Schedule of Mitigation Measures

(Extracted from Chapter 18 of EIAR)

18.0 SCHEDULE OF MITIGATION MEASURES

18.1 INTRODUCTION

Mitigation of potential impacts has been incorporated into the proposed development either by avoidance of potential impacts or by the design of the proposed development (as described in Chapter 3, Reasonable Alternatives). Where relevant, these measures are detailed in each chapter of the EIAR.

In addition, during the construction and operational phases of the development, all personnel working on the project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the Construction Environmental Management Plan (CEMP).

During the construction phase of the development, all works associated with the construction of the proposed Castlebanny Wind Farm will be undertaken with due regard to the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015).

18.2 SCHEDULE OF MITIGATION MEASURES FROM EIAR

The following table summarises the mitigation measures proposed within the EIAR.

Table 18.1: Schedule of Mitigation Measures within the EIAR

Item	Mitigation Measure	Project Stage
Chapter 5 – Population and Human Health		
5.1	Best practice construction methodology and measures to minimise impacts from excavation works, as described in Chapter 8 (Land, Soils and Geology), will keep the development area to a minimum and reduce land use changes. The proposed development is not anticipated to have a significant effect on the local or regional population, therefore no mitigation measures in respect of population trend impacts are required. From an economic perspective, the proposed development will provide employment opportunities to the local community and wider region during construction, operations and decommissioning. The project, primarily at construction stage, is also likely to increase spend in local businesses as persons involved in the project stay locally or purchase goods. Overall, there will be a positive impact on the local economy and no mitigation measures are required. To reduce the effect on tourists and local users of the South Leinster Way during the construction phase of the development, signage and maps of alternative routes will be erected at either end of the trail where access will be blocked as a result of construction activity.	Construction Phase
5.2	Fáilte Ireland has been consulted to identify any potential concerns for adverse tourism impacts. Fáilte Ireland has provided a guidance document for considering the potential impacts of projects on tourism and this guidance document has been considered in the completion of this assessment. A *Recreation Development Plan* for provision of amenity facilities at the site has been developed (available at Appenidx 2-6). The Community Benefit Fund will provide an opportunity for the local community to invest in local facilities and infrastructure and support local clubs/societies and near neighbours. Where required, specific mitigation measures for other environmental factors discussed previously which may interact with human health, such as landscape and visual effects, shadow flicker, air quality, water quality, noise & vibration and transport, are discussed in the relevant chapters of the main EIAR. A cross reference of environmental factors is also presented in Chapter 17 (Interactions of the Foregoing).	Operational Phase

5.3	Internal access roads, substation and wind turbine bases will be retained in place after decommissioning of the wind turbines to maintain access for forestry and recreation, minimise disruption to the electricity grid infrastructure and reduce the impact of construction activities (such as noise, air quality and traffic movements) on the local population associated with their removal. Turbine hardstandings will be covered with topsoil and revegetated. No mitigation is proposed for the decommissioning phase in respect of effects on population trends, property value or tourism.	Decommissioning Phase
Chapter 6 – Biodiversity		
6.1	**Mitigation by Avoidance** Mitigation by avoidance has been implemented in the design of the proposed Castlebanny Wind Farm. An Ecological Constraints and Opportunities Plan (ECOP) was prepared early in the design phase of the project, based on the results of desk studies and preliminary field surveys. Ecological receptors of High Local or greater value, such as the habitat complexes outlined in Section 6.3.2.3 were identified, and where possible, these were avoided when planning wind farm infrastructure. The ECOP was updated as new ecological survey results arose, and the findings were communicated to the client. This process has resulted in a wind farm design that minimises negative effects on ecological features to the greatest degree feasible. The wind farm design has been modified as required to avoid ecological features that were discovered in the surveys that followed early iterations of the detailed design. In July 2020, mammal surveys at "final" turbine locations revealed a breeding badger sett within the footprint of T18 and associated hardstand (Section 6.3.5.1 of the main EIAR). The turbine was moved a sufficient distance so as to avoid direct impacts and minimise disturbance. In June 2020, the grid connection route was moved from its original location paralleling a tributary of the Mullenhakill Stream to a route chosen to maximise distances to watercourses. Finally, the borrow pit near T15 was moved in November 2020 from a position overlapping the blanket bog pocket at Habitat Complex D to a position further west.	Construction phase

6.2	**Ecological Clerk of Works** An Ecological Clerk of Works (ECoW) will be appointed to ensure compliance during the construction stage with all mitigation measures and planning conditions related to ecology and with wildlife law.	
6.3	**Biodiversity Management Plan** A Biodiversity Management Plan has been prepared, and is presented in Appendix 6-6. The Biodiversity Management Plan includes details on how mitigation measures that require active conservation management of habitats or species will be implemented. It will be a living document, updated and amended by the ECoW during the lifetime of the project. A particular focus of the plan is the management of habitat creation and enhancement measures outlined in Section 6.5.3.1 and bat buffer zones in Section 6.5.3.2.	
6.4	**Designated Areas** Mitigation for potential effects on Natura 2000 sites is addressed in the NIS that accompanies this EIAR. Any mitigation requirements that arise as a result of potential effects on Natura 2000 sites are also listed in appropriate sections. As there will be no negative effects on NHA's or pNHAs, mitigation is not required.	
6.5	**Habitat Creation and Enhancement** A total of 19.1 ha of land will be managed with biodiversity as the primary objective (Figure 6-22 and Figure 6-23). This measure will serve as mitigation for habitat losses, and, in addition to habitats and flora, it will benefit fauna. In particular, they provide habitat as mitigation for breeding Snipe (Section 7.5.2). Due to the nature of the sites available, it was not possible to provide like-for-like replacement of habitats lost, mainly hedgerows and broadleaved woodland. With management, however, these areas will have a positive effect on the conservation status of other habitats and species. Habitat creation and enhancement sites are shown in Figure 6-22 and Figure 6-23, and site-specific management measures are detailed in the Biodiversity Management Plan (Appendix 6-6).	

	The habitat creation and enhancement sites are mainly marginal farmland. Site 1 is an area of species-poor, rushy *wet grassland* (GS4) in the western part of the wind farm site (Figure 6-22). Site 2 includes Habitat Complex E (Section 6.3.2.3) in the south of the wind farm site as well as an adjoining area of *improved agricultural grassland* (GA1) (Figure 6-23). Site 3 comprises Habitat Complex F (Section 6.3.2.3) and a small amount of adjacent land outside the grid connection route corridor. It comprises *wet grassland* (GS4) and hazel-dominated woodland along the Arrigle River (Figure 6-22). Site 3 is within the River Barrow and River Nore SAC. Site 4 is an upland site located on Coppanagh, a hill 10.3 km north-east of the wind farm site boundary (Figure 6-22, inset). Management measures have been developed on a site-specific basis and are detailed in the Biodiversity Management Plan in Appendix 6-6. Typical measures for conserving and enhancing biodiversity in these areas include: • Drain blocking, to increase wetland habitat area and improve ecological function and species composition • Scrub removal • Extensive grazing, where appropriate, to maintain open conditions, especially for Snipe	

6.6	**Bat Buffer Zone Management** Significant areas of forest and hedgerow will have to be cleared and maintained as open space as mitigation against collision mortality of bats (Section 6.5.5.1 of the main EIAR). Within the forest matrix, areas of open space with low vegetation can be important habitats for plants, small mammals, and invertebrates such as the Red List dingy skipper. Regularly disturbed habitats can be important for insects that nest in bare soil, such as solitary bees, and early successional plant species. Areas of willow and gorse scrub can provide cover and foraging for passerines and small mammals. Within former forested areas, the objectives of bat buffer zone management will be: • To control regeneration and height growth of tree species, such as birch and naturally regenerating conifers • Maintain for the long-term patches of scrub totalling 25% of the bat buffer areas, where this does not conflict with the first objective • Maintain a proportion (50%) of open grassland or heathland habitats • Maintain a proportion (25%) of disturbed habitat with high cover of bare soil, through machine disturbance during tree regeneration control and/or conversion of open habitats that become too scrubbed up It is anticipated that management interventions will be required on the order of every 3-4 years. A patch dynamics approach will be used in which open grassland or heathland that has become rank or invaded by bramble, gorse, bracken or other scrub will be disturbed or cleared and converted to disturbed / bare soil habitats. One-third of the bat buffer zone excluding permanent scrub, i.e. 25% of the total area, will be disturbed or cleared at each intervention. Table 6.18 of the main EIAR summarises the predicted total habitat area across all bat buffer zones currently occupied by forested habitats. It is predicted that after each intervention, the 25% of each buffer zone that is disturbed or cleared will remain as *disturbed ground* (ED) habitats for 3-4 years. These patches will then naturally develop into *semi-natural grassland* (GS) or *heath* (HH) for the next two interventions, so that 50% of a bat buffer zone will be under these habitats at any one time. The specific *semi-natural grassland* (GS) and *heath* (HH) habitats that will develop will depend on soil type, moisture and available seed sources but are likely to be mainly *dry meadows and grassy verges* (GS2), *dry-humid acid grassland* (GS3), *wet grassland* (GS4), *dry siliceous heath* (HH1) and *wet heath* (HH3). Predictions for the areas of *semi-natural grassland* (GS) or	

heath (HH) habitats in Table 6-18 of the main EIAR were based on the vegetation at or near each turbine location.

Table 6.18: Predicted habitat creation in formerly forested bat buffer zones (Extracted from Chapter 6 of the main EIAR)

Habitat Type	Area (ha)*
Scrub (WS1)	8.38
Disturbed ground (ED)	8.38
Semi-natural grassland (GS)	9.82
Heath (HH)	6.94
Total	**33.53**

*Excludes turbine hardstands and agricultural grassland.

Further details on management are included in the Biodiversity Management Plan in Appendix 6-6. Land that is in agricultural management will remain as such and will not be managed as described above. These areas and hardstand areas within bat buffer zones have been not been included in Table 6-18.

6.7 **Maintaining Site Hydrology**

As detailed in the hydrology mitigation (Chapter 9, Section 9.4), existing surface water flows across the site will be maintained through such measures as cross drains transferring water across access tracks.

6.8 **Habitat Protection**

Habitats in Complexes A and B, which are partially within the wind farm site planning boundary, will be protected from disturbance, such as vehicle traffic or construction material setdown, by robust

	temporary fencing – post and wire or similar. Fencing will be erected prior to construction works and will be marked with suitable hazard signs (e.g. *Keep Out. No Construction Traffic. Wildlife Protection Zone*). Similar temporary fencing and warning signage will be erected to protect the River Barrow and River Nore SAC where it intersects and is adjacent to the grid route corridor.	
6.9	**Flora** Wheels and tracks of machinery used in construction will be washed and free of soil before they are brought into the wind farm site to prevent accidental introduction of invasive plant species propagules (Section 2.11.2).	
6.10	**Bats Buffer Zones** Buffer zones of 50m from blade tip to nearest forestry/treeline/hedgerow will be implemented around all turbines on site (with the exception of T18, see Section 6.5.6.2 of main EIAR and below). This buffer zone is established best practice recommended as a standard mitigation measure for all wind farms, including all key-holed turbine sites (Scottish Natural Heritage *et al.*, 2019). As most bat activity in Ireland and Britain is in close proximity to habitat features, such as forest edges and hedgerows, this measure is predicted to be effective for all bat species, with the exception of high-flying species, such as Leisler's bat. The radius of a bat buffer zone on the ground depends on the height of the forest edge or hedgerow: taller trees require a broader buffer zone to maintain the 50 m distance from blade tip to treetop. To reduce the effects of the bat buffer zones on hedgerows, other linear features and scrub, two buffer zones, an outer and an inner, were calculated. Where turbines are sited in or near forests, the outer buffer zone radius was calculated based on the predicted top height of the trees at felling. Within this outer buffer zone, all trees greater than 5 m tall (at present or at commercial maturity) will be felled. The inner buffer zone radius (74.2 m) was calculated based on a height of 5 m, which is the threshold between scrub and woodland given by Fossitt (2000). Within this buffer zone, all hedgerows, scrub and small trees/shrubs will be removed. This will discourage Common and Soprano pipistrelles from approaching turbines, as they generally commute and forage along linear features such as treelines and hedgerows. Between the outer and the inner buffer zone boundaries, hedgerows, scrub and small trees/shrubs less than 5 m tall will be retained.	

	At T18, trees within 20 m of the badger sett will be left in situ and not felled (Section 6.5.6.2 of the main EIAR). The turbine blade tips will be 35 m from the retained trees at their closest point (c.f. recommended distance of 50 m). This minor adjustment of the buffer zone will have little impact on foraging bats. At T21 it was considered whether it would be preferable to retain some or all of the *broadleaved woodland* (WD1) and associated mature trees within the bat buffer. As Common and Soprano pipistrelle and Leisler's bat activity was high in one or more seasons in this area, it was considered that the collision risk outweighed woodland retention. In addition, the mature trees were situated along or near the proposed access route, making retention difficult.	
6.11	**Feathering** Bat casualties at windfarms can be reduced by pitching the blades out of the wind (feathering) in order to reduce rotation speeds below 2 rpm while idling. The reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50% (SNH *et al.* 2019). This option does not result in any loss of output and can be implemented at any site with a blade pitch control system. Therefore, as best practice, whenever it is practically possible and there is a risk to bats, such feathering will be implemented at Castlebanny Wind Farm for all 21 turbines.	
6.12	**Curtailment** Six turbines at the proposed Castlebanny Wind Farm were shown to have a high collision risk for Leisler's bats in at least one of the four survey seasons. These are Turbines, 6, 12, 16, 19, 20 and 21. These 6 turbines posed high risk for Leisler's bats in Autumn 2019 or Spring 2020. In addition, Turbines 12, 19 and 21 also recorded moderate risk for Leisler's bat in Summer 2019, Spring 2020 and/or Summer 2020 (Table 6.19 of main EIAR). These 6 turbines will be curtailed between mid-April and Mid October from sunset to sunrise. The cut in speed for these 6 turbines will be increased to 5.5 m/s at temperatures above 9.5 °C. Curtailment is well-established best practice proven to reduce bat mortality and recommended in situations where risk is high (Scottish Natural Heritage *et al.*, 2019). Extensive research conducted in Scotland has shown that 90% of bat activity occurs at wind speeds less than 5.5 m/s and temperatures greater than 10 °C (Scottish Power Renewables) and that by protecting	

90% of bat activity through curtailment, this resulted in zero bat fatalities. By implementing these wind speed and temperature thresholds at Castlebanny wind farm, it is predicted that similar negligible mortality rates would be achieved.

