)**.

Access to the proposed development site will be provided by the construction of a new site entrance from the L77951. From the site entrance, c. 0.65km of access track will be constructed to provide access to the proposed substation location.

In relation to the provision of vehicle visibility splays (sightlines), the proposed site entrance has been carefully designed to ensure compliance with the requirements of Table 2.1 of the Laois County Council Roads & Parking Standards 2007. The site entrance, being provided from a local tertiary road, provides for visibility splays of 60m in each direction.

In response to Laois County Council's request for further information (RFI) in respect of the permitted Pinewoods Wind Farm, the proposed construction material haul route has previously been the subject of an extensive and comprehensive condition and structural assessment. The haul route, from the R430, has undergone falling weight deflectometer tests, a road safety audit and a traffic impact assessment which, as a whole, found that significant effects on the road network were unlikely to occur.

All construction related traffic will be instructed to access the proposed development site using the above described vehicular access arrangement and fully laden HGVs will not be permitted to use alternative routes in the immediate vicinity of the proposed development site. As set out at **Section 3.5.1 (Chapter 3)**, and in accordance with a scoping consultation response received from the Roads Design Office of Kilkenny County Council, the L1828 will not be used for the transportation of materials to the site and all suppliers will be prohibited from utilising this road.

Laois County Council Planning Authority. Viewing Purposes Only!

13.1.3.3 Vehicle Specification

Delivery of general construction materials and drawing of aggregates to and from site for the construction of the proposed development will be generally undertaken using standard HGVs, cement mixer trucks, and dump trucks, the largest of which is anticipated to be a 16.5m articulated vehicle as shown in **Figure 13.1** below. The transportation of aggregates will generally be undertaken by 8-wheel tipper trucks, the typical specifications of which are illustrated at **Figure 13.2.**

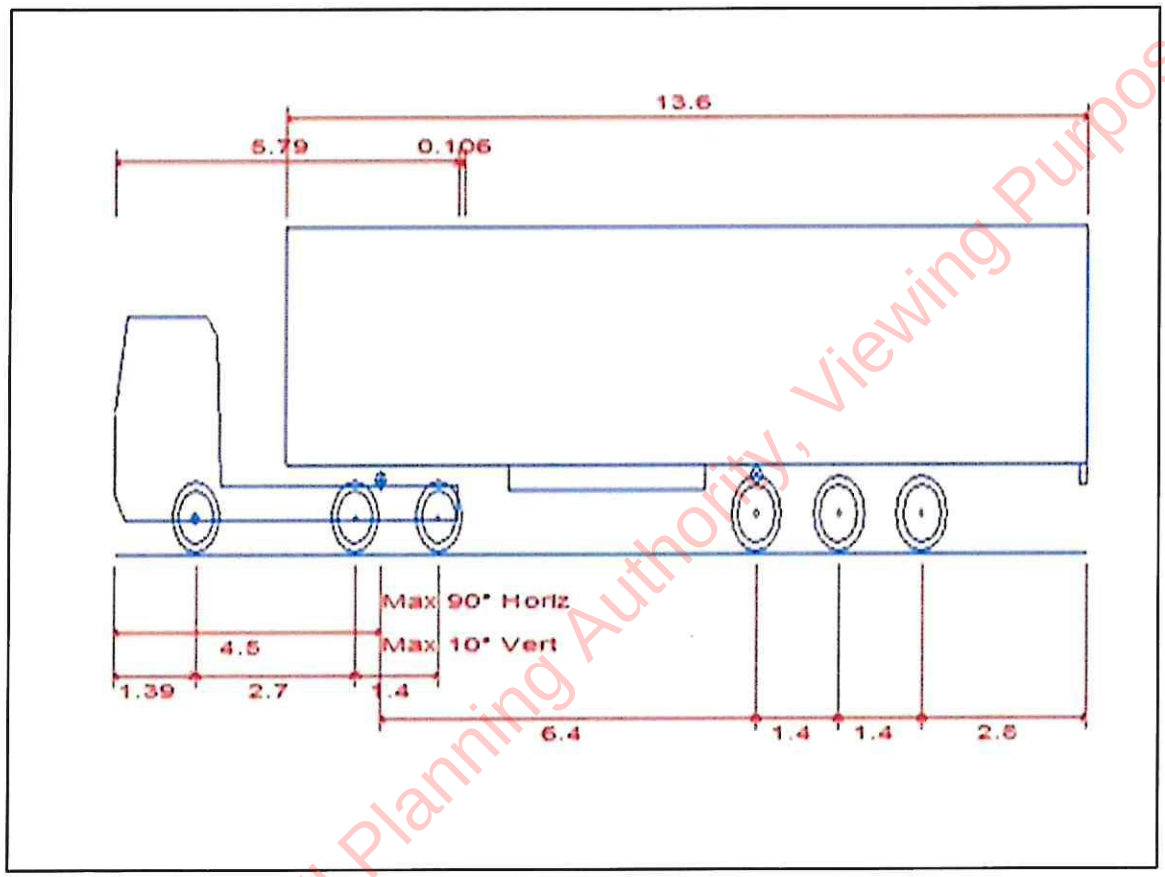

Figure 13.1: Standard HGV

Laois County Council Planning Authority, Viewing Purposes Only!

