Planning and Environmental Consultants

Environmental Impact Assessment Report

Seskin Renewables Wind Farm

Chapter 9 Water

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9. WATER

9.1 Introduction

9.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO to carry out an assessment of the potential effects of the Proposed Seskin Renewable Energy Development. This chapter relates to potential effects on Water due to the construction, operation and decommissioning of the Proposed Development. Section 1.1.1 of Chapter 1 of this EIAR has set out the terminology used to describe each of the elements of the Proposed Development. The terminology of project elements used within this chapter is outlined below:

- The 'Proposed Wind Farm' refers to the 8 no. turbines and supporting infrastructure which is the subject of this Section 37E application.
- The 'Proposed Grid Connection' refers to the 110kV substation and supporting infrastructure which will be the subject of a separate Section 182A application.
- The 'Proposed Development' comprises the Proposed Wind Farm and the Proposed Grid Connection, all of which are located within the EIAR Study Boundary (the 'Site') and assessed together within this EIAR.

The objectives of the assessment are to:

- Produce a baseline study of the existing water environment (surface and groundwater) in the area of the Proposed Wind Farm site and Proposed Grid Connection underground cabling route;
- Identify likely positive and negative effects of the Proposed Development on surface and groundwater during construction, operational, and decommissioning phases of the Proposed Development. Identify mitigation measures to avoid, remediate or reduce significant negative effects; and,
- Assess significant residual effects and cumulative effects of the Proposed Development along with other permitted and proposed projects and plans.

9.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience include hydrology, hydrogeology and karst hydrogeology and wind farm drainage design and management. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types including wind farm and grid connection developments.

This chapter of the EIAR was prepared by Adam Keegan and Michael Gill.

Adam Keegan PGeo (B.Sc., M.Sc.) is a hydrogeologist with 7 years environmental consultancy experience in Ireland. Adam has worked on numerous Environmental Impact Assessments for infrastructure projects, such as wind farms, strategic housing developments and quarries. Adam has experience in intrusive site

investigation works within mapped karst environments and experience in trial and production well drilling within areas mapped as Regionally Karstified Aquifers. Adam has worked on several wind farm EIAR projects, including Seven Hills WF, Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Coole WF.

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in karst hydrogeology and also in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, Derrinlough WF and Yellow River WF, and over 100 other wind farm-related projects, as well as Seven Hills WF which is situated within a mapped karst area. Michael has also worked on karst related projects in South and Mid Galway, Roscommon, Tipperary, Laois, Kilkenny, Limerick, Clare, Cork and Waterford.

9.1.3 Relevant Legislation

The EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

The requirements of the following legislation are complied with:

- Planning and Development Acts, 2000 (as amended).
- Planning and Development Regulations, 2001 (as amended).
- S.I. No. 477/2011: European Communities (Birds and Natural Habitats) Regulations, implementing EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Directive 2009/147/EC on the conservation of wild birds (the Birds Directive).
- S.I. No. 293/1988: Quality of Salmonid Water Regulations.
- Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission Directive 2014/101/EU ("WFD").
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 European Communities (Water Policy) Regulations 2003, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for the implementation of 'daughter' Groundwater Directive (2006/118/EC).
- S.I. No: 122/2010: European Communities (Assessment and Management of Flood Risks) Regulations, resulting from EU Directive 2007/60/EC.
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations,
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended.
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.
- S.I. No. 122/2014: European Union (Drinking Water) Regulations.

9.1.4 Relevant Guidance

The Water section of the EIAR is carried out in accordance with the guidance contained in the following:

- Environmental Protection Agency (2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;

- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Department of Environment, Heritage and Local Government (DoEHLG); Wind Energy Development Guidelines for Planning Authorities (2006);
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016);
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- Wind Farms and Groundwater Impacts: A guide to EIA and Planning considerations (DOE/NIEA, April 2015);
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018);
- European Commission (2017): Environmental impact assessment of projects – Guidance on the preparation of the environmental impact assessment report (Directive 2011/90/EU as amended by 2014/52/EU); and,
- Laois County Council (2021): Laois County Development Plan (2021-2027) (https://consult.laois.ie/en/consultation/laois-county-development-plan-2021-2027).
- Kilkenny County Council (2021): Kilkenny City and County Development Plan (2021-2027) (https://ourplan.kilkenny.ie/)