Table 6.19: Turbines recorded as having HIGH RISK and/or MODERATE RISK for Leisler's bat (Extracted from Chapter 6 of Main EIAR)

Turbine Number	Habitat	High Risk Period	Moderate Risk Period
6	conifer plantation	Spring 2020	
12	improved agricultural grassland	Autumn 2019	Summer 2019
16	improved agricultural grassland	Spring 2020	
19	improved agricultural grassland	Autumn 2019	Summer 2019 Spring 2020 Summer 2020

	20	immature conifer plantation	Spring 2020		
	21	immature broadleaf plantation	Autumn 2019	Summer 2019 Spring 2020 Summer 2020	
	When buffer zones, feathering and curtailment are implemented, post-mitigation collision effects on bats are predicted to be **not significant**.				
6.13	**Acoustic Deterrents** Ultrasonic acoustic deterrents have the potential to significantly reduce bat fatalities at wind farms. This equipment is currently being developed in the US and is expected to be commercially available in the near future, However, there are still concerns about their effectiveness to cover the entire sweep area of the blades. They may work best for one specific species but actually attract other bat species. Their impact on other wildlife has not been established. Further research is required before the use of acoustic deterrents becomes common practice in Europe (Arnett *et al.*, 2013). If this technology matures and becomes accepted best practice in Europe, it may be deployed at Castlebanny Wind Farm in the future as part of a mitigation refinement strategy with the approval of NPWS.				
6.14	**Roost buffer** Although no significant risks were predicted for bat roosts, a 50 m buffer zone will be established at Dempsey's stone shed and stone house ruin, located 168 m and 182 m, respectively, south-west of T12. No construction machinery will be permitted within this buffer zone to eliminate any slight risk of accidental damage to the roosts.				

6.15	**Other Fauna** **Pre-Clearance Surveys and Monitoring** Prior to tree felling and vegetation clearance, areas to be cleared will be surveyed by the ECoW or other qualified ecologist for mammal breeding or resting places, such as badger setts, and also bird nesting sites (Section 7.5.1 of main EIAR). Pre-clearance surveys will also inspect all known active and inactive badger setts on site and verify that inactive setts have not been reoccupied since the original survey. In the event that badgers have reoccupied a location where there is a risk of significant negative effects, solutions to eliminate this risk will be developed in conjunction with a badger specialist and in consultation with the NPWS. Solutions may include establishing and marking buffer zones, changing the timing or season of construction works in the area, or sett exclusion under license. In some locations, scrub or thicket-stage conifer plantation was impenetrable, and it was not possible to survey the entire length of access tracks and entire areas of hardstanding for mammal breeding or resting places, such as badger setts. In these situations, the EcoW or other qualified ecologist will monitor scrub and thicket conifer clearance on the ground to ensure that no setts or other mammal breeding places are present. In the event that a badger sett or other breeding or resting place for protected fauna are discovered, vegetation clearance will be halted. Solutions will be developed in conjunction with a badger or other appropriate specialist and in consultation with the NPWS. Solutions may include establishing and marking buffer zones, changing the timing or season of construction works in the area, or sett exclusion under license.	
6.16	**Badger Protection at T18** As discussed in Section 6.3.5.1, a large badger sett was discovered at the originally proposed location of T18. The turbine location was moved as a result, and the current proposed location of T18 is 79.1 m from the nearest sett entrance; the closest point of the T18 hardstand is located 48.7 m from the nearest sett. Because of the proximity of the large breeding badger sett to T18, the following special mitigation measures will be undertaken in this area. These are also included in the Biodiversity Management Plan (Appendix 6-6)	

6.17	<u>Pre-construction survey</u> The setts at T18 will be checked for activity and sett status prior to construction commencing in the vicinity. The setts may have been expanded or perhaps have become disused. Additional setts may be present in the construction areas.	
6.18	<u>Exclusion zones</u> An exclusion zone of 20 m minimum is required from the breeding sett entrances. In practice, this refers to a distance of 20 m from the extremity of the sett at its west but also to its north (and also in the case of tree felling to the south and east also – when this might be required in the future) (Figure 6-24 of main EIAR). A post and rail fence will be erected at 20 m from the western and northern sett entrances or at the edge of forest, whichever is larger. This will be erected before any other construction or tree felling takes place in this area, and suitable hazard signs will be erected (e.g. *Keep Out. No Construction Traffic. Wildlife Protection Zone*). In accordance with the NRA badger mitigation guidelines (National Roads Authority, 2005), no heavy machinery will be used within 30 m of badger setts (unless carried out under licence); lighter machinery (generally wheeled vehicles) will not be used within 20 m of a sett entrance (Figure 6-24 of the main EIAR).	
6.19	<u>Tree retention</u> The mature trees within 20 m of the breeding sett will be left in situ and not felled in order to maintain a non-interference zone of 20 m. The calculated area of the bat buffer zone around T18 has been adjusted to take this restriction into account. There are also small areas of trees north and south of the sett within the calculated bat buffer zone. These will also be retained and the buffer zone has been adjusted accordingly (Figure 6-24 of the main EIAR). The turbine blade tips will be 35 m from the retained trees at their closest point (c.f. recommended distance of 50 m). This minor adjustment of the buffer zone will have little impact on foraging bats.	

6.20	<u>Seasonality and construction exclusion zones</u> Where possible, any construction works or tree felling in the vicinity of the breeding sett will be conducted outside of the badger breeding season, which is 1st December to end June (hence operations may be conducted from 1st July to 30th November). If construction work is necessary at T18 within the badger breeding season, then no works will be conducted within 50 m. Where the works involve blasting, rock piling, rock breaking or similar very noisy work during the breeding season, this zone will be expanded to 150 m (Figure 6-24 of the main EIAR). In particular, blasting or rock breaking will not be used to excavate the turbine base at T18 during the breeding season.	
6.21	<u>Tree felling in future years</u> Any tree felling or clear felling in future years whether by Coillte or by the wind farm project will require a badger licence from NPWS if such is within 30 m of the sett (or 50 m if such felling is to be conducted during the breeding season). If any badger sett is known to those responsible for tree felling, then impacts on the breeding or resting place of a protected species *cannot be considered as unintentional*. If the need for tree felling arises as part of the wind farm project, a badger license will be applied for beforehand. In addition, a badger licence will be applied for prior to any tree felling in the vicinity of a known sett in the course of conventional forest management so that adequate mitigation measures can be taken to ensure the welfare of badgers present at the breeding sett or any other setts present on site. These measures will form mitigation for cumulative effects on badgers identified in Section 6.4.5.7 of the main EIAR. <u>NPWS license requirements</u> (1) NPWS will not entertain a request for a badger licence prior to planning approval for any development scheme. (2) It is considered that a badger licence is required if works or tree felling operations are conducted within 30 m of the breeding sett at T18 (and other known setts).	

	(3) It is considered that a badger licence is required if works or tree felling operations are conducted within 50m (the estimated distance of 48.7m from the nearest sett entrance to the T18 hardstand at its closest point is acceptable according to the specialist badger survey report at Appendix 6-3) of the main sett during the badger breeding season. (4) It is considered that a badger licence is required if blasting or rock piling works or similar are conducted within 150 m of the main sett during the badger breeding season (National Roads Authority, 2005). NB: the license application is made by a badger expert involved in oversight of such works or tree felling and not by the developer or forestry company. The conditions of a licence granted by NPWS may require additional mitigation measures to be taken.	
6.22	**Badger Protection along the Grid Connection Route** An active badger sett is present in woodland along the Mullenhakill Stream, approximately 40 m from the grid connection route at its closest point. There is the potential for disturbance when carrying out directional drilling and cable route excavation. It is not known if it is a breeding sett; however, mitigation will be implemented under the precautionary principle that it is. Mitigation will follow that detailed for the sett at T18, i.e.: • **Pre-construction survey:** the sett will be checked for activity and sett status prior to construction commencing in the vicinity • **Exclusion zones:** o An exclusion zone of 20 m will be observed from sett entrances. This exclusion zone will be marked with a post and rail fence erected before any other construction or tree felling takes place in this area, and suitable hazard signs will be erected. o No heavy machinery will be used within 30 m of a sett entrance, unless carried out under license	

	• **Seasonality:** Directional drilling will not be carried out during the breeding season (December – June inclusive). Other construction work will not be carried out within 50 m of a sett entrance during the breeding season. • **NPWS license requirements:** As above.	
6.23	**Fauna Protection at Excavations** At any of the construction sites required for the windfarm development, mammals and other fauna, such as frogs, are at risk of falling into open excavations. Silt ponds pose no risk as their sides are sufficiently sloped to permit escape. During construction, open excavations must incorporate facilities for animals to escape, by means of: • gently sloping earth or stone inclines to be left at the end of each day's operation – at each end of open trenches • for long excavations, timber escape planks to be left at c. 50m intervals along the trench at the end of each day's operations; these will usually be placed at right-angles to the trench. • for long excavations, occasional earth/stone or wooden plank bridges to allow badgers to cross the trench during construction • works will be limited to daylight hours where feasible to allow fauna to forage at dawn, dusk, and at night	
6.24	**Aquatic Ecology** Proposed drainage measures to reduce and protect the receiving waters from the potential impacts during the construction of the proposed development are as outlined in Chapter 9 Hydrology. These include measures to prevent runoff erosion from vulnerable areas and consequent sediment release into nearby watercourses to which the proposed development site discharges. Additional mitigation measures specific to aquatic ecological receptors are proposed, where appropriate, below. **Planning and Guidance**	

A CEMP has been prepared as part of this EIAR (see Appendix 2-7) .This CEMP includes Construction Method Statements along with a Surface Water Management Plan for protecting watercourses on the proposed wind farm site and along the proposed grid connection. These have been drawn up by engineers with experience in protection of water quality.

The CEMP will be distributed and discussed with all parties involved in the construction of the wind farm site (including any sub-contractors) in order to protect aquatic conservation interests within the study area. The Surface Water Management Plan sets out measures to avoid siltation, erosion, surface water run-off and accidental pollution events which all have the potential to adversely affect water quality within the site during the construction phase. The Surface Water Management Plan and detailed method statements for watercourse crossings includes preparatory works on the site, including installation of silt fences/curtains and bunds. The preparatory work, including assessment of existing bridge crossings, has been undertaken in advance of any excavations on the site.

The CEMP and method statement for watercourse crossings follows the guidelines set out in the following documents:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.
- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.
- CIRIA (2015a). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London.
- CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.
- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.

- IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney & Company for the Irish Wind Energy Association.
- Kilfeather, P.K. (2007) Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board. Southern Regional Fisheries Board, Clonmel, Co. Tipperary
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- SNH (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage, March 2012.
- SNH (2019). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

Aquatic Ecology Mitigation

Potential grid connection route and directional drilling effects

6.25 There are 3 No. stream/river crossings associated with the grid connection route (i.e. crossings of the Mullenhakill Stream, Arrigle River and Garrandarragh Stream). There will also be a crossing of a drainage ditch. The Mullenhakill Stream and Arrigle River will be crossed via directional drilling, with the Garrandarragh Stream and the drainage ditch crossed via trenching (shallow trefoil cable formation) within the existing culvert crossing. Mitigation measures relating to water quality preservation are outlined in detail in Section 9.4 of Chapter 9, Hydrology and Hydrogeology. These measures will also serve to protect aquatic ecological receptors.

Further to the mitigation measures outlined for directional drilling (Section 9.4.3.6 of Chapter 9), the Ecological Clerk of Works (ECoW) will monitor both turbidity and observe the riverbed during the

	drilling process to detect any leakage of drilling fluid. Should this leakage be observed from the trenches or river bed, works will cease immediately. Although no-instream works are proposed, directional drilling under the Arrigle River will only be done over a dry period in September. This period is required to avoid the salmonid spawning season (October – June) and the Kingfisher breeding season (March-August; mitigation for Kingfisher arises from the NIS that accompanies this EIAR). The primary risk to salmonids from directional drilling is frac out, which is unlikely but potentially serious if it occurs. The primary risk to Kingfisher is noise disturbance. If directional drilling outside September is unavoidable and a period in July-August is required, a survey for breeding Kingfisher will first be carried out to ensure no breeding birds will be disturbed by the drilling works. Similarly, directional drilling under the Mullenhakill Stream will only be done over a dry period in July-September to avoid the salmonid spawning season and the badger breeding season. A pre-construction otter survey will be undertaken in the vicinity of the drilling locations to ensure than no breeding or resting areas within 150m of the drilling locations have been established since the survey work for this EIAR. Should a holt be detected, works will not progress unless or until there is approval from NPWS and a derogation license is obtained.	
6.26	<u>Potential turbine delivery route (TDR) effects</u> Modifications along the turbine delivery route (TDR) involve the temporary removal of street furniture and clearing of some vegetation in addition to the temporary local widening at bends/junctions using hardcore material. Only a single road widening location was identified as posing a risk to aquatic ecological receptors, i.e. Rathpatrick Stream at the Slieverue Roundabout, N29, through the potential release of suspended solids and contaminated surface water run-off (e.g. pollutants/fuels from machinery). Whilst the Rathpatrick Stream in the vicinity of the proposed road widening works was not of value for fish, the watercourse likely supports European eel in its lower reaches (where it increases in size), given the close proximity to the River Suir estuary. European eels are less sensitive to siltation than other species (e.g. salmonids) but would be impacted by hydrocarbon pollution, should a fuel spillage etc. occur	

	during works. Mitigation to prevent indirect water quality impacts during road widening works will be applied, as detailed in the CEMP (Appendix 2-7).	
6.27	<u>Potential turbine base construction and access track construction effects</u> Turbine hard-standing areas associated with turbines T8, T9, T12 and T13 are located ≥120m from the nearest watercourses (i.e. Ballytarsna River, Mullenhakill Stream, and unnamed tributaries). The Ballytarsna River and Mullenhakill Stream supported salmonids (brown trout only at the of survey). The upper reaches of the Ballytarsna Stream in the vicinity of turbine T9, will be crossed via a precast concrete clear-span bridge. This will avoid in-stream works and reduce potential impacts to aquatic receptors at the crossing point and downstream. Clear-span bridge installation and access track works will only be done over a dry period between July and September (as required by IFI for in-stream works) to avoid the salmonid spawning season. Detailed mitigation measures to protect water quality (which include but are not limited to sediment run-off control, management of concrete & aquatic buffer zones) in respect of turbine base construction and access track construction are outlined in Section 9.4 of Chapter 9, Hydrology and Hydrogeology.	
6.28	<u>Potential borrow pit excavation effects</u> There is no identified direct connectivity between proposed (3 No.) borrow pit locations and watercourses, which would reduce the potential negative effects resulting from borrow pit construction and excavation activities. These are located near turbines T3, T6 and T15. However, the excavation of the borrow pit may result in silt-laden run-off entering receiving watercourses via the roadside drainage network. A lack of or an inadequate silt-attenuation system for the borrow pit may result in down-slope suspended solids and nutrient escapement to surface waters. While risks of water quality impacts are low given the location of borrow pits away from watercourses (i.e. >500m distance), siltation control measures will be applied where risk of silt-laden water entering roadside drainage network is encountered. Borrow pits will maintain a 50m set back from streams. Machinery will not be refuelled within 50m of surface water pathways.	