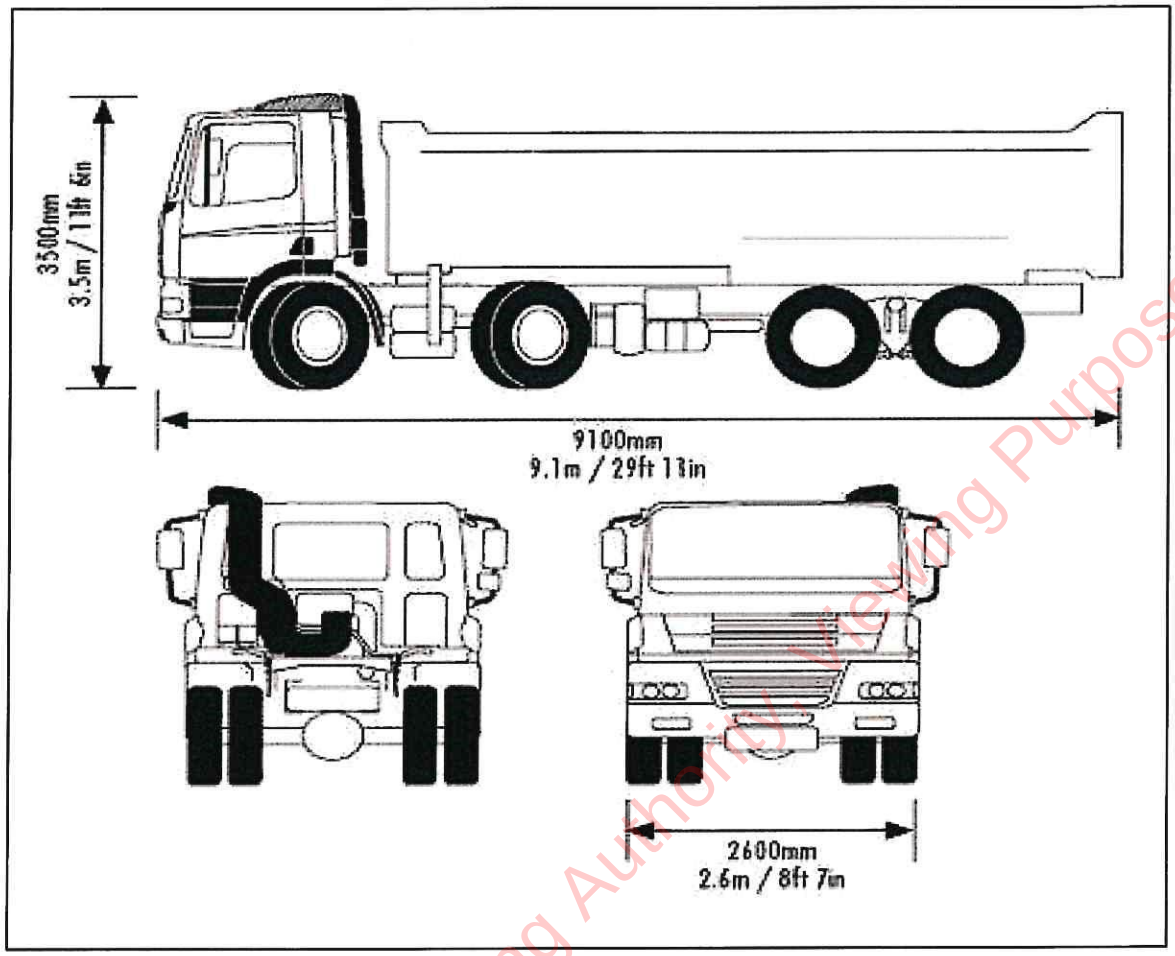

Figure 13.2: Standard Rigid Tipper Truck

13.1.4 Description of Likely Effects

13.1.4.1 Construction Phase

The construction period of the proposed development is estimated to have a duration of approximately 15-18 months, with the majority of traffic movements being associated with the construction of the substation compound and the delivery of electrical apparatus and equipment. During this period, trips will be associated with the arrival and departure of construction staff and with the delivery of aggregates, ready-mix concrete and electrical equipment.

The proposed development site is a sloping site and site excavation will be required to facilitate the required gradients for the buildings, structures and electrical equipment. This will necessitate the drawing of subsoil from the site via standard rigid tipper trucks.

Staff trips will mainly be made using LGVs and crew vehicles, while deliveries of stone, concrete, electrical equipment and other general construction materials will be made by HGV.

The construction phase of the proposed development will comprise a six-day week with normal working hours from 08:00 to 20.00 Monday to Friday and 08:00 to 18.00 on Saturdays. It may be necessary to undertake works outside of these hours to avail of favourable weather conditions or in the event of an emergency. Where

Laois County Council Planning Authority: Viewing Purposes Only!

construction activities are necessary outside of the normal working hours, local residents and the Planning Authority will receive prior notification.

HGV Movements

The estimated timescale for the completion of the construction phase is approximately 15-18 months, which allows approximately 15 months for civil construction and electrical installation and approximately 3 months for commissioning of the substation.

It is estimated that during civil construction, approximately 862 no. loads will be delivered to site; while, over the course of the construction phase, it is estimated that 3,911 loads of excavated material will be transported from the proposed development site to the Pinewoods Wind Farm or off-site for disposal in an appropriate environmentally sensitive manner. Assuming a 15 month civil works construction phase, this equates to approximately 318 no. loads per month or an average of 15 no. loads or HGV movements per day excluding Sundays and public holidays. The majority of civil construction material, such as aggregates, concrete and building materials will be delivered to site using standard rigid trucks, HGVs and ready-mix trucks.

While a substantial portion of the excavated material will be re-used in the formation of the proposed access track and substation compound (see **Chapter 3** and **Chapter 6**), it will also be necessary to import additional aggregate material to finish the access track and substation compound to the requisite specification. It is estimated that a total of 5,148m³ (605 no. loads) of stone aggregates will be imported to site.

There will be an estimated 33,250m³ (3,911 loads) of spoil material excavated which cannot be used in either the construction of the proposed development or, subsequently, in the reinstatement or landscaping of the site. This material will, where possible, be exported to the Pinewoods Wind Farm site for use in the construction of access tracks and areas of hardstanding (where suitable material arises) or may be used for reinstatement or landscaping purposes. Should excess material arise which cannot be re-used at either location, it shall be removed from site and disposed of at a licensed waste facility.

Following the completion of construction works, it is estimated that approximately 25 no. loads will be needed to remove all temporary equipment, plant and machinery and materials used on site e.g. equipment and machinery, fencing, cabins, storage containers etc. **Table 13.5** details the estimated amount of deliveries to/from the proposed development site.

Material	Quantity	No. of Loads
Rock/Stone Aggregates to be imported	5,148m³	605
Electrical Equipment & Cabling	-	87
Miscellaneous Building Materials (control building materials, concrete, fencing, tools etc)	-	130
Strain Towers	-	15
Removal of all temporary on-site equipment and materials	-	25
Transport/Removal of Excavated Material to Pinewoods Wind	33,250m³	3,911

Laois County Council Planning Authority, Viewing Purposes Only!

Farm or off-site		
Total	-	4,773

Table 13.5: Estimated Construction Materials and No. of Deliveries

The expected number of HGV deliveries is based on best estimates of trips generated by similar proposed developments, previous experience of such developments and based on the design of the project. Subject to planning permission being granted, these figures will be subject to refinement following the detailed design process, detailed pre-construction site investigations and consultation with the appointed contractor.

Based on the above estimated vehicular movements, the predicted effect on the road network as a result of the increase in HGV movements associated with the proposed development is moderate, negative, direct, high probability but short term. This assessment has been reached in consideration of the temporary duration of the proposed construction phase and the modest estimated daily increase in HGV movements of 15 no. movements on average.

Construction of Site Entrance

As discussed in **Chapter 3**, a new site entrance will be created to facilitate the construction of the proposed development. The site entrance has been designed to provide appropriate visibility splays. During the construction phase, all works related to the construction of the entrance will be undertaken from private lands which will ensure that there are no significant direct transport and access effects on the local road network through disruption or delay to traffic flows. As a result, effects are assessed to be moderate, negative, short-term and of a high probability.

Construction Personnel

The number of staff employed at the proposed development site will vary according to the phase of works, peaking at up to approximately 50 no. at any one time. It is expected that the majority of workers will arrive on site in LGVs and crew vehicles. In accordance with Objective TRANS 1 of the Laois CDP 2017-2023; vehicle sharing, subject to compliance with all relevant public health advice, will be actively encouraged to reduce vehicular movements. It is expected that c. 15 no. staff vehicles will visit the site on a daily basis during the peak construction period.

Parking for staff will be provided on-site. No parking will be allowed for construction workers on the public road network. The additional vehicular movements associated with staff travelling to site are not assessed as likely to result in significant effects on transport and access. Effects are assessed to be imperceptible/slight, negative, short-term and of high probability.

Overall Classification of Effects

The above sections have assessed the effects of the proposed development on transport and access which may arise as a result of the construction phase. Overall, the effects are not assessed to be significant and are concluded to be a slight, negative effect of short-term duration and high probability.

13.1.4.2 Operational Phase

During the operational phase, the proposed development will generally be unmanned. Operational monitoring activities will be carried out, remotely, on an

Laois County Council Planning Authority Viewing Purposes Only!

ongoing basis. However, regular visits to the site will be undertaken for routine inspections and maintenance. Under normal circumstances, the operation of the proposed development would require 1-2 no. visits to the site per week by maintenance personnel. Parking will be available within the proposed substation and maintenance staff will be instructed not to park on any public road. In the case of a major fault; e.g. change-out of electrical apparatus; larger machinery may require access to the site.