9.2 Methodology

9.2.1 Desk Study & Preliminary Hydrological Assessment

A desk study and preliminary hydrological assessment of the Site and the surrounding area was completed in advance of the Site walkovers (i.e. March 2024), site investigation works, and in advance of seasonal monitoring being implemented. The desk study was subsequently checked and updated where relevant in April 2025. This involved collection of all relevant geological, hydrological, hydrogeological and meteorological data for the study area. This included consultation with the following sources:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- EPA/Water Framework Directive Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 18 (Geology of Tipperary). Geological Survey of Ireland (GSI, 1996);
- Geological Survey of Ireland (2004) – Durrow Groundwater Body Initial Characterization Reports;
- Geological Survey of Ireland (2004) – Lisdowney Groundwater Body Initial Characterization Reports;
- Groundwater Karst Viewer (GSI online mapping portal - www.gsi.ie);
- OPW Flood Hazard Mapping (www.floodinfo.ie);
- Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie);
- GSI Groundwater Flood mapping (www.gsi.ie);
- CFRAM flood maps (www.cfram.ie);
- Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie); and,
- Group Water Scheme ZOC Reports; Ballyconra PWS, Seskin GWS, Durrow PWS, Cullahill GWS, Fermoyle PWS.

9.2.2 Site Investigations & Seasonal Hydrological & Hydrogeological Monitoring

A comprehensive geological, hydrological and hydrogeological dataset has been collected as part of this EIAR study.

Initial walkover surveys and geological/hydrogeological mapping were conducted on 12th April 2024 and 13th May 2024. During these site visits observations were made on near surface geological and hydrogeological features including exposed soil/subsoil and bedrock and walkover surveys of mapped karst features. A site visit was completed at the nearby Tirlán facility (dairy plant), with access granted to HES to record water levels in on-site monitoring wells, as well as access to the Ballyconra PWS wells (situated at the rear of the Tirlán site).

Intrusive and extrusive site investigations were conducted between 13th – 17th May 2024. HES supervised the drilling of 4 no. groundwater monitoring wells during this time, to provide detail on the nature and extent of subsoils and bedrock and evidence for potential karstification of the limestone bedrock. Further intrusive site investigation was carried out by Ground Investigation Ireland (GII) between 04th – 11th November 2024, as well as a geophysical survey conducted by Apex Geophysics. Additional trial pitting was completed within the Proposed Borrow Pit area in January 2025.

Further site visits were carried out in December 2024 and April 2025 to manually dip groundwater levels, download deployed water level loggers, as well as taking groundwater and surface water samples.

A site visit was also carried out at the Seskin GWS on 01st November. The boreholes were surveyed using a dGPS system, water levels were manually dipped in the 3 no. wells and water chemistry was recorded using a YSI Pro DSS water quality meter from a sample taken from the pumphouse sample tap.

Water levels in the boreholes surrounding the Proposed Wind Farm site were monitored between May 2024 – May 2025. The duration and extent of the water level monitoring are outlined in the relevant section (Section 9.3.6.3.2). In total 11 no. GWS/farm/domestic/monitoring wells were monitored with in-situ Diver water level dataloggers. The data were normalised with a permanent barometer located within the area and compared with rainfall data collected at the Durrow (OPW) rainfall station. These data provide a long-term record of water levels in boreholes which can be compared and correlated.

Intrusive and extrusive site investigations have been conducted between May 2024 – January 2025 to provide detail and clarity on the nature and extent of subsoils and bedrock as well as any evidence for potential karstification of the Limestone bedrock. These include:

- 4 no. groundwater monitoring boreholes drilled at locations MW1-MW4 in May 2024;
- 1 no. geophysical survey completed by Apex Geophysics between 14th – 21st October 2024;
- 1 no. rotary core borehole drilled between 08th -11th November 2024;
- 27 no. trial pits excavated by machine between 04th – 11th November 2024;
- 10 no. infiltration tests carried out between 04th -11th November 2024; and,
- A further 4 no. trial pits excavated near Turbine T3 in January 2025, within the Proposed Borrow Pit area.

In addition to the above site investigation, the following is a summary of the seasonal hydrological and hydrogeological monitoring that has been undertaken The locations of these monitoring points are shown in Figure 9-10 :

- Seskin GWS BH - 12 months of monitoring groundwater level data obtained at 15 minute intervals;
- Seskin Sump 1 - 12 months of monitoring groundwater level data obtained at 15 minute intervals;
- Seskin Sump 2 - 12 months of monitoring groundwater level data obtained at 15 minute intervals;
- MW1 - 12 months of monitoring groundwater levels at 2 hour intervals;
- MW2 - 12 months of monitoring groundwater levels at 2 hour intervals;
- MW3 - 9 months of monitoring groundwater levels at 2 hour intervals;
- MW4 – 12 months of groundwater levels data at 2 hour intervals;
- Domestic Well 1 (DW1) - 12 months of monitoring groundwater levels at 2 hour intervals;
- Tirlán GW1 - 5 months of monitoring groundwater levels at 2 hour intervals;
- Tirlán GW3 - 12 months of monitoring groundwater levels at 2 hour intervals;
- Tirlán GW4 - 5 months of monitoring groundwater levels at 2 hour intervals;
- Tirlán PW - 12 months of monitoring groundwater levels at 2 hour intervals;
- GPS survey of groundwater wells in the area to determine water levels in metres OD;
- Surface water sampling completed at 2 no. locations in April 2025; and,
- Groundwater sampling completed at 2 no. locations in April 2025.