6.29	**Potential tree felling effects** Tree felling is required at each of the 21 no. turbine locations, with the exception of turbines T10 and T19 (see Forestry report). However, the greatest risk of impact from felling activities was identified in turbine areas near watercourses, i.e. T9 (Ballytarsna Stream), T8 (Mullenhakill Stream) and T12 (unnamed Mullenhakill Stream tributary). These felling areas are located ≤150m from the nearest watercourses. All associated tree felling will be undertaken using good working practices as outlined by the CEMP (Appendix 2-7), the Forest Service in their 'Forestry Harvesting and Environment Guidelines' (2000c) and the 'Forestry and Water Quality Guidelines '(2000b). The latter guidelines deal with sensitive areas, erosion, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. Brash mats will also be used to support harvesting and forwarding machinery. The brash mats reduce erosion of the surface and will be renewed as they become used and worn over time. To ensure a tree clearance method that reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following guidance documents: • Forest Service (2019). Standards for Felling and Reforestation; • Forest Service (2000b). Forest Service Forestry and Water Quality Guidelines; • Forest Service (2000c). Forest Harvesting and Environmental Guidelines; Given the sensitivity of aquatic ecological receptors downstream (e.g. salmonid and lamprey habitats), it is recommended to undertake felling in the spring to facilitate the sowing of grass seed post-harvest to aid sediment filtration and nutrient absorption, using native grass species *Holcus lanatus* and *Agrostris capillaris* (DAFM, 2018). Machine operations must not take place in the 48 hour period before predicted heavy rainfall, during heavy rainfall or in the 48 hour period following heavy rainfall (DAFM, 2018). Removal of branch lop-and-top and other debris (brash) from felling areas within 20m of forestry drains (i.e. up-slope of active pathways to larger downstream watercourses) will reduce nutrient seepage immediately post-felling and in the years after felling has occurred (DAFM, 2019).	

6.30	**Potential site drainage effects** Although there are limited surface water pathways within the site, run-off may enter receiving watercourses via the road/access track drainage network or over-land seepage from infrastructure. Detailed mitigation measures to protect water quality (which include but are not limited to sediment run-off control, management of concrete & aquatic buffer zones) in respect of site drainage are outlined in Chapter 9.	
6.31	*Post-construction Monitoring* Post-construction monitoring is best practice to assess bat activity patterns, evaluate the efficacy of mitigation and inform any changes to the curtailment regime (Scottish Natural Heritage *et al.*, 2019). Post-construction monitoring to assess bat activity and search for bat corpses will be carried out for all turbines found to have a high collision risk for Leisler's bat. Under the final turbine layout these are Turbines 6, 12, 16, 19, 20 and 21. Bat activity data and mortality rates will be used in conjunction with weather data to refine curtailment if appropriate, in accordance with Scottish Natural Heritage *et al.* (2019) recommendations. Increased curtailment of these turbines may be recommended if these turbines prove to still be a risk during post-construction monitoring. If, on the other hand, monitoring proves collision risk to be lower than predicted, reduced curtailment may be recommended. Any refinement to the curtailment programme will be agreed in advance with NPWS.	Operational Phase
Chapter 7 – Ornithology		
7.1	Construction-phase mitigation measures to protect retained habitats within the wind farm site, and to protect wetlands and watercourses, are described in Chapter 6 (Biodiversity) and Chapter 8 (Hydrology & Hydrogeology).	Construction Phase
7.2	Pre-construction / construction breeding bird surveys will be carried out. These will be carried out in the breeding season preceding the start of construction, and in every subsequent breeding season across the duration of the construction period. The primary aims of these surveys will be to verify that no Hen Harriers are nesting in the wind farm site, and to identify breeding Snipe locations. In the unlikely event that Hen Harrier are nesting, any works within the potential disturbance zone of the nest site will be	

	postponed until after the end of the Hen Harrier breeding season. The pre-construction confirmatory bird survey will also search for nest sites of any other sensitive species and implement specific mitigation measures as required. The following additional specific measures will be implemented to mitigate impacts to bird populations: • Where possible, tree felling and scrub clearance will not be carried out during the bird breeding season (1st March - 31st of August). • Based on the results, of the pre-construction / construction breeding bird surveys, construction work will be timed to avoid work in close proximity to any breeding Snipe locations within the wind farm site during the Snipe breeding season. • Subject to the findings of the pre-construction bird surveys, construction work along the section of the grid connection route that crosses the Arrigle River will not be carried out during the Snipe breeding season to avoid disturbance to any breeding Snipe in this area. Three Biodiversity Management Areas have been selected for Snipe habitat creation / management to compensate for the predicted displacement impacts to the breeding Snipe population (Table 7-32 of the main EIAR). Two of these sites (BMA1 and BMA2) were included in the surveys carried out for this assessment and evidence of breeding Snipe was recorded at both sites. However, the habitat in both sites is in degraded condition so there is potential for management to improve the habitat quality. The third site (BMA3) was not included in the breeding wader surveys, but the habitat is potentially suitable for breeding Snipe.	
7.3	At BMA1, GoogleEarth imagery indicates that the area was drained between 2015 and 2017, and adjacent suitable habitat to the south was planted with forestry. While a chipping Snipe was recorded here in 2019, the habitat is very degraded and it seems unlikely that this area could support a viable breeding Snipe population in its current condition. Implementation of an appropriate management regime at this site has the potential to result in a large improvement in the quality of the habitat for breeding Snipe. However, the small size of the site and its isolation from other areas of potential Snipe habitat, may limit its potential for breeding Snipe.	
7.4	GoogleEarth imagery also indicates that drainage work in the middle section of site BMA2 has reduced the quality of the habitat for breeding snipe, although this took place earlier (between 2009 and 2015). The wet heath in the northern section of the site is rather dry and not very suitable for Snipe, while the	

	fields in the southern section are intensively managed and completely unsuitable. Given the size of the site, implementation of an appropriate management regime at this site has the potential to result in creation of a valuable area of Snipe breeding habitat.	
7.5	The vegetation condition in BMA3 in the wet grassland habitat is broadly suitable for breeding Snipe, although there is some scrub invasion occurring. While the site is small, there is an adjacent area of potential Snipe habitat on the eastern side of the river to the north. However, the enclosed nature of the site may limit its potential for breeding Snipe.	
7.6	Management plans have been prepared (Appendix 6-6 of the main EIAR) for each site to create the following optimum habitat conditions for breeding Snipe: very high water table from March to mid/late June, soft damp soil, and a mixture of tall, species-rich vegetation with tussocks and rushes (Benstead *et al.*, 1997). The management required to achieve these conditions will include blocking of drains to raise water levels and implementation of an appropriate low intensity grazing regime, with no grazing during the Snipe breeding season. Suitable stocking rates are around 100-250 livestock units days/ha/year (Benstead *et al.*, 1997). At BMA3, control of scrub encroachment may be required.	
7.7	Under the best case scenario, it is considered that the implementation of Snipe habitat creation / management measures at these three sites could create suitable habitat for 4-6 pairs of Snipe: 2-4 pairs at BMA2 and 1 pair each at BMA1 and BMA3. This would represent an increase of 1-3 pairs on the existing Snipe population (if there is an existing Snipe pair at BMA3), or 2-4 pairs (if BMA3 is currently unoccupied).	
7.8	A post-construction monitoring programme will be carried out. This will include carcass searches to monitor collision mortality, vantage point surveys to help interpret the results of the carcass searches, breeding wader surveys to assess displacement impacts to breeding Snipe and the success of the Snipe mitigation, and Woodcock surveys to assess displacement impacts to the Woodcock population. The design of the monitoring programme will be based on the SNH's *Guidance on Methods for Monitoring Bird Populations at Onshore Wind Farms* (SNH, 2009).	Operational Phase
7.9	The carcass searches will include trials of searcher efficiency and scavenger removal. The frequency of the searches will be weekly in May-July (the Lesser Black-backed Gull breeding period) and at least monthly for the rest of the year, and will be reviewed after the completion of the first year of surveys to determine if a higher search frequency is required. The searches will continue each year until sufficient	

	data has been collected to generate a statistically robust assessment of the collision mortality impacts to Buzzard, Lesser Black-backed Gull and Kestrel. The vantage point surveys will take place in tandem with the carcass searches.	
7.10	The other surveys will take place in Years 1, 2, 3, 5, 10 and 15. These will follow the methods that were used for the breeding wader and Woodcock surveys carried out by the GNM survey team (see Section 7.2.3.4 of the main EIAR). The breeding Snipe surveys will cover all potential breeding Snipe habitat within 500 m of the turbines, the Snipe mitigation sites, and control sites. The latter will be potential Snipe breeding habitats that are outside the 500 m of the turbine buffers and are not part of the mitigation sites. The Woodcock surveys will include the three transect routes that were used by the GNM survey team. However, as most of these transect routes are outside the 250 m turbine buffers, additional transect routes, and/or point surveys, will also be used to generate sufficient data from within the 250 m turbine buffers.	
Chapter 8 – Land, Soils and Geology		
8.1	A number of mitigation measures considered for soil and geology are similar to those relating to hydrology and hydrogeology, further detail can be found in Chapter 9 'Hydrology and Hydrogeology' of the main EIAR. The construction of the development has the potential (with no mitigation) to cause "not significant" to "moderate" short-term to long-term effects to the soil and geology of the proposed development site. Implementing mitigation measures detailed below will reduce the significance of the effects. The mitigation measures have been based on CIRIA (Construction Industry Research and Information Association, UK) technical guidance on water pollution control and on current accepted best practice (CIRIA, 2001). Good site practice will be applied to ensure no fuels, oils, wastes or any other substances are stored in a manner on site in which they may spill and enter the ground. Dedicated, bunded storage areas will be used for all fuels or hazardous substances.	Construction Phase
8.2	The materials encountered in the trial pits are likely to be relatively stable during the excavation for the turbine bases. A physical barrier will be installed between the excavations and the potentially unstable material at unstable conditions, in the form of a granular berm or sheet piles. The long-term stability of the area around the wind turbine foundations will be achieved by filling the area back up to existing ground level following installation of the foundation.	

8.3	Excavation works will be monitored by a suitably qualified and experienced geotechnical engineer or engineering geologist. The earthworks will not be scheduled to be carried out during severe weather conditions.	
8.4	All works will be managed and carried out in accordance with the Construction and Environmental Management Plan (CEMP), which is included in Appendix 2-7. In the event An Bord Pleanála decides to grant permission for the proposed development, the final CEMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Board. All works will be managed and carried out in accordance with the Forestry report (Appendix 2-4 to the main EIAR).	
8.5	The disturbance and excavation of soil, subsoil and bedrock is an unavoidable effect of the development but every effort will be made to ensure that the amount of earth materials excavated is kept to a minimum in order to limit the effect on the geological aspects of the site. The management of geological materials and spoil is an important component of controlling dust and sediment and erosion control. Excavated soils and bedrock will only be moved short distances from the point of extraction and will be used locally for landscaping. Landscaping areas will be sealed and levelled using the back of an excavator bucket to prevent erosion. The upper vegetative layer will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the landscaped soils. These measures will prevent the erosion of soil in the short and long term. Soils, overburden, and rock will be reused on site to reinstate any excavations where appropriate.	
8.6	To ensure slope stability, excavations will be battered back (sloped) to between 1:1.5 and 1:2 depending on depth and type of material. Permanent slopes will generally be less than 1:3. The works programme for the construction stage of the proposed development will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecasted. Works should be suspended if forecasting suggests any of the following is likely to occur: • >10 mm/hr (i.e. high intensity local rainfall events); • >25 mm in a 24 hour period (heavy frontal rainfall lasting most of the day); or,	

	• >half monthly average rainfall in any 7 days. Prior to works being suspended the following control measures should be completed: • Secure all open excavations; • Provide temporary or emergency drainage to prevent back-up of surface runoff; and, • Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded. All excavation works during the construction stage will be monitored by an experienced engineer. you cannot rely on post consent assessment.	
8.7	Mitigation measures will be put in place during the construction of the scheme to reduce the likelihood of an excavation collapsing. Mitigation measures include construction of a granular berm or temporary sheet pile wall to support the soft clays during construction. Based on the GI undertaken, together with information obtained from other sources, provides necessary information to assess the suitability of the ground to support the proposed development. There is a very low risk of landslide (high factor of safety) which is further reduced by implementation of the mitigation measures.	
8.8	Access tracks will be constructed first to allow for access on the site. Vehicular movements will be restricted to the footprint of the permitted development, particularly with respect to the newly constructed access tracks. This means that machinery must be kept on tracks and aside from advancing excavations do not move onto areas that are not permitted for the development, such as areas which have not been designated for access or infrastructure.	
8.9	A construction phase Waste Management Plan (WMP) is included in the CEMP which controls the management of all site-generated construction waste and the storage and disposal of the waste. Waste streams (including material-related streams such as soils, stone, metals, paper and cardboard, plastics, wood, rubber, textiles, bio-waste and product-related streams such as packaging, electronic waste, batteries, accumulators and construction waste) will be managed, collected, segregated and stored in separate areas at the temporary compound and removed off site by a licensed waste management contractor at regular intervals during the works. Appropriated facilities are included in the CEMP, Appendix 2-7 to the EIAR.	