Overall, the volume of traffic predicted to be generated during the operational phase is very low. Therefore, the effect of traffic associated with the operation of the proposed development on the existing public road network will be imperceptible as a result of the type of traffic and the low volumes generated.

13.1.4.3 Decommissioning Phase

As set out at **Chapter 3 (Sections 3.2** and **3.8)**, the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

13.1.5 Cumulative Effects

Cumulative effects are assessed as only likely to occur during the construction phase of the proposed development. Cumulative effects are unlikely to occur during the operational phase due to the absence of significant traffic generation as outlined in **Section 13.1.4.2**.

Other developments which have been included within the cumulative assessment are listed at **Chapter 1**. The majority of developments listed, for example one-off rural dwellings and agricultural developments, do not generate significant volumes of traffic during either the construction or operational phases such that would have the likelihood to result in cumulative effects.

Pinewoods Wind Farm

The proposed development will be commissioned as a single construction phase with the Pinewoods Wind Farm. It is likely, therefore, that cumulative transport and access effects will arise particularly in relation to increased traffic volumes on the surrounding road network. Upgrade works to the public road network associated with the Pinewoods Wind Farm, as permitted by the Board, will be substantially completed prior to the delivery of materials for the proposed development to ensure that the local road network is capable of accommodating the increased traffic volumes and avoid, insofar as possible, additional traffic disruption.

In respect of the permitted development and having regard to the associated traffic volumes and the proposed upgrade works, the Board' Inspector determined that:-

> *"...having regard to the short term duration and subject to detailed mitigation as outlined, the proposal is acceptable for a roads and traffic perspective."*

Subsequently, in deciding to grant planning permission, the Board concluded that:-

> *"...the proposed development would be acceptable in terms of traffic safety and convenience."*

As part of the cumulative assessment, the existing road network has been re-evaluated to determine whether there has been any change to the condition or structural integrity of the road network since the completion of the previous

Laois County Council Planning Authority Viewing Purposes Only!

assessments. The appraisal of the road network comprised a driven windshield survey and a subsequent comparison with the results of previous assessments and it is concluded that there have been no significant changes to the existing road network, or its condition, in the intervening period which would conflict with the conclusions of those assessments or the findings of the Board.

The proposed improvement/upgrade works will ensure that the road network is fully capable of accommodating all construction phase traffic and it is concluded that the proposed development will not result in any significant cumulative effects on the structural integrity of the road network.

The traffic volumes predicted to be generated during the construction of the proposed development are set out at **Section 13.1.4.1**. As set out at **Chapter 13 (Volume III)**, it is predicted that 2,434 no. HGV deliveries will be required to import aggregates to the Pinewoods Wind Farm for the construction of access tracks and hardstandings. The construction phase of the proposed development will involve the export of c. 5,872m³ or approximately 690 no. loads of rock material to the Pinewoods Wind Farm where it will be utilised in the construction of access tracks and areas of hardstanding. The export of this material will utilise a short stretch of the L77951 local road; however, due to the limited volumes of traffic on this road and the absence of dwellings along the stretch of road to be used, no likely significant effects are assessed as likely.

The availability of locally won material at the proposed development site and the opportunity to use this material in the construction of the Pinewoods Wind Farm represents a significant environmental benefit in terms of reducing traffic movements on the wider road network from the predicted level of 2,434 no. to 1,744 no. In this context, the proposed development will result in a beneficial cumulative effect on transport and access.

Overall, while the proposed development will result in an increase in the volume of traffic movements on the local road network during the construction phase; given the conclusion that the effects arising during the construction phase will be slight, negative, short-term and high probability and the conclusions of the Board in respect of the Pinewoods Wind Farm, it is concluded that significant cumulative effects arising from the project as a whole (i.e. proposed development and permitted Pinewoods Wind Farm) are not assessed as likely to arise.

Cullenagh Wind Farm

The Cullenagh Wind Farm, located c. 5km north of the proposed development is not assessed as likely to result in significant cumulative transport and access effects due to the separation distance between the developments and the absence of direct effects and traffic management/restriction requirements resulting from the proposed development.

Laois-Kilkenny Grid Reinforcement Project

The Laois-Kilkenny Grid Reinforcement Project, to which the proposed development will be connected, may be constructed in advance of or concurrently with the proposed development. Should the construction phases overlap, it is likely that there will be a slight, negative, indirect and short term effect on transport and access due to increase construction traffic. However, due to the temporary duration of the construction phase associated with the respective projects and the transient nature of the construction activities associated with the Laois-Kilkenny Grid Reinforcement

Laois County Council Planning Authority, Viewing Purposes Only!

Project, it is concluded that there is no likelihood for significant cumulative effects to arise.

Quarrying Activities

In relation to quarrying activities, given that the proposed development is not located proximate to these developments or along a likely transportation route, significant cumulative transport & access effects are unlikely. As discussed above, due to the requirement to import concrete and aggregates, it is likely that some traffic movements associated with these quarrying activities will, in fact, be to the proposed development site. It is assessed, therefore, that there is no likelihood of significant transport or access effects arising and the likelihood of cumulative effects is assessed to be slight, negative, indirect and short-term.

13.1.6 Mitigation & Monitoring Measures

13.1.6.1 Mitigation

The likely effects of the proposed development have been identified as being slight to moderate and temporary in nature and associated with short-term construction activities. Likely effects during the operational phase have been assessed as being imperceptible and hence mitigation measures are not deemed to be necessary.

As the proposed development is likely to be constructed concurrently with the permitted Pinewoods Wind Farm, all mitigation measures relevant to that particular development will be implemented, as applicable, in respect of the proposed development. The implementation of these measures will ensure that the road network and local residents, businesses and landowners do not experience any likely significant effects.

With regards to the proposed development, while the likelihood of significant effects is not assessed as likely, even in the absence of mitigation; a suite of specific measures are available which will further reduce any likely effects during the construction phase. The following mitigation measures will be implemented:-

- Traffic movements will be limited to 08:00 - 20:00 Monday to Friday and 08:00 – 18:00 on Saturdays with no movements on Sundays or public holidays. It may be occasionally necessary to undertake works outside of these hours to avail of favourable weather conditions or in the event of an emergency. Where construction activities are necessary outside of the normal working hours, local residents and the Planning Authority will receive prior notification;
- Traffic movements associated with the proposed development will be carefully scheduled to minimise, insofar as possible, cumulative vehicular movements during times of peak traffic movements at the Pinewoods Wind Farm (i.e. during turbine foundation concrete pours);
- Wheel washing equipment (e.g. dry ramp system) will be used, as necessary, to prevent any debris being transferred from site to the adjacent public roads. All drivers will be required to ensure that their vehicle is free from dirt and stones prior to departure from the construction site. Where conditions exist for dust to become friable, techniques such as damping down of the affected areas will be employed and vehicles/loads will be covered to reduce dust emissions;
- A Traffic Management Plan shall be agreed as part of the Construction Environmental Management Plan (CEMP) with the Local Authority prior to the commencement of development;

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- All reasonable steps shall be taken to ensure that motorway, national and regional routes are used to transport all materials to/from the site, in so far as is possible. Local roads in the vicinity of the proposed development site, in particular the L77951 between the proposed development site and the Pinewoods Wind Farm, will be regularly inspected to ensure that the structural integrity of the road is not adversely affected due to HGV movements. Should a deterioration in the road condition be identified, remedial measures, in agreement with the local authority, will be implemented;
- The L1828 will not be used for the transportation of materials to the site and all suppliers will be prohibited from utilising this road;
- The proposed site entrance will be reinstated in a manner which ensures that the requisite visibility splays and road safety are maintained;
- Adequate signage shall be provided providing access, safety and warning information;
- Traffic disruption shall be kept to minimum duration and extent;
- A designated contact point and coordinator will be put in place to manage all access arrangement and to interface with the public and the Local Authority; and
- The site shall be closed to the public during the construction phase.

13.1.6.2 Monitoring

The proposed material haul routes, from the R430 to the proposed site entrance, will be monitored during construction to identify any damage which may have been caused by construction traffic. Where any damage has been caused by traffic associated with the proposed development, it shall be repaired by the appointed contractor as soon as practicable.

13.1.7 Residual Effects

13.1.7.1 Construction Phase

There are no significant residual effects, positive or negative, assessed as likely to occur during the construction phase. Mitigation measures have been proposed to offset any likely effects and any residual effects are assessed to be slight, negative and short-term.

13.1.7.2 Operational Phase

There will be no residual effects during the operational phase as only occasional light vehicles are envisaged to visit the site during operation for routine maintenance.

13.1.7.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, residual decommissioning phase effects will not occur.

13.1.8 Summary

This section has assessed the likelihood of significant effects arising on transport and access as a result of the proposed development. The proposed development has generally been assessed as being likely to result in effects of a negative, slight/moderate, direct, short-term, and high probability. After mitigation, the likely residual effects have been assessed as imperceptible/slight, negative and short-term in nature.

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Likely cumulative effects, with the permitted Pinewoods Wind Farm and other developments in the vicinity, are not assessed as likely to be significant.

Overall, this assessment has identified no likelihood of significant effects on transport and access which could arise as a result of the construction, operation or decommissioning of the proposed development either individually or in combination with other existing, permitted or proposed developments. A suite of mitigation measures have also been proposed which will serve to further mitigate and prevent any likely transport and access effects.

Laois County Council Planning Authority, Viewing Purposes Only!

13.2 Aviation

13.2.1 Introduction

This section assesses the likelihood for effects on aviation to arise as a result of the construction, operation or decommissioning of the proposed development. The proposed development is not, due to the absence of particularly tall structures, a type of development which is likely to give rise to effects on or interactions with aviation. However, given that he proposed development forms part of the overall Pinewoods Wind Farm, which comprises 11 no. permitted wind turbines, it has been considered appropriate to re-evaluate the likelihood of significant aviation effects arising as a result of the project as a whole.

The requirement for an assessment of the likely effects on aviation is set in the *Wind Energy Development Guidelines for Planning Authorities 2006* which state:-

> *"The siting of wind turbines may have implications for the operations of communications, navigation and surveillance systems used for Air Traffic Control for the separation and safety of aircraft. Wind turbine siting may also have implications for the flight paths of aircraft."*

13.2.1.1 Statement of Authority

This section has been prepared by members of the GES Environment & Planning Team. GES has substantial experience having prepared Material Asset (Telecommunications) chapters for multiple EIAR developments.

13.2.2 Methodology

The assessment involved consultation with various stakeholders including the Irish Aviation Authority (IAA) and Department of Defence. In addition, publications issued by the IAA and the Department were reviewed to determine if the proposed development site, in combination with the permitted Pinewoods Wind Farm, was assessed as being of significance or if significant effects, additional to those assessed at **Volume III Chapter 12** were likely.

This assessment has also had regard to the Draft Air Corps Wind Farm/Tall Structures Position Paper (August 2014) (**Annex 13.2**) which sets out the Air Corps position to the appropriate siting and management of wind farms and tall structures. This assessment includes a detailed review of this position paper and a spatial comparison of the proposed development site with identified 'Danger Areas', 'Restricted Areas' and 'Low Level Flying Areas'.

13.2.2.1 Consultation

Consultation was undertaken with the IAA and Department of Defence to establish if any effects on aviation resulting from the proposed development were likely. A consultation letter was issued to both in February 2020 (see **Chapter 1**) which included a Scoping Report, a general description of the proposed development and site location drawings.

A response was received from the Department of Defence, see **Annex 1.5 (Volume II)**, who confirmed that it had no observations to make. A response was not received from the IAA.

13.2.3 Description of Existing Environment

There are no major airports in the vicinity of the proposed development. The

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proposed development is located c. 90km southwest of Dublin Airport and c. 110km east of Shannon International Airport.

According to the IAA, there are no aerodromes or airstrips in the immediate vicinity of the proposed development or indeed within county Laois. The nearest licensed aerodrome is 'Kilkenny Airport' in County Kilkenny at an approximate distance of 25km.

At a local level, the Midlands Heliport is located c. 1km southwest of the proposed development site. The heliport is not licensed by the IAA but may, on occasion, be used as a training facility for microlights.

The proposed development site is not located within any 'Danger' or 'Restricted' area as identified at Annex A or B of the Air Corp Position Paper. Similarly, the subject site is not located within 3 no. nautical miles of any critical low level route identified at para. 2(2)(c) and illustrated at Annex D of the Paper. The proposed development is located within a 'Military Operating Area'; however, notably, the Department of Defence has not identified any likelihood of adverse effects.

Air traffic control radar is of two types. Primary Surveillance Radar (PSR) equipment sends out pulses of electromagnetic energy which will reflect off objects in their path. The radar's receiver antenna detects the returning 'echoes' and these are displayed on the radar screen. The time taken for the pulse to travel out to the target and back gives an indication of the range of the object from the radar

Secondary Surveillance Radar (SSR) is the second type of radar equipment used for air traffic control. Like primary radar, SSR relies on an antenna rotating continuously through 360°. However, the radar does not transmit raw pulses of energy; it transmits an interrogation signal. The signal is received at the SSR antenna, decoded, and the height and location of nearby aircraft are presented on the radar screen. This enables controllers to positively identify radar returns on their screens and (after verbal confirmation from the pilot) to confirm the aircraft's height.

13.2.4 Description of Likely Effects

13.2.4.1 Construction Phase

Due to the low altitude of activity during the construction phase, it is assessed that there will be no likely effect on aviation.

13.2.4.2 Operational Phase

Due to the generally low altitude of the proposed development (tallest structure of 20.75m), it is considered that there will be no operation phase effects on aviation.

The proposed development site is not located within any low flying areas, restricted areas, danger areas or low level routes identified within the Air Corps Wind Farm/Tall Structures Position Paper. While the proposed development (and permitted Pinewoods Wind Farm) is located within a 'Military Operating Area'; given the consultation responses received from the Department of Defence in respect of both the proposed and permitted developments, significant effects are not assessed as likely.

With regards the likelihood of effects on the Midlands Heliport, it remains unclear as to the level of activity currently associated with this facility. Indeed, in respect of the permitted Pinewoods Wind Farm, the Board's Inspector, at Section 7.5.9 of her report, stated that she was unable to obtain clarity regarding the operation of the facility. Notwithstanding the above, a scheme of aviation lighting to be installed on

Laois County Council Planning Authority, Viewing Purposes Only!

the permitted wind turbines will be agreed with the IAA to avoid any likely significant aviation effects. Due to the low altitude of infrastructure associated with the proposed development, significant effects on the Midlands Heliport are assessed as unlikely.

It is concluded, therefore, that the operation of the proposed development and permitted wind turbines will not result in any likely significant effect on the Air Corps or aviation activities.

13.2.4.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

13.2.5 Cumulative Effects

Due to the absence of other tall structures in the wider vicinity of the proposed development site and permitted Pinewoods Wind Farm, it is assessed that there is no likelihood for the project as a whole to have any significant effects on aviation, in combination with other existing, permitted or proposed developments.