8.10	A wastewater holding tank (twin-hulled) will be used for the temporary welfare facilities and managed by a licensed contractor. The concrete wash-out areas will be bunded, controlled and emptied by a licensed waste collector as required. Any excess building materials (PVC piping, cement materials, electrical wiring, etc.) will be taken off site at the end of the construction phase.	
8.11	A CEMP (Appendix 2-7 to the EIAR) has been developed to include the checking of equipment (plant, vehicles, fuel bowsers) on a regular basis during the construction phase of the project. The purpose of the CEMP is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations.	
8.12	The CEMP (Appendix 2-7 to the main EIAR) provides details on measures and mitigation in relation to the management of fuels and oils on site. These include: • Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling will occur at a controlled fuelling station; • Mobile bowsers, tanks and drums will be stored in secure, bunded, impermeable storage area, away from drains and open water; • Fuel containers will be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores; • Ancillary equipment such as hoses, pipes will be contained within the bund; • Taps, nozzles or valves will be fitted with a lock system; • Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage; • Only designated trained operators will be authorised to refuel plant on site; • An emergency plan for the construction phase to deal with emergency accidents or spills is contained within the CEMP; and • An emergency spill kit with oil boom and absorbers will be kept on site in the event of an accidental spill. All site operatives will be trained in its use.	
8.13	The internal access tracks will require a drainage network to be in place for the construction and operation phases of the site. Fundamental to any construction phase is the need to keep clean water (i.e.	

	runoff from adjacent ground upslope of the permitted development footprint) separate from construction area runoff and manage all other run off and water from construction in an appropriate manner. This will necessitate the implementation of the measures in the CEMP to mitigate against sediment loss and erosion, with associated settlement ponds and silt traps. The Sediment and Erosion Plan forms part of the CEMP (Appenidx 2-7 to the EIAR) for the site. The Sediment and Erosion Plan is included as a design feature thereby applying mitigation by design. The good management of material on site will reduce any indirect risk to water.	
8.14	The handling, storage and re-use of excavated materials are of importance during the construction phase of the project. Excavated topsoil will not be stored in excessive mounds on the site. Excavated and affected areas will be left to naturally revegetate. If revegetation of the upper layer is unsuccessful, the area will be seeded with indigenous species. The re-vegetation of these areas promotes stability, reduces desiccation, run-off erosion and susceptibility to freeze/thaw action.	
8.15	The materials encountered in the trial pits are likely to be relatively stable during the excavation for the turbine bases. A physical barrier can be implemented between the excavations and the potentially unstable material at unstable conditions, in the form of a granular berm or sheet piles. The long-term stability of the area around the wind turbine foundations will be achieved by filling the area back up to existing ground level following installation of the foundation.	
8.16	Excavation works will be monitored by a suitably qualified and experienced geotechnical engineer or engineering geologist. The earthworks will not be scheduled to be carried out during severe weather conditions. Subject to landowner permission, selected private water supply wells at representative locations closest to turbine and borrow pit locations around the site will be monitored for water level and quality pre-construction and during the construction phase.	
8.17	Similar to the construction phase, a twin-hulled wastewater holding tank will be provided and will need to be periodically emptied by a permitted contractor. Likewise, any oil spill related to the equipment or their maintenance will be cleaned and all wastes from the control building and ancillary facilities will be removed by the appropriate contractor.	Operational Phase
8.18	The operational team will carry out maintenance works (to access tracks, substation and turbines) and will put in place mitigation measures to reduce the risk of hydrocarbon or oil spills during the operational phase of the windfarm. The potential effects are limited by the size of the fuel tank of vehicles used on the site.	

8.19	The proposed mitigation measures during the operational phase are as follows: • Minimal refuelling or maintenance of operational vehicles or plant will take place on site. Off-site refuelling will occur at a controlled fuelling station; • On site re-fuelling will be undertaken using a double skinned bowser with spill kits on the ready for accidental leakages or spillages; • Re-fuelling will be undertaken by suitably trained personnel only; • Fuels stored on site will be minimised. Storage areas where required will be bunded appropriately for the fuel storage volume for the time period of the operation and fitted with a storm drainage system and an appropriate oil interceptor.	
8.20	It is intended that unsuitable founding soils (topsoil) and subsoils will be reused for site landscaping and used to reinstate the borrow pits. Temporary stockpiling from excavations will be avoided near sensitive receptors such as watercourses. All of the excavated soils will be used for local landscaping or for borrow pit reinstatement. Approximately 2.5% of the site will be altered as a result of the proposed development.	
8.21	In order to minimise the potential impacts to Land Use, the following mitigation measures are proposed: • Minimising areas for earthworks thereby reducing land take requirements; • Restricting areas for construction works and temporary storage to a minimum; • Retention of all existing perimeter planting and re-generating vegetation where possible and sufficiently protect in areas close to construction works as described in BS 5837:2005; • Disturbance of existing vegetation will be minimised where possible and proposed planting will help integrate the proposed development into the current land use; • The handling, storage and re-use of excavated materials are of importance during the construction phase of the project. Stockpiles will be located away from the watercourses and drainage ditches. Topsoil and subsoils will be stored near the landscaping and in the reinstatement of borrow pit areas. Topsoil will be stockpiled no higher than 2.5m and follow the recommendations set out in the NRA Guidelines for the Management of Waste from National Road Construction Projects (NRA, 2014); • Turves will be stored turf side up and must not be allowed to dry out;	

	• No permanent spoil or stockpiles will be left on site; • The method for restoration of excavated or disturbed areas is to encourage stabilisation and early establishment of vegetation cover, where available, vegetative sods/turves or other topsoil in keeping with the surrounding vegetation type will be used to provide a dressing for the final surface; and • To prevent erosion and run-off and to facilitate vegetation reinstatement, any sloped embankment will be graded such that the slope angle is not too steep and that embankments match the surrounding ground profile.	
8.22	Decommissioning will comprise the removal of all over ground elements of the wind farm. The site roadways may be in use for additional purposes to the operation of the wind farm (e.g. for forest/agricultural and recreational access) by the time the decommissioning of the project is to be considered, and therefore the site roads will remain in-situ for future use. Some of the hardstand material will be removed where required, and along with the turbine foundations, covered in topsoil and revegetated. The substation and grid connection infrastructure will form part of the permanent national grid network. The risks associated with leaving tracks in-situ are relatively low. The decommissioning phase will not require any significant works that will impact the land and soils environment. A fuel management plan to avoid contamination by fuel leakage during decommissioning works will be implemented as per the construction phase mitigation measures. Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant. Some of the impacts will be avoided by leaving elements of the Proposed Development in place where appropriate. The bases will be rehabilitated by covering with local topsoil in order to regenerate vegetation which will reduce runoff and sedimentation effects. Access tracks which are not required for farm use or forestry will also be left to vegetate naturally. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures in Section 8.5.1 of the main EIAR. The replanted forestry lands will continue as commercial forestry where the forestry cycle of felling and replanting occurs.	

Chapter 9 – Hydrology & Hydrogeology		
9.1	As outlined in Chapter 2 of the main EIAR, Description of the Proposed Development, the design of the proposed development has considered a range of best practice construction measures which will ensure avoidance and reduction of impacts throughout the construction, operational and decommissioning phases. Additional measures have been developed to mitigate the impacts identified in the preceding section. In identifying and avoiding sensitive surface waters, the proposed development has implemented 'avoidance of impact' measures. Mitigation by avoidance is viewed as part of the 'Reasonable Alternatives' (Chapter 3 of the main EIAR). Examples include moving the grid connection route away from streams discharging into the River Arrigle, locating fuel storage and construction compounds >50 m from surface water streams. No marked streams are crossed by the turbine access tracks. A number of internal drains including drains near T5 and T9 are crossed by internal access tracks. These are typically dry during the summer months.	Construction Phase
9.2	A number of mitigation measures are outlined and are considered as in-built to the design of the project. These mitigation measures are a combination of measures to comply with legislation and best practice construction methods to be implemented in order to prevent water (surface water and groundwater) pollution. Examples of these measures are the storage of potentially polluting materials in fully bunded tanks and controlling / reducing runoff from hardstand areas.	
9.3	In order to mitigate potential impacts during the construction phase, best practice construction methods will be implemented in order to prevent water (surface water and groundwater) pollution. A CEMP (Appenidx 2-7 to the main EIAR) was developed for the project to ensure adequate protection of the water environment. All personnel working on the project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.	
9.4	During the construction phase, all works associated with the construction of the wind farm will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015). Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016). Groundwater	

	from the borrow pits will be treated in the settlement lagoons. Subject to landowner permission, selected private water supply wells at representative locations closest to turbine and borrow pit locations around the site will be monitored for water level and quality pre-construction and during the construction phase.	
9.5	All mitigation and management measures outlined hereunder will be incorporated into the Surface Water Management Plan, which forms part of the CEMP. Mitigation measures are incorporated into the CEMP (Appendix 2-7 of the main EIAR) and will be incorporated into the specification for the Civil Engineering Works contract. The implementation of the Surface Water Management Plan will be overseen by a suitably qualified ecologist/engineer and will be regularly audited throughout the construction phase. The assigned ecologist/engineer will be required to stop works on site if he/she is of the opinion that a mitigation measure or corrective action is not being appropriately or effectively implemented.	
9.6	It is recommended that local surface water features in the immediate vicinity of the site boundary are monitored pre-construction and during construction to take account of any variations in the quality of the local surface water and groundwater environment as a result of activities related to the proposed development. Monitoring of selected groundwater wells/spring including St Molins Well will be undertaken during the construction period. Subject to landowner permission, selected private water supply wells at representative locations closest to turbine and borrow pit locations around the site will be monitored for water level and quality pre-construction and during the construction phase.	
9.7	Inspections of silt traps are critical after prolonged or intense rainfall while maintenance will ensure maximum effectiveness of the proposed measures. Turbidity monitors/alarms will be strategically placed upgradient on the River Arrigle and downgradient of works to assess on-going construction works. A programme of inspection and maintenance will be designed, and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed and records kept.	
9.8	During the construction phase, field testing and laboratory analysis of a range of parameters will be undertaken at adjacent watercourses, specifically following heavy rainfall events (i.e. weekly, monthly and event based as appropriate).	
9.9	As stated previously, to maximise the erosion and sediment control benefits of natural vegetation soil cover, stripping of soil is to be kept to a minimum and confined to construction areas only. Where	

	practical, construction works will be staged to minimise the extent and duration of disturbance, e.g. plan for progressive site clearance, only disturbing areas when they are scheduled for current construction work.	
9.10	To minimise any impact on the underlying subsurface strata from material spillages, all oils and solvents used during construction will be stored within specially constructed dedicated bunded areas. Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area of the site, away from surface water gullies or drains. Spill kits and hydrocarbon absorbent packs will be stored in this area and operators will be fully trained in the use of this equipment. For certain vehicles which are less mobile, refuelling may need to occur elsewhere on site. This will be carried out using a double skinned and bunded bowser, towed behind a jeep (or similar). Refuelling using this will take place only by trained personnel, and only at locations greater than 50m from any watercourse. A spill kit will be stored with the bowser and the person operating the bowser will be trained in their use. When not in use this will be stored in the designated area of the construction compounds.	
9.11	All construction waste will be sorted and stored in on-site skips, prior to removal by a licensed waste management contractor.	
9.12	Concrete is required for the construction of the turbine bases and foundations. After concrete is poured at a construction site, the chutes of ready mixed concrete trucks must be washed out to remove the remaining concrete before it hardens. Wash out of the main concrete bottle will not be permitted on site; wash out is restricted only to chute wash out. Wash down and washout of the concrete transporting vehicles will take place at an appropriate facility offsite.	
9.13	The best management practice objectives for concrete chute washout are to collect and retain all the concrete washout water and solids in leak proof containers or impermeable lined wash out pits, so that the wash material does not reach the soil surface and then migrate to surface waters or into the ground water. The collected concrete washout water and solids will be emptied on a regular basis. Washout will be undertaken at the construction compounds.	
9.14	With regards to on-site storage and handling of potentially pollutant materials:	

	• Fuels and chemicals will be stored within bunded areas as appropriate to guard against potential accidental spills or leakages. The bund area will have a volume of at least 110 % of the volume of such materials stored; • All on-site refuelling will be carried out by a trained competent operative. • Mobile measures such as drip trays and fuel absorbent mats kept with all plant and bowsers and will be used as required during all refuelling operations; • A spill kit will be stored with the bowser and the person operating the bowser will be trained in their use; • No refuelling will take place within 50 m of any watercourse; • All equipment and machinery will have regular checking for leakages and quality of performance and will carry spill kits; • Any servicing of vehicles will be confined to designated and suitably protected areas such as construction compounds; and • Additional drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site. As outlined, if not correctly managed, earthworks can lead to loss of suspended solids to surface waters. The main factors influencing the rate of soil loss and subsequent sediment release include: • Climate; • Length and steepness of slopes; • Soil erosion potential; • Soil Vegetation/cover; • Duration and extent of works; and • Erosion and sediment control measures.	
9.15	The works programme for the initial construction stage of the Proposed Development will take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.	

9.16	The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities: • General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates; • MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale; • 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events; • Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and, • Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest. Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event. Works will be suspended if forecasting suggests any of the following is likely to occur: • >10 mm/hr (i.e. high intensity local rainfall events); • >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or, • >half monthly average rainfall in any 7 days.	

9.17	Prior to works being suspended the following control measures will be completed: • Secure all open excavations; • Provide temporary or emergency drainage to prevent back-up of surface runoff; and, • Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded; and • Provide cover to material storage areas i.e. adequate tarpaulin over stockpile areas if material cannot be reinstated prior to suspension.	
9.18	As a further precaution, near-stream construction work will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document *"Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites"*, that is, May to September inclusive. This time period coincides with the period of lowest expected rainfall and, therefore, minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.	
9.19	Runoff will be maintained at Greenfield (pre-development) runoff rates. The layout of the development has been designed to collect surface water runoff from hardstanding areas within the development and discharge to associated surface water attenuation lagoons adjacent to the proposed infrastructure. It will then be managed by gravity flow at Greenfield runoff rates.	
9.20	It is proposed, that during the ground clearance of the proposed development, the contractor will implement water control measures to limit the impact on water quality using standards measures as set out in Forestry Report (Appendix 2-4 of the main EIAR). Brash will be used along harvesting and extraction routes for soil protection. The forwarder will be loaded to the manufacturer's maximum specification and no more to avoid overloading and unnecessary soil compaction.	
9.21	Suspended solid (silt) removal features will be implemented in accordance with CIRIA C697 SuDS Manual, and CIRIA C648 Control of water pollution from linear construction projects	

9.22	All temporary and permanent drainage from the site shall be designed to have as a minimum three stages of treatment, as defined in the SuDS Manual. Management of runoff will include the following: • Filtration of water through filter media (sand / stone check dam, silt fence); • Detention / settlement in settlement ponds or behind check dam in swales; and • Conveyance of shallow depths of water in vegetated swale.	
9.23	Interceptor drains/diversion ditches will be installed ahead of the main earthworks activities to minimise the effects of collected water on the stripped/exposed soils once earthworks commence. This drainage will integrate into the existing forestry drainage. These drainage ditches will be installed on the upgradient boundary of the areas affected by the access track earthworks operations and installed ahead of the main track construction operations commencing. They will generally follow the natural flow of the ground. The interceptor drains will intercept any storm water surface run-off and collect it to the existing low points in the ground, allowing the clean water flows to be transferred independently through the works without mixing with the construction drainage. It will then be directed to areas where it can be redistributed over the ground by means of a level spreader.	
9.24	Track edge drainage/swales are required to control run-off from the running surface to lower water levels in the subgrade, to control surface water and to carry this flow to outlet points. Swales along access tracks are to be installed in advance of the main construction phase. On sections of track where there is significant longitudinal gradient, regular surface water interception channels will be employed – these will typically be at 10-20m intervals to collect any surface water that is discharging as sheet flow along the track and discharge the flow into the trackside swale. Swales will provide additional storage of storm water where located along gradient. Given the steep longitudinal gradients on some sections of access track, regular check dams will be employed within the trackside swale on these sections to reduce the flow velocity and provide settlement opportunity. Check dams will be constructed from course gravel/ crushed rock. Check dams will have a minimum 0.2m freeboard (from top of check dam) to top of swale level, to prevent overtopping of flows onto the access track. All check dams, etc to be checked at least once weekly via a walkover survey during the full period of construction. All excess silts to be removed and disposed of appropriately. Where check dams have become fully blocked with silt, they will be replaced.	

9.25	Swales will be re-vegetated by hydro-seeding with indigenous seed mix as soon as is practicable following excavation. This will reduce the flow velocity, treat potential pollutants, increase filtration and silt retention.	
9.26	Settlement ponds will be located downstream of road swale sections and at turbine/hardstand locations, to manage/buffer volumes of runoff discharging from the drainage system during periods of high rainfall, thereby reducing the hydraulic loading to watercourses. Settlement ponds are designed in consideration of the greenfield runoff rates. The following shall apply to construction of settlement ponds at the site: • Pond depths generally to be excavated to less than 2m; • Side slopes to be shallow, nominally at a 1 in 3 side slope (maximum); and • Material excavated from the settlement pond should be compacted around the edge of the pond.	
9.27	Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained.	
9.28	The settlement pond design is based on primary settling out of suspended solids from aqueous suspension. The theory behind the design of the settlement lagoons is the application of Stoke's Law. The settlement lagoons will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment. Flow rates for storm events will be maintained at or below greenfield runoff rates as detailed in Section 9.5.4.	
9.29	Settlement lagoons will be installed concurrently with the formation of the road and will be fenced off for safety. They will be located as close to the source of sediment as possible and as far as possible from the buffer zones of existing watercourses. The minimum buffer zone width will be 50m as outlined.	
9.30	Settlement lagoons will be regularly cleaned/maintained to provide effective and successful operation throughout the works. Outfalls and drainage ditches will be cleaned, when required, starting up stream with the outfalls blocked temporarily prior to cleaning.	

9.31	The sediments/silt in the settlement lagoons will be cleaned regularly and removed via the contractor and deposited at suitable locations on site, away from watercourses. Machine access is required to excavate the accumulated sediment. Control measures include: • Regular inspection and maintenance of settlement lagoons and drains; • Settlement lagoon maintenance and/or cleaning will not take place during periods of extended heavy rain; • Settlement lagoons will be fenced off for safety; • Settlement lagoons will where practicable be constructed on even ground and not on sloping ground and where possible will discharge into vegetation areas to aid dispersion; and • The settlement lagoons will be monitored closely over the construction timeframe to ensure that they are operating effectively.	
9.32	All stockpiled material will be side cast, battered back and profiled to reduce rainfall erosion potential. The stockpiling of materials will be carefully supervised as per the mitigation measures listed in Section 8.5.1 within Chapter 8 of the Main EIAR, Soils and Geology.	
9.33	Traffic on site will be kept to a minimum. Only the proposed onsite access track will be used for project-related traffic.	
9.34	Correct buffer zone management will help reduce the risk of sedimentation from felling operations (See Appendix 2-4 of the main EIAR). Buffer zone guidelines for planting and felling activities are provided by the Forestry Service in the *'Forestry and Water Quality Guidelines'*; it is proposed to apply these buffer zone guidelines to construction activities also. Construction activities will be curtailed within buffer zones in order to reduce erosion and sedimentation and, therefore, to protect water quality. Buffer zone widths vary from 10m to 25m, depending on slope and soil erosion classification. Details of buffer zones are included in Table 9-12 of the main EIAR.	
9.35	The slopes across the proposed Wind Farm site are predominantly moderate with some steep slopes. As the soil type varies across the site, this suggests that a 10 to 20m buffer zone is appropriate. As an additional measure, all infrastructure on the proposed wind farm site including for turbines, borrow pits, site compounds, substation and access tracks (excluding grid connection) will maintain a 50m set back from streams.	

9.36	All associated tree felling will be undertaken using good working practices as outlined in the Forestry Report (Appendix 2-4) and CEMP (Appendix 2-7 to the main EIAR) , the Forest Service in their 'Forestry Harvesting and Environment Guidelines' (2000) and the 'Forestry and Water Quality Guidelines '(2000). The latter guidelines deal with sensitive areas, erosion, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. Brash mats will also be used to support harvesting and forwarding machinery. The brash mats reduce erosion of the surface and will be renewed as they become used and worn over time.	
9.37	During the construction phase, two temporary site compounds will be required. Temporary on-site toilet facilities (chemical toilets) will be used. These will be sealed with no discharge to the surface water or groundwater environment adjacent to the site.	
9.38	Potential impacts on surface water flow during the construction phase of the wind farm are mitigated by the proposed drainage design which has been designed to minimise disturbance to the current hydrological regime by maintaining diffuse flows.	
9.39	Where main drain crossings occur (i.e. access tracks), it is proposed to use a clear-span design bridge or bottomless culverts. Installation of such features will take place during dry periods to reduce the risk of sediment entering the watercourse. Smaller forestry drains with be crossed using normal culverts.	
9.40	A number of ephemeral drainage features (drains) are also present on site. These appear stagnant or dry except during wet weather. Culverting of these will only take place during dry weather periods. Culverts will be designed to be of a size adequate to carry expected peak flows. Culverts will be installed to conform, wherever possible, to the natural slope and alignment of the drainage line. Where required, culverts will be buried at an appropriate depth below the channel bed and the original bed material placed at the bottom of the culvert. The sizing of any new internal drainage crossings will maintain existing depth of flow and channel characteristics. The CEMP and method statement for watercourse crossings follows the guidelines set out in the following documents: • CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.	

	• CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London. • CIRIA (2015a). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London. • CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London. • CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London. • DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019 • Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines. • IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin. • IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin. • IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney & Company for the Irish Wind Energy Association. • Kilfeather, P.K. (2007) Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board. Southern Regional Fisheries Board, Clonmel, Co. Tipperary • Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin. • NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority. • PPG1 - General Guide to Prevention of Pollution (UK Guidance Note); • PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note); • SNH (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage, March 2012. • SNH (2019). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.	
9.41	Embedded culverts will be buried to a depth of 0.3m or 20% of their height (whichever is greatest) below the bed. Crossing construction will be carried out, in so far as is practical, with minimal disturbance to	

	the drain bed and banks. If they have to be disturbed, all practicable measures including location of stockpiles away from drainage ditches will be taken to prevent soils from entering any water. Any culverting works at drains will take place only during dry periods when the drains are dry/stagnant. Silt traps will be placed on the downgradient side of the crossing.	
9.42	Cement and raw concrete will not be spilled into watercourses. No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and emplacement of pre-cast elements will take place. Pre-cast elements for bridge, culverts and concrete works will be used where possible. During the delivery of concrete on site, only the chute will be cleaned on-site, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout lagoons. These lagoons will be cleaned out by a licensed waste contractor. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Weather forecasting will be used to plan dry days for pouring concrete. The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.	
9.43	A setback distance of 10 to 20 m from any watercourse will be kept clear of brash as far as practicable, to avoid felling of trees into watercourses and removal of them or any other accidental blockages that may occur. Where practicable, crossings should be adequately elevated with low approaches such that water drains away from the crossing point. Earth embankments constructed for bridge approaches will be protected against erosion e.g. by re-vegetation or rock surfacing etc.	
9.44	The mitigation strategies for the substation foundations follow similar procedures to the excavations for turbine and hardstanding foundations see Section 8.6.3.1. All works will be monitored by a suitably qualified and experienced engineer.	
9.45	Where existing drainage ditches need to be realigned (e.g. around substation), the new ditch will match the profile of the existing ditch in relation to side-slope profile and the material at the base of the channel.	
9.46	Silt fencing will be erected at the location of stream crossings along the grid connection route. Silt curtains and floating booms will also be used where deemed to be appropriate and this will be assessed separately at each individual location.	
9.47	No refuelling of machinery will take place within 50m of a watercourse. Excavated material will not be stockpiled or side-cast within 50m of a watercourse. Appropriate steps will be taken to prevent soil/dirt generated during the temporary upgrade works to the TDR from being transported on the public road.	

	Road sweeping vehicles will be used to ensure that the public road network remains free of soil/dirt from the location of the TDR works and grid connection when required. This will reduce the potential for sedimentation of surface watercourses locally. Further mitigation measures in relation to the grid connection cable route and road/junction accommodation works on the TDR are outlined in the CEMP (Appendix 2-7 to the EIAR)	
9.48	There will be 3 no. natural watercourse crossings along the grid connection route, and one significant drainage ditch crossing. Directional drilling is the proposed construction method for 2 no. of identified crossings, at the River Arrigle and one of its tributaries. Shallow trefoil formation will be used for the other two crossings in order to cross over existing drains/ culverts. Further information on watercourse, bridge and culvert crossings are provided in Chapter 2, Description of the Proposed Development.	
9.49	Where existing drainage ditches need to be realigned (e.g. around substation), new ditches will match profile of existing ditch in relation to width, existing side slope profile (or lower) and material at base of channel will reused. The sizing any new culverts will be designed to maintain existing flow characteristics and depth of flow. Within the site development area, culverts will be assessed to ensure no barriers to fish migration occur. Where barriers occur, such culverts will be improved to increase fisheries potential.	
9.50	In order to prevent significant water quality impacts and morphological impacts, trenchless technology will be carried out to install the cable below the River Arrigle and Mullenakill Stream. A number of measures to mitigate potential impacts associated with the directional drilling are listed below: • A minimum 50 meter vegetative buffer zone will be maintained between the works area and the watercourse. • There will be no storage of material / equipment or overnight parking of machinery inside the 50m buffer zone; • Before any ground works are undertaken, double silt fencing will be placed upslope of the watercourse channel along the 50m buffer zone boundary; • Additional silt fencing or straw bales (pinned down firmly with stakes) will be placed across any natural surface depressions / channels that slope towards the watercourse; • Silt fencing will be embedded into the local soils to ensure all site water is captured and filtered;	

	• The area around the bentonite batching, pumping and recycling plant will be bunded using terram (as it will clog) and sandbags in order to contain any spillages; • Drilling fluid returns will be contained within a sealed tank / sump to prevent migration from the works area; • Spills of drilling fluid will be cleaned up immediately and stored in an adequately sized skip before being taken off-site; • If rainfall events occur during the works, there will be a requirement to collect and treat small volumes of surface water from areas of disturbed ground (i.e. soil and subsoil exposures created during site preparation works); • This will be completed using a shallow swale and sump down slope of the disturbed ground; and water will be pumped to a proposed distribution area at least 50m from the watercourse; • The discharge of water onto vegetated ground at the percolation area will be via a silt bag which will filter any remaining sediment from the pumped water.; • Any sediment laden water from the works area will not be discharged directly to a watercourse or drain; • Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter is discharged to the watercourse; • If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied; • On completion of the works, the ground surface disturbed during the site preparation works and at the entry and exit pits will be carefully reinstated and re-seeded at the earliest opportunity to prevent soil erosion; • The silt fencing upslope of the river will be left in place and maintained until the disturbed ground has re-vegetated; • There will be no refuelling allowed within 50m of the watercourse crossing; and, • All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing. • The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e. Clear Bore Drilling Fluid or similar will be used);	

	• The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage; • One or more lines of silt fencing will be placed between the works area and the adjacent river; • Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility; • Adequately sized skips will be used where temporary storage of arisings are required; • The drilling process / pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse; • This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur then drilling will be immediately stopped; • Any frac-out material will be contained and removed off-site; and • The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix.	
9.51	As part of the requirements of the new EIA Directive, the applicant is requested to consider the "Expected Significant Adverse Effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned." This section describes the expected significant effects on the environment arising from the vulnerability of the proposed development to risks of major accidents and/or natural disasters which are relevant the project. The EIA Directive which states the need to assess: "the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or natural disasters which are relevant to the project concerned." In this regard, the most likely major accidents that could occur as a result of the proposed development (and its associated works) include: • Significant hydrocarbon spillage; • Turbine collapse; and • Turbine or substation fire. The most likely natural disasters that might occur and potentially impact the proposed development (and its associated works) include:	

	• Fire; and • Landslide. Due to the limited quantities of fuel on site and disperse storage, the potential for a significant spillage of hydrocarbons is negligible and does not give risk to a major accident or disaster. Notwithstanding the negligible risk of serious spillage, additional spillage protection measures are included in the mitigation measures for the Proposed Development. In the unlikely event of a minor spill, the spill will be collected by the dedicated refueling hardstand area, only completed by trained operatives and spill kits to be made readily available. Additional measures in relation to hydrocarbon or oil spills are further discussed in Section 9.6.4.1 of the EIAR. Section 8.5 of the EIAR outlines mitigation measures in relation to potential contaminants. There are no streams in close proximity to turbine or substation locations. Due to the felling of trees around the substation and turbine locations, in the unlikely event of a fire there is no significant additional fire risk due to separation distances. In the event of substation or turbine fire there is minimal potential for fire spread due to the proposed design (i.e. hardstand areas combined with tree felling buffers) and limited volumes of hydrocarbons or flammable material. There is no significant impact on the surface water from turbine collapse, turbine or substation fire. It can be concluded that the risk of major accidents associated with this development and hydrological/hydrogeological factors is very low and would not cause unusual, significant or adverse effects on the hydrological or hydrogeological environment during the construction, operational and decommissioning phases.	
9.52	The operational team will carry out maintenance works such as servicing of wind turbine and transmission infrastructure, upkeep of access tracks and any hardstand areas, ensuring drainage system remains functional throughout the operation of the windfarm.	Operational phase
9.53	Mitigation for the operational maintenance works include regular scheduled maintenance works, regular inspections of all project elements with any unscheduled repairs or maintenance arising to be undertaken.	