13.2.6 Mitigation & Monitoring Measures

13.2.6.1 Construction Phase

Due to the absence of tall structures and likely aviation effects, there are no specific mitigation measures during the construction phase.

13.2.6.2 Operational Phase

Due to the absence of tall structures and likely aviation effects, there are no specific mitigation measures during the operational phase.

As is best practice, and as required by Condition 18 of An Bord Pleanála PL11.248518 (Pinewoods Wind Farm), a scheme of aeronautical warning lighting for the permitted wind turbines will be agreed with the Planning Authority prior to the commencement of development. The 'as constructed' turbine coordinates, ground and tip height elevations will be provided to the IAA following installation of the wind turbines.

13.2.6.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

13.2.7 Residual Effects

No likely significant residual effects during the construction, operational or decommissioning phases are assessed as likely to occur.

13.2.8 Summary

This assessment concludes that the proposed development is unlikely to result in any significant effect on aviation. The proposed development does not comprise particularly tall structures which could pose a risk to military or civilian aviation operations. Accordingly, with the installation of appropriate aviation warning lighting at the permitted Pinewoods Wind Farm, significant effects on aviation are unlikely to occur as a result of the project as a whole, either individually or in combination with

Laois County Council Planning Authority, Viewing Purposes Only!

other existing, permitted or proposed developments.

Laois County Council Planning Authority, Viewing Purposes Only!

13.3 Telecommunications

13.3.1 Introduction

This section considers the likely effects of the proposed development upon a range of communications infrastructure, including telecommunication networks, broadcast radio and television and fixed infrastructure such as telecommunication masts. In theory, given the nature of the proposed development and the absence of tall structures, interference or adverse effects are unlikely.

However, given that he proposed development forms part of the overall Pinewoods Wind Farm, which comprises 11 no. permitted wind turbines, it has been considered appropriate to re-evaluate the likelihood of significant telecommunication effects arising as a result of the project as a whole.

13.3.1.1 Statement of Authority

This section has been prepared by members of the GES Environment & Planning Team. GES has substantial experience having prepared Material Asset (Telecommunications) chapters for multiple EIAR developments.

13.3.2 Methodology

The methodology employed in assessing the likelihood for significant effects on telecommunication networks consisted of desk based research and consultation with various telecommunication companies and relevant authorities. Desk based research was undertaken to identify:-

- Locations of known telecommunications facilities;
- Known telecommunication fixed links; and
- Known television broadcast and re-broadcast facilities.

During the EIAR scoping process (see **Chapter 1**), the following telecommunication companies, bodies and authorities were consulted with;-

- An Garda Síochana;
- Broadcasting Authority of Ireland;
- BT Communications Ireland;
- Commission for Communications Regulation;
- Eir Mobile;
- Imagine Group;
- Mosaic Net;
- National Ambulance Service;
- Open Eir;
- Ripplecom;
- 2rn (RTE Transmission Network Ireland);
- Tetra Ireland Communications Ltd;
- Three (3) Ireland;
- Towercom;
- Virgin Media Ireland; and
- Vodafone Ireland Ltd.

The responses received, from Eir Mobile and 2rn (RTE Transmission Network Ireland), can be viewed at **Annex 1.5**. The responses received confirm that there will be no significant effect on the telecommunications network in the area of the proposed development.

Laois County Council Planning Authority, Viewing Purposes Only!

13.3.3 Description of Existing Environment

The consultations undertaken illustrates that the proposed development site is not a significant location for telecommunication links. While there are telecommunication masts located within the wider environs of the subject site[5], on the basis of the consultations undertaken there are no telecommunication links which have are likely to be affected by the proposed development.

13.3.4 Description of Likely Effects

Due to the low altitude of the proposed development and the absence of predicted likely effects identified in consultation responses, the following assessment focuses on the project as a whole, including the permitted Pinewoods Wind Farm.

13.3.4.1 Construction Phase

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

13.3.4.2 Operational Phase

Interference of wind turbines with electromagnetic transmissions

The operation of wind turbines can affect electromagnetic transmissions in two ways: by blocking or deflecting line of sight radio or microwave links or by 'scattering' transmission signals.

Microwave UHF (Ultra High Frequency) and VHF (Very High Frequency) television signals

These are generally quite narrow signals that travel in a straight line. Wind turbines (or any structure) can disturb microwave signals if they obstruct the line of sight between the transmitter and the television aerial of a nearby residence.

The blades of the permitted turbines can block some signals, or they could act as an unwanted relay transmitter, causing TVs in local residences to receive a 'ghost' signal. Wind turbines may cause a reception shadow when they stand between a TV transmitter and dwellings with TV aerials pointing through the wind turbines towards the transmitter. Television viewers in such locations will have their signal scattered, causing loss of detail, loss of colour or a buzz from their television. Generally, careful choice of turbine siting can mitigate any likely significant effects, as the separation distance required to avoid problems is generally a matter of a few hundred meters. However signal boosting measures installed post wind farm completion can also be effective.

Scattering of signal mainly affects domestic TV and radio reception, and the general public may be concerned that a wind farm will interfere with these services. Experience has shown that, when this occurs, it is of a predictable nature and can generally be alleviated by the installation or modification of a local repeater station or cable connection, or by using a more directional kind of aerial.

Analogue and Digital Television Signals

The UK OFCOM document *"Tall structures and their impact on broadcast and other wireless services"*[6] in order to provide an overview for developers and planning

[5] http://siteviewer.comreg.ie/#explore

[6] OFCOM: Tall structures and their impact on broadcast and other wireless services, August 2009, http://licensing.ofcom.org.uk/binaries/spectrum/fixed-terrestrial-links/wind-farms/tall_structures.pdf

Laois County Council Planning Authority, Viewing Purposes Only!

authorities on how tall structures such as wind turbines may affect reception of wireless services.

There are two problems that can occur due to interference from tall structures: (1) signal blocking, and (2) reflection. Signal blocking can occur when a tall structure is situated between the transmitter and receiver. This causes a shadow behind the structure that can reduce signal levels. The severity of the reduced signal can vary depending on a number of factors such as the height of the structure.

Signal reflection can occur when wireless signals are reflected from the sides of structures. In the case of wind turbines, because the blades are rotating, the reflections can fluctuate and be quite complex. Reflections from turbines can also vary depending on the speed at which the blades are rotating and the angles of the blades. According to OFCOM, digital television signals are much better at coping with signal reflections, and pictures do no experience ghosting.

As analogue television has been phased out in Ireland, problems with ghosting and signal reflection due to interference from turbines will be reduced. The digital television signal is much better at coping with signal reflection. Since the digital switchover, the power of transmitters emitting the digital signal has been increased to deal with the demand. This higher output is likely to overcome any signal interference and is not likely to effect the reception received on televisions. Overall, the likelihood of adverse signal effects is much less significant with digital television than with analogue television.

Mobile Phone Signals

Despite the presence of a number of telecommunication (mobile phone) masts in the wider area, the consultation process (for both the proposed development and permitted Pinewoods Wind Farm (see **Volume III Chapter 1**) has not identified the likelihood for significant interference to occur and no service provider expressed concerns and, therefore, significant effects on mobile phone signals are not assessed as likely.

13.3.4.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

13.3.5 Cumulative Effects

Due to the absence of other tall structures in the vicinity of the proposed development and permitted Pinewoods Wind Farm, it is assessed that there is no likelihood of the overall project resulting in significant effects on telecommunications, in combination with other existing, permitted or proposed developments.