9.54	The potential impact of hydrocarbon or oil spills during the operational phase of the windfarm are limited by the size of the fuel tank of vehicles used on the site. Mitigation measures for the potential release of hydrocarbons or oil spills include: • The plant and vehicles to attend site should be regularly inspected or at least prior to the scheduled site visit to be free from leaks and is fit for purpose; • Fuels stored on site will be minimised, any storage areas will be bunded appropriately for the fuel storage volume for the time period of the operation; • Operational team to be competent and trained in an emergency plan for the operation phase to deal with accidental spillages; and • Spill kits will be available to deal with accidental spillages.	
9.55	All fuel will be stored in bunded areas. The bund capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. The exception to this being double walled tanks equipped with leak detection, which do not require additional retention.	
9.56	A hydrocarbon interceptor will be installed at the proposed substation site with regular inspection and maintenance, to ensure optimal performance.	
9.57	Given the requirement for sanitary facilities during occasional operation and maintenance works, wastewater effluent will be directed to an onsite holding tank, from where it will be tankered off site to a suitably licensed wastewater treatment plant. An automatic alert system will be used to monitor the holding tank to alert the operator if the tank is nearing full capacity. A water supply will be collected using a rainwater harvesting facility on the control building. Potable water will be brought onsite in bottles.	
9.58	Decommissioning of the proposed development would result in the cessation of renewable energy generation, the removal of all above ground turbine components whilst other infrastructural elements such as turbine foundations. The site access tracks, parking area, cabling and substation will remain in place. The risks associated with leaving tracks and infrastructural components in situ are relatively low. The decommissioning phase will not require any significant works that will impact the drainage network. A	Decommissioning Phase

	fuel management plan to avoid contamination by fuel leakage during decommissioning works will be implemented as per the construction phase mitigation measures. Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant. Some of the impacts will be avoided by leaving elements of the Proposed Development in place. The turbine bases and hardstanding areas will be rehabilitated by covering with locally sourced topsoil in order to regenerate vegetation which will reduce runoff and sedimentation effects. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures in Section 9.6.3 of the main EIAR. These impacts have therefore been assessed as similar to the construction phase. Mitigation measures for the construction phase will therefore also be implemented during decommissioning.	
Chapter 10 – Shadow Flicker		
10.1	The shadow flicker modelling predicts worst-case 'bare earth' conditions without vegetation (including forestry), buildings or other obstacles. In reality, existing screening in the form of buildings, vegetation and local topographic variations will have a significant impact on the level of shadow flicker that will actually be experienced by the identified shadow flicker receptors. When these additional screening features are taken into account, the actual impact in terms of incidence and duration may be significantly reduced or even eliminated.	Construction Phase
10.2	Wind turbine technology will be installed as standard practice to automatically shut-down individual turbines during periods of confirmed shadow flicker to prevent its occurrence at receptors adjacent to the wind farm. The technology will be installed and commissioned for all turbines and typically comprises a pre-programmed function to stop the turbine blades from rotating during a given time period based on the modelled and verified shadow flicker predictions. The technology is typically fitted with a photosensitive sensor to verify that there is sufficient light for shadow flicker to occur. A Turbine Shutdown Scheme will be the primary mitigation measure for shadow flicker impact and will be implemented for the proposed wind farm development based on the predicted shadow flicker at each shadow flicker receptor. The Turbine Shutdown Scheme will be employed to ensure that shadow flicker does not occur at the affected property(s). A process will be established by the wind farm operator	Operational Phase

	whereby local residents can highlight any concerns or complaints about the operation of the scheme. All concerns raised will be investigated by the wind farm operator and the turbine shutdown software adjusted accordingly, as required. During the commissioning phase, there is potential for some shadow flicker to be experienced as the shadow flicker management software is installed and refined. However, the commissioning team will ensure that the maximum daily limit of 30 minutes per day is not exceeded during this temporary commissioning period. It is noted that any shadow flicker effects which may be experienced at identified receptors exclusively from the existing wind farms at Rahora and Ballymartin/Smithstown (i.e. not as a result of the proposed development) cannot be mitigated by the Developer. As set out in Section 10.4.3 of the EIAR, it is predicted that even in the worst-case scenario, without mitigation, there are only two shadow flicker receptors (P145 and P146) which have the potential to experience a cumulative effect.	
10.3	If there is sufficient existing screening at a shadow flicker receptor, the Turbine Shutdown Scheme may not be necessary for that receptor. The Developer will engage with any affected residents to investigate options for new or additional screening measures (such as planting), where appropriate and agreeable to the affected residents. Where agreed screening measures are implemented, the effectiveness of the measures will be monitored and if the measures are not functioning to the satisfaction of the property owner/occupant, they will be included in the Turbine Shutdown Scheme as set out in Section 10.5.1 of the EIAR. A system for logging complaints related to shadow flicker will be put in place in advance of the commissioning of the proposed wind farm, and details of the process will be made available to local residents. In the event of shadow flicker occurrence, this can be reported and measures implemented immediately to adjust the timing/programming of the turbine shutdown management controls.	

Chapter 11 – Material Assets – Telecommunications and Aviation		
11.1	There are no potential impacts on aviation/telecommunications anticipated for the majority of the proposed construction phase, and so there are no mitigation measures required. Towards the end of the construction phase, prior to the erection of turbines, the mitigation measures described in Item 11.3 and Item 11.5 below will be implemented.	Construction Phase
11.2	As with any excavations, particularly in the public road network, there is a potential to disrupt local underground services. A confirmatory survey of all existing services will be carried out prior to construction to verify the assumptions in this report and identify the precise locations of any services. The developer will liaise with the service provider where such services are identified. Digging around existing services, if present, will be carried out by hand to minimise the potential for accidental damage. There are no other impacts likely to arise during the construction phase, and therefore no other mitigation measures are required.	
11.3	The proposed development will require certain lighting requirements for tall structures. This will increase the visibility of the proposed development to any local aircraft. The final locations and dimensions of each turbine will be mapped and provided to the local authority and stakeholders (such as the Irish Aviation Authority) prior to erection to ensure that maps and databases are up-to-date for flight navigation. Further details are provided in Appendices 11-1 and 11-2 of the main EIAR.	Operational phase
11.4	In order to avoid any impacts on the Instrument Flight Procedures: The assessments show that the clearance distances between the assessed procedures and the proposed turbines exceed all relevant clearance minima. With respect to potential new IFPs as a result of the runway extension, a worst-case 2,000ft DME 12nm arc has been assessed. Considering an existing wind farm (Ballymartin/Rahora), a 1,000ft clearance would not be possible. Therefore, the minimum altitude would need to be increased and taken into account in the design of new IFP's for the extended runway. In doing so, steps could be taken to accommodate the proposed wind farm to ensure minimum clearance distances	
11.5	The proposed development is not anticipated to have any impact on any telecommunication links in the region due to the distance between the existing links and the proposed turbine locations. The developer has signed an agreement with 2RN (Appendix 11-5 to the EIAR) to commit to restoring service to any	

	end users that may have their service disrupted as a result of the proposed development. This is standard industry practice and will eliminate any potential impacts in this regard.	
11.6	Segregation of waste will be carried on site to maximise the potential for waste recycling and minimise any potential for impacts on waste services. A licensed waste collector will be used to remove any waste that does occur on site. A low-flush cistern will be fitted to reduce the volume of wastewater produced.	
11.7	Segregation of waste will be carried on site to maximise the potential for waste recycling and minimise any potential for impacts on waste services. Appropriately licensed waste collectors will be used to remove any municipal waste, wastewater or general demolition waste that does occur on site. The majority of wastes from decommissioned infrastructure will be recyclable, and the large items (turbines, met mast) will be collected and processed by appropriately licensed specialist companies with the capability to process these items correctly.	Decommissioning Phase

Chapter 12 – Noise and Vibration		
12.1	The comments in this section relate primarily to the construction phase, but apply equally to the decommissioning phase: Regarding construction/decommissioning activities, reference shall be made to BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*, which offers detailed guidance on the control of noise and vibration from construction activities. It is proposed that various practices 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 the surface of the site access roads even to mitigate the potential for vibration from lorries.	Construction Phase

	Furthermore, a variety of practicable noise control measures will be employed. These include: • selection of plant with low inherent potential for 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.	
12.2	The contract documents shall specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures when deemed necessary to 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 considered, where necessary, to ensure compliance with the relevant construction noise criteria: • No plant used on site will be permitted to cause an on-going 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 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 is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen. • During the construction programme, supervision of the works will include ensuring compliance with the limits detailed 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 7:00hrs and 19:00hrs weekdays and between 7:00hrs and 19:00hrs on Saturdays. However, to ensure that optimal use is made of good weather period or at critical periods within the programme (i.e. concrete pours) or to accommodate delivery of large turbine component along public routes it could be necessary	Construction Phase

	on occasion to work outside of these hours. Any such out of hours working will be agreed in advance with the local Planning Authority. In addition to the mitigation measures outlined above, where grid connection works are taking place within 50m of the nearest NSL, screening will be used as an effective method to reduce the noise level at the nearest receivers. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and receiver. The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen will be wrapped around the source. *BS 5228-1:2009+A1:2014* states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier will be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice, screens constructed of materials with a mass per unit of surface area greater than 10kg/m^2 will give adequate sound insulation performance. As an example, the use of a standard 2.4m high construction site hoarding will provide a sufficient level of noise screening once it is installed at a suitable position between the source and receiver. Annex B of *BS 5228-1:2009+A1:2014* (Figures B1, B2 and B3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on site from standard materials.	
12.3	Where rock breaking is employed, the following are examples of measures that will be considered, where necessary, to mitigate noise emissions from these activities: • Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency. • Ensure all leaks in air lines are sealed. • Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured. • Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.	

12.4	Air overpressure from a blast is difficult to control because of its variability, however, much can be done to reduce the effect. A reduction in the amount of primer cord used, together with the adequate burial of any that is above the ground, can give dramatic reduction to air overpressure intensities especially in the audible frequency range. Most complaints are likely to be received from an area downwind of the blast site, and therefore, if air blast complaints are a continual problem, blasting during unfavourable weather conditions will be postponed. As air blast intensity is a function of total charge weight, then a reduction in the total amount of explosives used can also reduce the air overpressure value.	
12.5	Further guidance will be obtained from the recommendations contained *within* BS 5228: Part 1 and the *European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations 1988* in relation to blasting operations. The methods used to minimise effects will consist of some or all the following: • Restriction of hours within which blasting can be conducted. • A publicity campaign undertaken before any work and blasting starts (e.g. 48 hours written notification). • The firing of blasts at similar times to reduce the 'startle' effect. • On-going circulars informing people of the progress of the works. • The implementation of an onsite documented complaints procedure. • The use of independent monitoring by external bodies for verification of results. • Trial blasts in less sensitive areas to assist in blast designs and identify potential zones of influence.	
12.6	Vibration associated with construction activities will be limited to the values set out in Table 12-2 of Chapter 12 of the EIAR, Noise and Vibration. 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. Site investigations have indicated that no piling activities are anticipated. Therefore, no mitigation measures are proposed. On review of the likely vibration levels associated with construction activities, it is concluded that the construction of the proposed development is not expected to give rise to vibration that is either significantly intrusive or capable of giving rise to structural or cosmetic damage to buildings.	

12.7	In the unlikely event of vibration levels giving rise to human discomfort, in order to minimise such impacts, the following measures shall be implemented during the construction period: • A clear communication programme will be established to inform closest building occupants in advance of any potential intrusive works which may give rise to vibration levels likely to exceed perceptible levels. The nature and duration of the works will be clearly set out in all communication circulars. • Alternative less intensive working methods and/or plant items shall be employed, where feasible. • Appropriate vibration isolation shall be applied to plant, where feasible. • Cut off trenches to isolate the vibration transmission path shall be installed where required. • Monitoring will be undertaken at identified sensitive buildings, where proposed works have the potential to be at or exceed the vibration limit values.	
12.8	Specific to blasting, the following mitigation measures will be employed to control the impact during blasts: • Trial blasts will be undertaken to obtain scaled distance analysis. • Ensuring appropriate burden to avoid over or under confinement of the charge. • Accurate setting out and drilling. • Appropriate charging. • Appropriate stemming with appropriate material such as sized gravel or stone chipping. • Delay detonation to ensure small maximum instantaneous charges. • Decked charges and in-hole delays. • Blast monitoring to enable adjustment of subsequent charges. • Good blast design to maximise efficiency and reduce vibration. • Avoid using exposed detonating cord on the surface.	
12.9	Noise and vibration monitoring is proposed in accordance with the guidance contained in *British Standard BS5528* during the construction phase.	
12.10	An assessment of the operation noise levels has been undertaken in accordance with best practice guidelines and procedure as outlined in Section 12.2.1.4 of the EIAR. The findings of the assessment	

	confirmed that the predicted operational noise levels will be within the relevant best practice noise criteria curves for wind farms. Therefore, noise mitigation measures are not required for the operational phase of this development. If alternative turbine technologies are considered for the site the turbine selected will comply with the noise limits set out in this assessment. In the unlikely event that an issue with low-frequency noise is associated with the proposed development, it is recommended that an appropriate detailed investigation be undertaken. Due consideration should be given to guidance on conducting such an investigation which is outlined in Appendix VI of the EPA document entitled *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* (EPA, 2016). This guidance is based on the threshold values outlined in the Salford University document *Procedure for the assessment of low frequency noise complaints,* Revision 1, December 2011.	Operational Phase
12.11	In the unlikely event that an issue of AM is associated with the proposed development, an appropriate investigation shall be undertaken in accordance with the guidance outlined in the Institute of Acoustics (IoA) Noise working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) namely, *A Method for Rating Amplitude Modulation in Wind Turbine Noise* (August 2016) or subsequent revisions.	
12.12	A post commissioning noise monitoring survey will be conducted to ensure compliance with any noise conditions applied to the development. In the unlikely instance that an exceedance of these noise criteria is identified, the assessment guidance outlined in the IoA GPG and Supplementary Guidance Note 5: *Post Completion Measurements* (July 2014) will be followed and relevant corrective actions will be taken, if required. For example, implementation of Noise operational modes resulting in curtailment of turbine operation can be implemented for specific turbines in specific wind conditions to ensure predicted noise levels are within the relevant noise criterion curves/planning conditions. Such curtailment can be applied using the wind farm SCADA system without undue effect on the wind farm operations. For post-commissioning of the proposed turbine units, it is proposed that the noise monitoring methodology detailed in the relevant section of this report will be repeated with consideration of the guidance outlined in the IoA GPG and Supplementary Guidance Note 5.	