13.3.6 Mitigation & Monitoring Measures

13.3.6.1 Construction Phase

As no significant effects are assessed as likely to occur during the construction phase, no specific mitigation measures are proposed.

13.3.6.2 Operational Phase

Extensive consultation with telecommunications providers has confirmed that significant adverse effects on existing telecommunication signals are unlikely to

Laois County Council Planning Authority Viewing Purposes Only!

occur as a result of the operation of the proposed development.

While the overall project (proposed development plus permitted Pinewoods Wind Farm) is assessed as unlikely to interfere with any microwave links, all operators will be kept informed of any changes to the precise positioning of infrastructure to ensure that compliance with telecommunication constraints is maintained.

If, despite precautions, telecommunication interference in any form is identified and is attributed to the project, appropriate remedial measures will immediately be undertaken. A range of technical measures are available to mitigate any instances of interference including signal amplifiers, active deflectors and relay transmitters, repeater stations, booster units, realignment of domestic aerials, installation of higher quality aerials and the installation of suppression equipment. Remedial works will be promptly undertaken to ensure uninterrupted telecommunication, broadcasting and mobile phone service provision.

13.3.6.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

13.3.7 Residual Effects

No likely significant residual effects are assessed as likely to occur.

13.3.8 Summary

It can be concluded that, on the basis of a desktop assessment and extensive consultation with stakeholders, the proposed development will not result in likely significant effects on the telecommunications network.

The implementation of mitigation measures, with regards the Pinewoods Wind Farm, will ensure that any likely significant effects on terrestrial television signals are appropriately managed and mitigated. Therefore, it is assessed that significant effects on telecommunications are unlikely to occur from the project as a whole, either individually or in combination with other existing, permitted or proposed developments.

Laois County Council Planning Authority, Viewing Purposes Only!

13.4 Resources & Utility Infrastructure

13.4.1 Introduction

This section provides details of the likelihood for significant effects or interactions with existing renewable and non-renewable resources and existing utility infrastructure. Within the wider environs of the proposed development site, there is evidence of the extraction and use of resources; particularly in relation to quarrying activities and commercial forestry.

There is also the presence of utility infrastructure, with overhead electricity lines connecting to the majority of dwellings in the wider area while medium voltage electricity lines traverse the landscape and telecommunication lines are located adjacent to the majority of local roads.

13.4.1.1 Statement of Authority

This section has been prepared by members of the GES Environment & Planning Team. GES has substantial experience having prepared Material Asset (Resource & Utility Infrastructure) chapters for multiple EIAR developments.

13.4.2 Description of Existing Environment

13.4.2.1 Renewable Resources

There are no operational wind energy developments in the vicinity of the proposed development site. The nearest operational development is the Gortahile Wind Farm located c. 14km southeast of the proposed development. The permitted Pinewoods Wind Farm, which the proposed development will serve, is located immediately southeast of the proposed development site while the permitted Cullenagh Wind Farm is located c. 5km to the north. A number of existing/permitted domestic scale wind and solar energy projects are also evident in the wider landscape.

13.4.2.2 Non-Renewable Resources

There are a number of extant quarrying activities within counties Laois, Kilkenny and Carlow. There are no quarries located within the proposed development site or in its immediate vicinity with the nearest quarry, Kilsaran Concrete, located c. 1.5km to the west. Due to the presence of aggregates within the proposed development site, it is proposed that suitable material will be used in the construction of the proposed development; however, additional materials will be imported from local suppliers (see **Chapter 2**). Further details on the importation of materials are provided at **Section 13.1**.

13.4.2.3 Utilities Infrastructure

The existing electricity transmission network in south County Laois/north County Kilkenny largely comprises 110kV and 38kV electricity transmission lines while lower voltage networks distribute electricity to customers. The network in this part of the Midlands Region is, however, considered to be 'weak' and, as a result, Eirgrid sought, and were later granted, planning permission for a development (known as the 'Laois-Kilkenny Grid Reinforcement Project') comprising *inter alia* upgrades to existing transmission networks, new electrical substations and new 110kV overhead electricity lines. This development proposed the construction of a new 110kV overhead line between the Ballyragget and Coolnabacky substations which is located immediately adjacent to the proposed development site. The proposed substation will be connected to this overhead line and electricity being transmitted

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along the line will pass through the proposed substation (see **Chapter 3** for further details). **Figure 13.3**, below (reproduced at **Annex 13.3**), illustrates the existing electricity transmission network in the wider region of the proposed development site and denotes the route of the Ballyragget-Coolnabacky 110kV overhead line.

In addition, there is an extensive telecommunications network in the wider environs of the proposed development site.

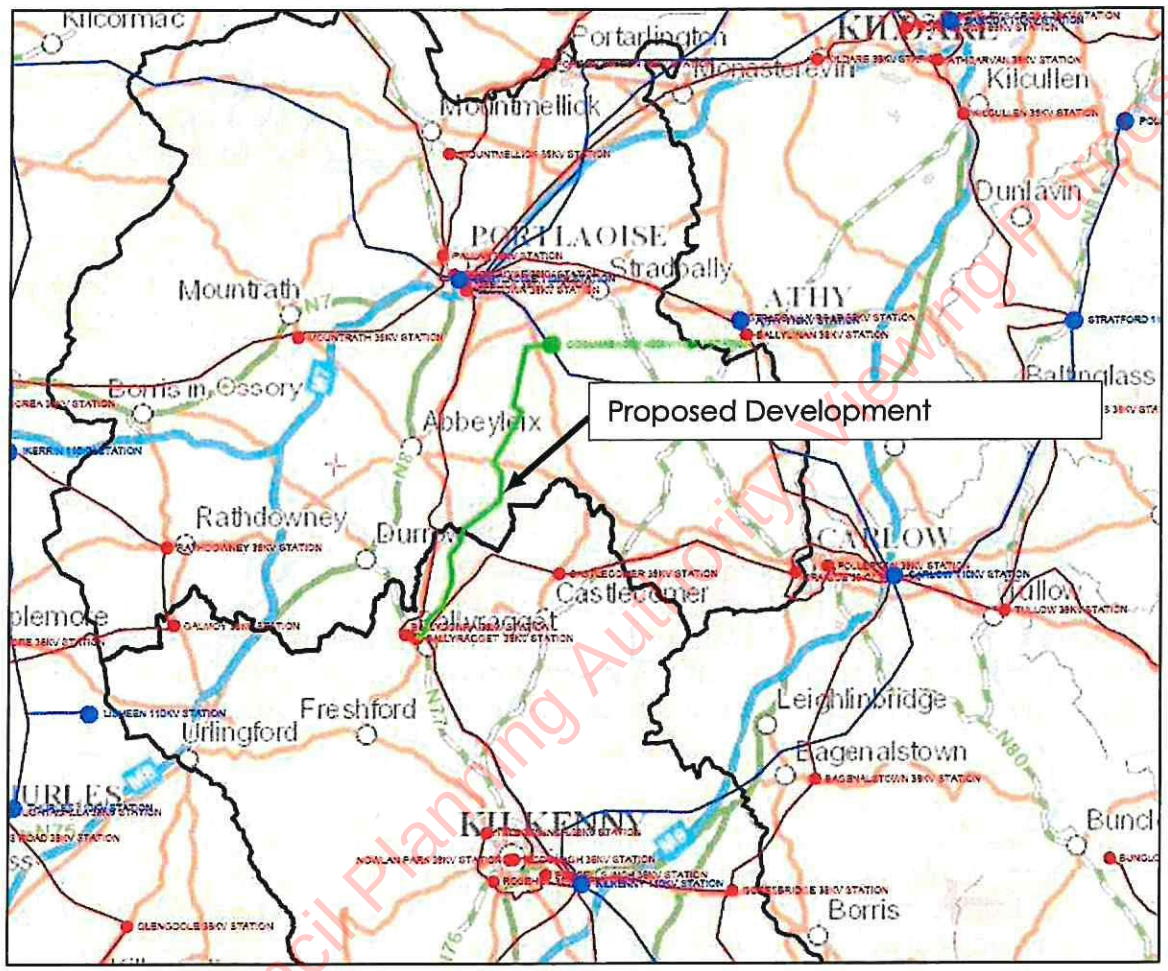

Figure 13.3: Electricity network in County Laois and surrounding counties

Note: 38kV network indicated in red; 110kV network indicated in blue

13.4.3 Description of Likely Effects

13.4.3.1 Construction Phase

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

During the process of connecting the proposed development to the national grid; assuming the Laois-Kilkenny Grid Reinforcement Project is fully operational, some

Laois County Council Planning Authority Viewing Purposes Only!

minor, temporary disruption to electricity supply, at a local level, may occur. However, during this process, Eirgrid will balance the loading on the network to ensure that no significant disruption occurs and significant effects do not arise.

The construction phase will result in the extraction of non-renewable resources in the form of aggregates for the construction of access tracks, substation footing and concrete for substation construction. However, aggregates will only be sourced from quarries with have full planning permission and have been subject to EIA; and, therefore, the effects of this extraction have already been fully assessed. As a result, it is assessed that significant effects on the environment are unlikely to occur as a result of the proposed development, either individually or in combination with other existing, permitted or proposed developments.

13.4.3.2 Operational Phase

The operational phase of the proposed development will not result in any likely effect on existing utility infrastructure or renewable or non non-renewable resources. The connection of the proposed development to the national grid will strengthen the electricity network infrastructure in the wider region through the construction of a 110kV substation which will serve the national network.

It may be necessary to occasionally import aggregates to the site during operations to maintain access for service vehicles; however, materials will again be sourced from authorised quarries with full planning permission and no likely significant effects will occur.

The proposed development will have no likely operational phase effects on existing renewable resources. It is assessed that the proposed development will, by facilitating the export of electricity generated by the Pinewoods Wind Farm to the national electricity network, result in a likely overall positive effect in terms of carbon reduction and climate change (see **Chapter 8**). It is assessed, therefore, that adverse effects on the environment are unlikely to occur in respect of resources and utility infrastructure during the operational phase as a result of the proposed development, either individually or in combination with other existing, permitted or proposed developments.

13.4.3.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

13.4.4 Cumulative Effects

The proposed development is not assessed as likely to result in any significant cumulative effects on resources or utility infrastructure, either individually or in combination with other existing, permitted or proposed developments, including the Pinewoods Wind Farm.

13.4.5 Mitigation & Monitoring Measures

13.4.5.1 Construction Phase

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

13.4.5.2 Operational Phase

No specific mitigation measures are proposed or required during the operational

Laois County Council Planning Authority Viewing Purposes Only!

phase.

13.4.5.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

13.4.6 Residual Effects

No likely significant residual effects are assessed as likely to occur.

13.4.7 Summary

This assessment concludes that the proposed development is unlikely to result in any significant adverse effect on renewable and non-renewable resources or on utilities infrastructure. The operation of the proposed development will bring about a benefit in terms exporting electricity generated from a renewable source to the national grid and a strengthening of national electricity grid infrastructure in the wider region of the proposed development site. This assessment similarly concludes that the proposed development is unlikely to result in any significant adverse cumulative effects in combination with existing, permitted or proposed developments.

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Pinewoods Wind Farm Substation & Grid Connection

Chapter 14: Interactions of the Foregoing

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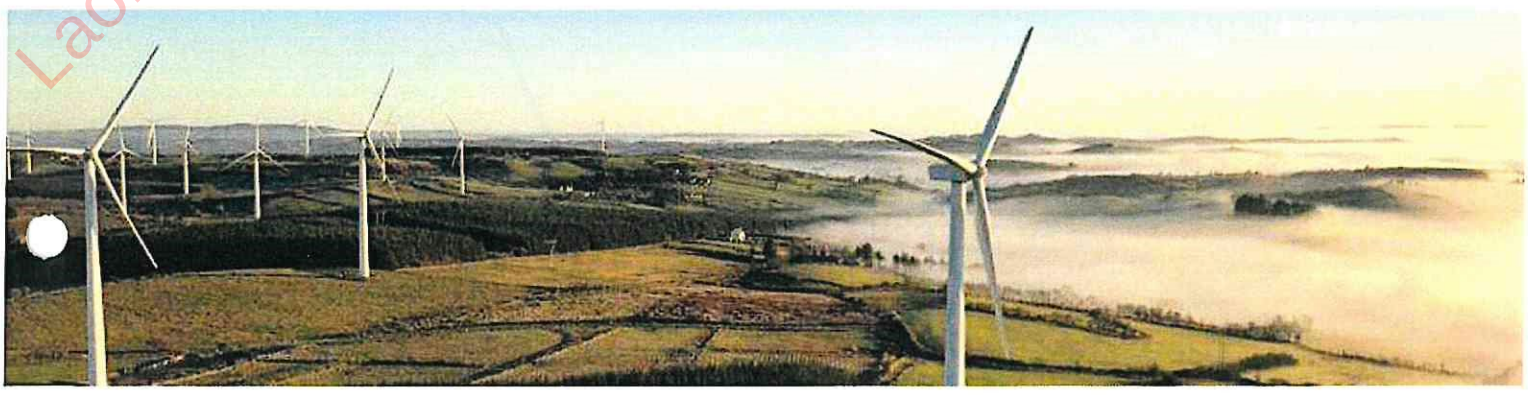

Laois County Council Planning Authority, Viewing Purposes Only!

Contents

Laois County Council Planning Authority, Viewing Purposes Only!

14.1 Introduction

This chapter summarises the critical results and conclusions of each individual chapter of this EIAR and identifies interactions between issues arising under separate factors which might otherwise not be noticed but which need to be assessed to ensure all likely significant effects are identified and assessed.

The interactions between effects on different environmental factors are also addressed, as relevant, throughout this EIAR by ensuring that effects are cross-referenced between topics, thus reducing the need to duplicate coverage of such topics. Close co-ordination and management within the EIA project team, and careful read-across editing, ensured that assessors were vigilant for complex interactions (direct, indirect, secondary and cumulative), and where they are likely to arise, they are adequately identified and assessed. This included interactions between effects and possible cumulative effects arising from the mitigation measures proposed that could magnify effects through the interaction or accumulation of effects.

Reference should also be made to **Chapter 2** which provides an evaluation of reasonable project alternatives and **Chapter 3** which provides a detailed description of the proposed development. The design of the proposed substation is an iterative process; the final proposed development integrates numerous 'mitigation by design' measures, and these *a priori* respond directly to many of the likely effects identified in this EIAR.

14.2 Interactions

It is general practice that interactions are shown by a means of a matrix, as set out in **Table 14.1** below, examining each aspect of the receiving environment which is considered in detail in the respective chapters of this EIAR, and cross-tabulated against all other aspects that have also been considered. This is accompanied by a brief text describing the interactions, including during the construction and operation stage.