12.13	In all instances the total predicted construction and decommissioning noise levels are expected to be below the appropriate Category A value (i.e. 65dB $L_{Aeq,1hr}$) and therefore a significant effect is not predicted in relation to the nearest noise sensitive locations in terms of construction and decommissioning noise. The mitigation measures that will be considered in relation to any decommissioning of the site are the same as those proposed for the construction phase of the development, i.e. as per Section 12.5.1 of the EIAR.	Decommissioning phase

Chapter 13 – Landscape and Visual Impacts		
13.1	Given the highly visible nature of commercial wind energy developments, it is not generally feasible to screen them from view using on-site measures, as would be the primary form of mitigation for many other types of development. Instead, landscape and visual mitigation for wind farms must be incorporated into the early stage site selection and design phases. In this instance the main forms of landscape and visual mitigation employed are: • Consolidation of the turbine layout; • Staggered linear layout to complement its elongated ridgeline setting; • The buffering of residential receptors;	Construction Phase
13.2	The relationship between the height and the density or number of turbines required to achieve the best use of the site is a key design consideration. The use of tall turbines as part of a mitigation strategy may seem counter-intuitive, but this is one of the key design attributes of the Castlebanny Wind Farm. Firstly, it is important to repeat (as previously addressed in Section 13.3.4.1 of the EIAR) that, in accordance with both the 2006 Wind Energy Development Guidelines and the Draft Revised Wind Energy Development Guidelines 2019, the site of the proposed development is considered to be located within a landscape that is generally consistent with the 'Hilly and Flat Farmland' landscape type. While the 'height' of turbines "tend not to be tall" for this landscape type, "*an exception to this would be where*	

	they are on a high ridge or hilltop of relatively large scale. Accordingly, a tip height of 185m is proposed for the site of the proposed development. Secondly, there is a balance to be struck between the visual and spatial dominance of turbines and the clutter and frequency of turbines within a view, as both of these effects contribute towards the magnitude of visual impact. On the basis of these factors, and through design stage analysis, it is considered that the slightly increased sense of visual dominance derived from the proposed 185m turbines is preferable to the reduced level of permeability and increased visual clutter associated with a greater number of shorter turbines required to achieve the same output. This is illustrated in Figure 13-16 in Chapter 13 of the EIAR, Landscape and Visual Impact, which compares a similar energy yield across three turbine heights within the same view. Whilst This figure is an illustrative diagram, early design stage analysis was specifically undertaken for the Castlebanny site to examine the landscape and visual effects of different turbine heights. The results supported the use of fewer 185m TH turbines over an increased number of 170m TH turbines due to improved spacing characteristics with no material difference in visual presence or scale conflict within underlying landform and land use patterns see Figure 13-22 and Figure 13-23 of the main EIAR. It is considered that the elongated, ridge top nature of the site, in tandem with the extensive forest plantations can accommodate tall turbines without undue conflicts of scale. However, even at separation distances of greater than 750m (from the nearest point of the curtilage of any residential property to any of the proposed turbines) tall turbines have a greater potential to dominate the scale of rural dwellings and ancillary structures than shorter turbines. Nonetheless, due to developing technology and greater efficiency, turbines with tip heights comparable to those proposed are becoming more commonplace in recent years, with 169m-high (tip height) turbines now operating at Meenwaun in County Offaly and Oweninny Wind Farm (175m tip height) in County Mayo. In June 2020, An Bord Pleanála approved the proposed Derryadd Wind Farm in Co. Longford, which has 24 turbines, with a tip height of up to 185m, as well as Drumlin Hills Wind Farm (180m tip height) in Co. Monaghan.	
13.3	Although a relatively large-scale development of 21 turbines, the design consolidates the turbine cluster within a single landscape and visual setting contained wholly within the network of local roads. In doing so, the potential for local residents to be exposed to views of turbines on both sides of local roads (as opposed to dead-end farm or forestry tracks), or from more than one or two aspects of their property/dwelling, is eliminated. The potentially confusing visual scenario of turbines popping up in	

	different aspects of a view, particularly for those moving through the landscape, is also reduced. Overall, this is likely to reduce landscape and visual impacts.	
13.4	For the proposed Castlebanny Wind Farm, the minimum setback distance from local residences is approximately 780m, which is well in excess of the established 500m minimum setback stipulated in the current 2006 Wind Energy Development Guidelines, and also in excess of the minimum 4 times blade tip height setback requirement (from the nearest point of the curtilage of any residential property to any of the proposed turbines) under the Draft Revised Wind Energy Development Guidelines (2019). By default, this has resulted in the proposed turbines being placed into a robust receiving landscape of forestry and farmland. This degree of buffering from residential dwellings is of benefit to several aspects of residential amenity, including noise, shadow flicker and visual impact. In relation to visual impact, it is worth noting that, according to the laws of perspective, the doubling of viewing distance equates to a halving of perceived height. Increasing set back distances has exponential benefit in terms of reducing the potential for overbearing within the first few kilometres. Increasing set back distances has exponential benefit in terms of reducing the potential for overbearing within the first few kilometres, as illustrated in Figure 13-24 of the main EIAR.	
Chapter 14 – Air Quality and Climate		
14.1	During the construction phase of the proposed development, all contractors will ensure that machinery used on site is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from construction traffic.	Construction Phase
14.2	Potential effects arising from dust and exhaust emissions will be minimised through the provision of mitigation measures that are detailed below and also incorporated into the Construction Environmental Management Plan (CEMP) (Appendix 2-7 of the EIAR). These are as follows: • Minimisation of extent of working areas; • Stockpiling of excavated materials will be limited to the volumes required to practically meet the construction schedule; • Drop heights of excavated materials into haulage vehicles will be minimised to a practicable level; • Daily inspections by site personnel to identify potential sources of dust generation along with implementation measures to remove causes where found;	

	• Provision of dust suppression measures (e.g. sweeps/covers/water bowsers) will be used on stockpiles and the road surface during periods of extended dry weather. • Traffic coming to site will only use the specified haul routes.; • Onsite borrow pits will be used to minimise quantities of stone material being brought to site; • Best practice (including industry recognised dust suppression techniques/equipment) will be used to minimise the potential for dust production during the extraction of rock from the borrow pits and excavations elsewhere; • Vehicles and plant will be routinely serviced to minimise the exhaust emissions during construction; • Vehicles will not be left running unnecessarily and low emission fuels will be used where possible; and • The use of a wheelwash near the site entrance (will prevent the transfer of dust from the construction works on to public roads.	
14.3	During the operational phase of the proposed development, the works onsite will be limited to maintenance associated with the wind farm components and use of the amenity facilities. Although the intensity of activity will be only a small fraction of the construction phase, all employees and contractors that are on site will ensure that machinery used is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from maintenance traffic. As the proposed development will produce a significant amount of renewable energy, the operational phase will not require further climate-related mitigation measures.	Operational Phase
14.4	During the operation phase of the proposed development routine maintenance works will be required, during which all contractors/staff will ensure that machinery used on site is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from maintenance traffic. Traffic associated with the public amenity facility will be confined to the proposed public car park.	
14.5	Similar to the construction phase, all contractors will ensure that machinery used on site is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from construction traffic.	Decommissioning Phase
14.6	All relevant mitigation measures as described in the Section 14.6.2.1 of the main EIAR will be implemented during decommissioning works, the majority of which are related to machinery and vehicles at the site. Vehicles and plant will be routinely serviced to minimise the exhaust emissions	

<table>
<tr><td></td><td>during construction and will not be left running unnecessarily. Similarly, emphasis will be put on dust reduction measures and inspections as described in Section 14.6.2.1 of the EIAR</td><td></td></tr>
<tr><td colspan="3">Chapter 15 –Cultural Heritage</td></tr>
<tr><td>15.1</td><td>The best form of archaeological mitigation – preservation in situ – is achieved by avoiding direct physical impacts upon archaeological, architectural and cultural heritage site, structures, monuments and features. All designated archaeological, architectural and cultural heritage sites, structures, monuments or features have been avoided by the design team as far as was practicably possible, taking into account all the environmental constraints and requirement of the project brief. For example, the design of the grid connection cable was amended so as to avoid the zone of notification for a nearby recorded archaeological monument. The following sections detail mitigation measures to avoid or minimise impacts on archaeological and architectural heritage.</td><td rowspan="2">Construction Phase</td></tr>
<tr><td>15.2</td><td>Mitigations take into account Coillte's standard mitigation measures regarding archaeology and cultural heritage (Figure 15-7 and Figure 15-8, from Tiernan 2017: 49-52 – see also Appendix 2-4), though these relate to harvesting and establishment of forests rather than developments such as the proposed wind farm.

Table 15-7: Coillte standard mitigations for harvesting (extracted from Chapter 15 of the main EIAR)
<table>
<tr><th>Category</th><th>No</th><th>Mitigation</th></tr>
<tr><td>Unlisted monuments</td><td>60</td><td>Report all unlisted archaeological sites discovered during operations to Coillte manager</td></tr>
<tr><td>Unlisted monuments</td><td>61</td><td>Suspend all work in the vicinity of the discovery; create minimum 20 metre exclusion zone and do not disturb monument.</td></tr>
<tr><td>Cultural Features</td><td>63</td><td>Do not damage cultural features</td></tr>
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</table>

Cultural Features	64	Fell trees away from cultural features	
Cultural Features	65	Do not stack timber on cultural features	
Cultural Features	66	Where linear features (including townland boundaries) have to be crossed, minimise the number of crossing points and use existing crossing points where available	
Cultural Features	67	Buffer crossing points with brash, and remove brash before forwarder leaves the site	
Cultural Features	68	Report new cultural features to Coillte site manager	

Category	No	Mitigation
Archaeology, cultural features	73	Do not enter the exclusion zone around monuments and structures
Archaeology, cultural features	75	Do not plant within 20m of the edge of monument or protected structure
Archaeology, cultural features	76	Leave 4m unplanted corridor for access to archaeological monuments

15.3	The National Monuments Act, as amended requires that, in the event of the discovery of archaeological finds or remains that the relevant authorities, the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht (DoCHG) and the National Museum of Ireland, should be notified immediately. Allowance will be made for full archaeological excavation, in consultation with the

	National Monuments Service of the DoCHG, in the event that archaeological remains are found during the construction phase.	
15.4	In areas where there is the potential that archaeological, architectural or cultural heritage site, structures, monuments or features could be impacted on during the construction phase, one or both of the following mitigations measures have been recommended: **Archaeological testing** – best practice in areas of moderate archaeological potential demands caution, to ensure that archaeological deposits are identified as early as possible, thereby ensuring that any loss from the archaeological record is minimised. During archaeological testing, a licensed eligible archaeologist supervises excavations of pre-determined trenches undertaken with a toothless grading bucket, under licence to the National Monuments Service of the DoCHG. Undertaking this confirmatory surveying will ensure that sufficient time can be allowed within the construction schedule for the excavation of any archaeological deposits discovered. **Archaeological monitoring** –– in areas of moderate archaeological potential, excavations associated with construction works, namely topsoil stripping, will be monitored by a suitably qualified archaeologist. In the event that archaeological deposits are discovered, work in the area will cease immediately and the archaeologist will liaise with the National Monuments Service of the DoCHG and the National Museum of Ireland.	
15.5	A suitably qualified cultural heritage consultancy / consultant will be appointed to oversee the effective implementation of the archaeological mitigation measures recommended in this chapter for the construction phase of the proposed development. The consultancy / consultant will maintain continuing liaison with the National Monuments Service of the DoCHG and Kilkenny County Council's Executive Archaeologist throughout the construction phase of the development.	
15.6	All archaeological mitigation is to be undertaken under licence to the National Monuments Service of the DoCHG and the National Museum of Ireland.	
15.7	Due to differences in the nature of aspects of the development as well as variable ground conditions – particularly where there has been planted forest which is considered to have caused prior ground disturbance – mitigation measures to ensure the recording and management of any unrecorded archaeological sites are tailored to the specific conditions at each proposed development area. Ground	

conditions, including prior ground disturbance, at the location of all proposed turbines is assessed summarised in Figure 15-4 of the main EIAR.

Archaeological mitigation measures for different components and locations of the wind farm project are detailed below and summarized in Figure 15-8 of the main EIAR;

Table 15-9: Summary of recommended archaeological mitigation measures (Extracted from Chapter 15 of the main EIAR)

Works planned	Archaeological mitigation
Wind farm – developments in areas of previously or currently planted forest	Inspection of topsoil stripping at the development locations to determine level of ground disturbance; archaeological monitoring if minimal ground disturbance is identified; licenced excavation if required
Wind farm – tracks and hard stands along existing tracks	No archaeological mitigation required
Wind farm – developments in areas with no previous or current planted forest	Archaeological testing in advance of ground works at the location of the development for turbines T5, T10, T12, T16, T19 and T21 and for the tracks between turbines T10-T12 and T19-T21-T20 followed by archaeological monitoring of all topsoil stripping at these locations; licenced excavation if required

	Grid connection cable	Archaeological monitoring of topsoil stripping in advance of trenching along the route		
	TDR works areas	Archaeological testing in advance of ground works within the zone of notification for the recorded castle at the Ballynoony West (KK040-003)		
15.8	<u>Wind farm – turbines, compounds, borrow pits and other developments</u> Archaeological testing will be carried out across the footprint of the wind turbines and other development areas where these occur on land which has not previously been planted forest. Six turbines are planned for areas of unplanted pasture: T5, T10, T12, T16, T19 and T21. Following testing, full-time monitoring of topsoil stripping at the six locations of unforested pasture will take place. The testing and monitoring will be conducted by a suitably qualified archaeologist licenced by the DoCHG. Should archaeological material be uncovered during this testing, the feature will be trowelled back to determine its form, age, nature and extent then photographed and recorded to best professional standards (MoLAS 1994) and adhering to the Department's *Policy and Guidelines on Archaeological Excavation* (1999). Based on information gathered from archaeological testing and monitoring, and in consultation with the National Museum and the National Monuments Section of the DoCHG, further mitigation such as excavation may be required. In areas of the development where there is or has been planted forest, archaeological inspections of topsoil stripping by a suitably qualified archaeologist will take place to determine the level of ground disturbance and to assess the presence of any archaeological features. If the ground disturbance is found to be minimal at these locations then full-time archaeological monitoring will occur.			
15.9	<u>Wind farm – tracks and hard stands</u> In two areas of the development where tracks are being newly built on previously unforested pasture, archaeological testing will be carried out along the route of proposed tracks and across hard stand areas.			

	The two identified locations are the track between T10-T12 in the centre of the area and the track between T19-T21-T20 in the northwest of the area. The testing will be conducted by a suitably qualified archaeologist licenced by the DCHG. Should archaeological material be uncovered during this testing, the feature will be trowelled back to determine its form, age, nature and extent then photographed and recorded to best professional standards. Based on this information and in consultation with the National Museum and the National Monuments Section of the DoCHG, further mitigation such as excavation may be required. Where existing tracks are being used or upgraded, no archaeological mitigation measures are required.	
15.10	<u>Grid connection cable</u> Where the grid connection crosses unforested pasture, archaeological monitoring of topsoil removal along the route will be carried out. The archaeological monitoring will occur prior to the main excavation of the trench to ensure that if any archaeological features are exposed that these can be investigated as required. The testing will be conducted by a suitably qualified archaeologist licenced by the DoCHG. Should archaeological material be uncovered during this testing, the feature will be trowelled back to determine its form, age, nature and extent then photographed and recorded to best professional standards (MoLAS 1994). Based on this information and in consultation with the National Museum and the National Monuments Section of the DoCHG, further mitigation such as excavation may be required.	
15.11	<u>TDR works areas</u> Two of the TDR works areas, in Ballynoony West, have archaeological potential and one crosses a zone of notification for a recorded monument. The remaining areas are in heavily built up land such as highways and roundabouts. In advance of construction, archaeological testing will be carried out at the location of the recorded castle and its zone of notification at Ballynoony West (KK040-003). The testing will be conducted by a suitably qualified archaeologist licenced by the DoCHG. Should archaeological material be uncovered during this testing, the feature will be trowelled back to determine its form, age, nature and extent then photographed and recorded to best professional standards. Based on this information and in consultation with the National Museum and the National Monuments Section of the DoCHG, further mitigation such as excavation may be required.	

15.12	**Architectural heritage mitigation** There are no architectural heritage sites (RPS) located within the wind farm project area or beside the grid connection cable route or TDR works areas. Impacts to vernacular heritage buildings within the project area have been avoided through the project design. One location where the potential direct impact of the development on above-ground vernacular historical feature, in the vicinity of turbine T21 (Figure 15-1 of the main EIAR) , was avoided by routing the track next to the building. Construction of the track north of T21 will avoid the standing stone structure: the design shows this track as running directly to the west of the structure.	
15.13	There are not anticipated to be any impacts on cultural heritage as part of maintenance works during the wind farm's operational phase.	Operational Phase
15.14	There are not anticipated to be any direct or indirect impacts on cultural heritage as part of the decommissioning phase. All mitigation measures relating to architecture will have been completed as part of the construction phase.	Decommissioning Phase
Chapter 16 - Traffic and Transport		
16.1	Existing forestry accesses are available on the local road network around the Wind Farm. The selection of the site access location on the L7451, was based on minimising the impact of the proposed development on the local residents. The proposed new crossing point on the L7451 was selected over a site access further south with existing infrastructure, to increase the separation distance of residents to the construction traffic crossing point on the L7451. Use of the R704 access into the forestry instead of along the L7451 at the R704 junction, will also remove the construction traffic off the local road (L7451) and passing of larger vehicles in proximity to the local community.	Construction Phase
16.2	<u>Junction Visibility</u> Adequate visibility is available from the site accesses onto the Local Road, L7451, of 2.4m 'x-distance' by 'y-distance' of 160m in accordance with the TII DN-GEO-03060. Maintenance of the hedgerows	

	within the visibility splays shall be undertaken to maintain the required visibility splays and mitigate the potential for overgrown vegetation which may result in inadequate visibility at the accesses during the construction activities, see Appendix 2-2 Drawing No. 10730-2051. At the R704, the existing visibility is not in accordance with the current standards and was highlighted as a Problem in the Road Safety Audit (RSA) undertaken by the independent RSA Team. A hidden dip is located within the current vertical road profile, obstructing the visibility to approaching vehicles from the west at the R704 site access. To improve safety at this access ensuring adequate visibility, it is proposed to widen the existing site access, realign the existing access road and modify the vertical geometry of the existing road to remove the hidden dip and improve the visibility. Adequate visibility at the site accesses will mitigate the potential increased likelihood for collisions between construction generated traffic and existing road network traffic.	
16.3	<u>Junction Swept Paths</u> In accordance with the TII DN-GEO-03060 and as agreed during scoping with Kilkenny County Council, swept path analysis has been undertaken at the site access for a worst-case typical construction vehicle (i.e. articulated truck (16.5m long)), in addition to those undertaken for the AIL. The swept path of the maximum legal articulated vehicle accessing / departing the site are available in Appendix 2-2 on Drawings No. 10730-2052 and 70730-2053. As previously discussed in Section 16.3.2.5, the swept path analysis of the longest AIL, the turbine blade, were undertaken following identification of potential pinch points in the route assessment report in Appendix 2-2. The proposed site access design has been developed to take cognisance of the swept path of all vehicles arriving to and departing from the site. On the R704, an overrun area is proposed where infrequent larger movements are required. The gate has been positioned to allow for a large vehicle to wait clear of passing traffic on both the R704 and L7451, to avoid potential collision between a passing vehicles and one stopped to open the gates at the site access. At the approach to the site accesses, the internal access tracks are proposed at a widened width of 7.0m, to accommodate safe clearance width between two large construction vehicles passing and acting as passing bays.	

16.4	<u>Internal Access Tracks & Passing Bays</u> Along the access track from the R704 to the L7451 site access crossroad, the road width is up to 5.5m wide, widening locally on approach to the site accesses to 7.0m over a distance of 50m. In addition to these facilities for passing of vehicles, a long passing bay will be constructed within this forestry area to facilitate queuing of vehicles away from the public road network. This passing bay is 5.0m x 70m long which can accommodate 7 no. concrete trucks. Each passing bay within the Wind Farm site is approximately 50m long by 4.5m wide, accommodating up to 5 no. of 10m standard rigid trucks. The passing bays will facilitate continuous movements to the works areas with limited disruptions. The internal road layout has been designed to accommodate the swept paths of the vehicles anticipated onsite. The internal access track layout has been created with two loops. These loops may be used by vehicles onsite to queue on approach to the works areas and allow for continuation from the works area in a forward manner to depart the site. To supplement the internal access track loops and pending their full construction as the works progress, there are to be 2 no. compounds, 9 no. passing bays and a widened internal access track location at the junction of the access track to T2 and T3 within located within the Wind Farm site, refer to Drawing No. 10730-2010 of Appendix 2-1 of the EIAR.	
16.5	**Drainage** Some minor drainage works will be required at the site accesses and adjacent to the internal access tracks as outlined in Chapter 9 Hydrology and Hydrogeology of the EIAR.	
16.6	**Haul Routes** Mitigation measures on the haul roads and cable route includes: • The crossing point of the L7451 was moved to create additional distance to residents to minimise construction traffic noise impact.	

- Selection of a viable route with the lowest impact on the road network.
- Avoidance of sensitive receptors and urban settings
    - The construction route to the site is from the regional road R704 via forestry lands to the site via a new crossroad access located on the L7451. This proposal removes multiple interaction locations with residents along this local road and has one fixed location for interaction.
    - The site access route encourages the use of the strategic infrastructure in the area while avoiding the local road and potential sensitive receptors.
    - Turbine delivery route along national and regional roads with largest capacity to accommodate the vehicles.
    - The typical construction traffic haul roads are principally along the national and regional road network, avoiding the local primary and secondary roads.
    - Restricting HGV movements during peak sensitive times on the road networks (i.e. at school times)
    - The grid connection route will be laid primarily in forestry and agricultural lands, minimising works within the public road with the exception of road crossings and a short section (approximately 300m) along the L3418.
    - There will be no effect on the L8273 during cabling works as the cable will be laid by drilling underneath it, resulting in no impact on use.
- To mitigate traffic on the national road network, a number of possible routes have been investigated as possible sources of material for delivery.
- To mitigate the impact of the AIL delivery on the road network, the advanced works are to be undertaken (i.e. hardstanding, making signs demountable, utility diversions etc). The hardstanding works areas will be temporary in nature and removed once the final turbine is delivered to site.
- The Local Authority identified drainage as a key consideration with regards to the site development of the wind farm itself and also the temporary works required for the AIL haulage. Proposals for drainage within the site have been identified in Chapter 2 and Chapter 9 of the main EIAR.

To mitigate the impact of the AIL deliveries these deliveries will be undertaken under garda and traffic management escort during off-peak (i.e. night-time) hours. The arrangement of the appropriate abnormal load licenses will be obtained by the appointed contractor in a timely fashion

	on procurement of the AIL. The appointed contractor will liaise with the relevant road's authorities and an Garda Síochána on the delivery schedule for the AILs.	
16.7	**Traffic Impact** To mitigate the impact of the construction traffic, the Wind Farm will utilise all available resources within the existing site to reduce the requirement for importation of materials to site. Excavation of stone material from 3 no. borrow pits within the Wind Farm site to provide capping material will reduce the HGV volumes. The second largest traffic volume impact is associated with the haulage of the materials for the internal access track construction. In addition to the borrow pits, the internal access tracks have been designed to utilise existing forestry access tracks where feasible, reducing the volume of materials required for importation to the site. The largest volume traffic impact is associated with the concrete pours for the turbine foundations. The works at other areas within the main site will continue during these concrete pours, but only essential deliveries will be scheduled to occur on the same days as the concrete pours. To mitigate this impact, liaison with local authorities and the community in advance of the foundation pours as well as minimising other works/deliveries as noted.	
16.8	**Trench Reinstatement** To mitigate the impact of the cable laid within the public road the reinstatement works will be backfilled and reinstated as soon as practicable. The reinstatement works will be undertaken in accordance with the "Purple Book" best guidance and practices as required by Kilkenny County Council. The proposed reinstatement and construction details and phasing will be agreed with associated Local Authorities Municipal District Office in advance of the works. The Contractor will be responsible for arranging for the required road opening licenses.	
16.9	**Pre- and Post-Construction Pavement Surveys** The client will undertake pre-construction and post-construction visual pavement surveys on the Haul Roads. Where the surveys conclude that damage on the roadway is attributable to the Construction Phase of the proposed project, the developer will fund the appropriate reinstatement	

	works to bring the road back to pre-construction condition as a minimum, details for which will be agreed with the Roads Authorities.	
16.10	**Traffic Management Plan (TMP)** The successful completion of this project will require significant co-ordination and planning and a comprehensive set of mitigation measures will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the proposed development. The Traffic Management Plan (TMP) proposed for the Castlebanny Wind Farm is included in the CEMP. Any changes which may arise from the planning process and in the detailed construction programme can be incorporated. The following mitigation has been incorporated into the TMP: • Haul route selection to avoid sensitive receptors. • Widened approaches to the site accesses within the development to facilitate queuing of construction vehicles off the public road. • Traffic Management Operatives (TMOs) will be provided by the principle contractor in accordance with their Traffic Management Plan at the site accesses during peak construction traffic activities, refer to the TMP. • A wheel wash will be provided within the site. • Passing bays on the internal access track and a loop layout within the Wind Farm site to facilitate safe passing of vehicles within the site, vehicles travelling in a forward direction (reducing higher risk reversing manoeuvres). • For the longitudinal cabling works on the L3418, to reduce the potential impact by the traffic management road closure, a suitable diversion route will be agreed with the Local Authority in advance of the works.	
16.11	To avoid delays to the project programme all required road opening licenses, agreements with the Local Authorities and An Garda Síochána to facilitate movement of abnormal loads shall be sought by the appointed Contractor in a timely manner to avoid delays to the project.	

16.12	As outlined in Section 16.3.3.2 of the EIAR due to the relatively low operational traffic, it is envisaged that the operational impacts of the proposed development will be not significant / slight effect when compared to the existing background traffic. As such, no mitigation measures are proposed for the operation and maintenance of the Wind Farm and associated generated recreational traffic.	Operational Phase
16.13	On decommissioning of the Wind Farm, a decommissioning plan will be prepared and implemented to minimise the effects during this stage. The decommissioning phase will employ similar mitigation measures as the construction phase. As the decommissioning phase is envisaged to be over 35 years from now, a new TMP will be undertaken to take account of any road improvements and changes to the network in the future. When the turbine blades are decommissioned, they are cut to a more manageable size. The reduced blade section lengths, tower sections and nacelle are likely to remain abnormal loads, however the swept path of the long blades will be reduced. This will reduce the impact on third parties and existing road infrastructure (i.e. signs, vehicle restraint systems etc). As previously mentioned, the large volume of material aggregate and concrete imported to site will remain onsite. The principal expected volumes of traffic will be primarily associated with the transportation off-site of turbine components and a significantly reduced volume of materials only (i.e. haul routes maintained, turbine foundations retained, substation retained, car parking hardstanding areas retained for future amenity), the residual impact is considered to be slight and temporary.	Decommissioning Phase