Where an interaction is considered to be both likely and significant, it is given a reference number in the matrix and detail of the interaction is discussed below, including whether it is weak or strong, or whether the interaction is positive or negative. Where there is no number indicated in the matrix, it is assessed there is no likelihood for any significant effects by way of interaction between the environmental factors.

The most common interactions for developments of this nature are between human beings and noise, human beings and visual perceptions, and construction traffic effects.

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Interactions	Population and Human Health	Biodiversity	Land and Soils	Water	Air Quality & Climate	Landscape	Cultural Heritage	Noise & Vibration	Shadow Flicker	Material Assets
Population and Human Health						1		2		3
Biodiversity			4	5						
Land and Soils		4					6			
Water		5								
Air Quality & Climate										7
Landscape	1									
Cultural Heritage			6							
Noise & Vibration	2									
Shadow Flicker										
Material Assets	3				7					

Table 14.1: Matrix of Interactions

14.2.1 Interaction 1: Population & Human Health and Landscape

The likely effects of the proposed development on landscape, and the interaction with population and human health, have been discussed in **Chapter 4** and **Chapter 9** of this EIAR. The proposed development has been assessed having regard to the sensitivity of the landscape, the degree of intrusion or dominance created by it and the degree to which is it visible in the landscape. Viewshed Reference Points (VRPs) consisting of views from key prospects and receptors were identified and a detailed analysis of each, accompanied by photomontages, is discussed in **Chapter 9**. Overall, it is concluded that the proposed development is likely to go largely unnoticed in the landscape and that it will not result in any likely significant interaction with population and human health.

14.2.2 Interaction 2: Population & Human Health and Noise & Vibration

During the construction phase, noise will be generated through a number of typical on-site construction stage activities which will be mitigated through appropriate mitigation and good construction practices. Likely effects will therefore be short-term and temporary in nature and a perceptible increase in noise, which is sufficient to cause a significant effect to local residential amenity, is not likely, given the

Laois County Council Planning Authority, Viewing Purposes Only!

separation distances between existing properties and the subject site.

During the operational phase, noise levels from the proposed development are predicted to be below existing background noise levels at the nearest properties thus avoiding any likely significant adverse effects. Therefore, it is concluded that the proposed development will not result in a likely interaction between population and human health, and noise and vibration.

14.2.3 Interaction 3: Population & Human Health and Materials Assets (Transport & Access)

In terms of population & human health and material assets, the only likely interaction relates to transport and access.

The proposed development will generate traffic during the initial construction stage. In terms of vehicle movements, it is estimated that approximately 4,773 trips (includes both in and out) of HGVs will be required. Some minor levels of disruption may occur; however, traffic management measures will be agreed with the Planning Authority and implemented in full to ensure that any likely significant effects are avoided.

The increase in traffic volumes on the surrounding road network will be temporary in nature as the expected duration of the construction phase is 15-18 months. Once the proposed development is operational, traffic movements to and from the proposed development site will be infrequent, averaging 1-2 no. visits per week by a light commercial vehicle for maintenance purposes. Therefore, it is concluded that the proposed development will not result in a likely significant interaction between population and human health, and transport & access.

14.2.4 Interaction 4: Biodiversity and Land & Soils

As outlined in **Chapter 6**, excavated ground exposed during the construction phase may lead to the sedimentation of nearby watercourses. Mitigation measures will be implemented such that there will be no likelihood of silt laden runoff having an adverse effect on water quality and aquatic ecology in surrounding water bodies. Mitigation measures proposed during construction will also ensure that the proposed development does not result in a likely significant negative effect on soils or the geological environment.

The excavation and removal of soils for the construction of permanent features will lead to habitat loss. However as discussed in **Chapter 5**, the proposed development is generally located within areas of improved agricultural grassland, which is of lower ecological importance, and is not located within an ecologically sensitive area.

Overall the conclusion of the biodiversity study is that the residual effects on the important ecological receptors; including designated sites, habitats, flora and fauna; are reduced to slight negative at most, and are not considered likely to be significant. Therefore, it is concluded that the proposed development will not result in a likely significant interaction between biodiversity and land & soils.

14.2.5 Interaction 5: Biodiversity and Water

As outlined in **Chapter 6**, excavated ground exposed during the construction phase may, in the absence of mitigation, lead to the sedimentation of nearby watercourses and downstream effects on habitats and species. A suite of substantial mitigation measures is proposed which will be fully implemented in order to exclude the possibility for silt laden runoff to discharge to surface water features and to

Laois County Council Planning Authority Viewing Purposes Only!

ensure that adverse effects on water quality do not occur. Mitigation measures proposed during the construction phase will also ensure that the proposed development does not result in a likely significant negative effect on soils or the geological environment. The interaction between biodiversity and water is also closely related to the interaction between biodiversity and land and soils and this interaction should also be read in conjunction with **Interaction 5**.

In light of the assessment undertaken and the mitigation proposed, there is no likelihood of significant interactions between biodiversity and water.

14.2.6 Interaction 6: Land & Soils and Cultural Heritage

The excavation of soils raises the possibility for previously unrecorded subsurface cultural heritage features to be discovered. To limit any likely adverse effects or significant interactions, as is normal practice on construction sites, archaeological monitoring of all excavations will be undertaken under licence from the Department of Culture, Heritage and the Gaeltacht[1] to ensure that any features uncovered are appropriately recorded and managed. Overall, therefore, it is concluded that the excavation of soils will not result in any likely significant interaction with cultural heritage.

14.2.7 Interaction 7: Air Quality & Climate and Materials Assets (Transport & Access)

There will be no likely significant interaction between Material Assets (Transport & Access) and Air Quality and Climate during the construction phase of the proposed development. Exhaust emissions from construction vehicles will result in a negligible adverse effect on local air quality; however, this will not be perceptible to local residents. This is a short-term, temporary effect and is fully addressed at **Chapter 8**. As the likely traffic associated with the operational phase of the proposed development will be very low; overall, it is assessed that there will be no likely significant interaction between Air Quality, Climate and Material Assets (Transport and Access).

14.3 Summary of Interactions & Effects

All environmental factors are interrelated to some degree and the assessment of these interactions is an important requirement of the EIAR process. Having assessed the interaction of likely effects during the construction, operational and decommissioning phases; the interaction of effects is not assessed as likely to result in any effects that could magnify effects through the interaction or accumulation of effects. All interactions of effects are assessed and have been fully considered in the relevant chapters of this EIAR. Through facilitating the export of renewable energy to the national grid from the permitted Pinewoods Wind Farm, the proposed development will result in positive environmental effects at international, national, regional and local level; particularly in relation to air quality where and any localised adverse effects resulting from the construction phase will be entirely off-set during the operational phase due to the long term positive effect on both air quality and climate and, in turn, on human health.

Overall, it is concluded that the effect of the proposed development on the receiving environment is not likely to be significant. Likely effects from the proposed development vary in significance but are generally in the minor to negligible range. A number of positive effects have also been identified such as community benefits;

[1] Or as succeeded following reorganisation of Government Departments.

Laois County Council Planning Authority, Viewing Purposes Only!

a reduction in the use of fossil fuels; and a significant contribution towards achieving Ireland's national and European targets for energy production from renewable sources.

Overall, the likely effects and interactions which have been identified in this EIAR demonstrate that the proposed development will not result in any likely significant negative effect on the environment, and will result in a likely significant positive effect on the environment by facilitating the production of energy from renewable sources at an appropriate location.

Laois County Council Planning Authority, Viewing Purposes Only!

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