9.2.3 Scoping and Consultation

The scope for this chapter of the EIAR has also been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process is outlined in Section 2.7 of this EIAR. Issues and concerns highlighted with respect to the water environment are summarised in

Table 9-1 below.

Table 9-1:Summary of Water Environment Related Scoping Responses

Degree/Nature	Description	Addressed in Section
Geological Survey of Ireland (GSI)	Geoheritage › The audit for Co. Kilkenny was carried out in 2007 and revised in 2012. The audit for Laois was completed in 2016. Our records show that there are no County Geological Sites in the vicinity of the proposed wind farm EIAR study boundary. Groundwater › For areas underlain by limestone, please refer to the karst specific data layers (karst features, tracer test database; turlough water levels (gwlevel.ie). Background information is also provided in the Groundwater Body Descriptions. Please read all disclaimers carefully when using Geological Survey Ireland data. › The Groundwater Data Viewer indicates aquifers classed as a 'Regionally important gravel aquifer', a 'Regionally Important Aquifer - Karstified (diffuse)', a 'Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones' and a 'Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones' underlie proposed wind farm study EIAR study boundary. › The Groundwater Vulnerability map indicates the range of groundwater vulnerabilities within the area covered is variable. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' in your assessments, as any groundwater-surface water interactions that might occur would be greatest in these areas. › Our records show that there are groundwater drinking water abstractions (Ballyconra Public Water Supply (PWS) and Seskin Group Water Scheme (GWS)), with zones of contribution/source protection areas within the proposed wind farm study	› The Groundwater Karst Viewer data source was consulted during the desk study phase of the assessment. Areas identified were assessed during site walkover surveys and throughout the EIAR process. › The Groundwater viewer was used within the initial desk study assessment of the Site and areas of varying groundwater vulnerability were noted. Site investigation data has been used to provide further site-specific data on the nature of the subsoils (addressed in Chapter 8 and below in Section 9.3.6 and 9.3.7). › The nearby Group Water Schemes were identified during the desk study assessment of the Proposed Development. A site visit has been performed at each GWS site, along with groundwater level monitoring in the GWS wells over a12 month period to provide data on groundwater levels, groundwater flow directions and the overall hydrogeological regimen in the area.

Degree/Nature	Description	Addressed in Section
	EIAR study boundary. Key to groundwater protection in general, and protection of specific drinking water supplies, is preventing ingress of runoff to the aquifer. Design of drainage will need to be cognisant of the public water schemes and the interactions between surface water and groundwater as well as run-off. Appropriate design should be undertaken by qualified and competent persons to include mitigation measures as necessary, such as SUDs or other drainage mitigation measures. › Any excavation/cuttings required for realignment should ensure that groundwater flow within the zones of contribution to the groundwater abstraction points is not disrupted, resulting in diminished yields. Note that there could be other groundwater abstractions in the locality for which Geological Survey Ireland has not undertaken studies, and a robust assessment should be undertaken by qualified and competent persons including a survey of all current wells and water abstractions within the vicinity. Given the nearby drinking water sources (Public Water Scheme, Group Water Scheme), the effects of any potential contamination as a result of the project would need to be assessed.	› Mitigation measures relating to excavations/cuttings are outlined in Section 9.4.2.1.
Uisce Éireann	All potential impacts arising from the development proposal on Uisce Éireann's abstraction points must be identified and addressed in the EIAR and planning application. This includes the Ballyragget Infiltration Gallery abstraction point located approximately 2km to the south of the main turbine site, while the proposed cabling associated with the proposed wind farm is located within the Groundwater Catchments Zone of Contribution (ZOC) for the Ballyragget abstraction. Any other surface water or groundwater abstraction points where a potential hydrological and hydrogeological exists must also be identified and addressed in the EIAR and planning application. The EIAR must include and consider all direct, indirect and cumulative effects on the abstraction points and water sources and provide mitigations for same to ensure there is no impact to, nor deterioration of ground and surface water source(s) in the area.	› All Uisce Éireann assets near the Proposed Development Site have been identified through consultation with Uisce Éireann, including the Ballyragget infiltration gallery abstraction point. The potential effects on this infrastructure has been assessed and is included below in Section 9.4.2.12.

9.2.4 Impact Assessment Methodology

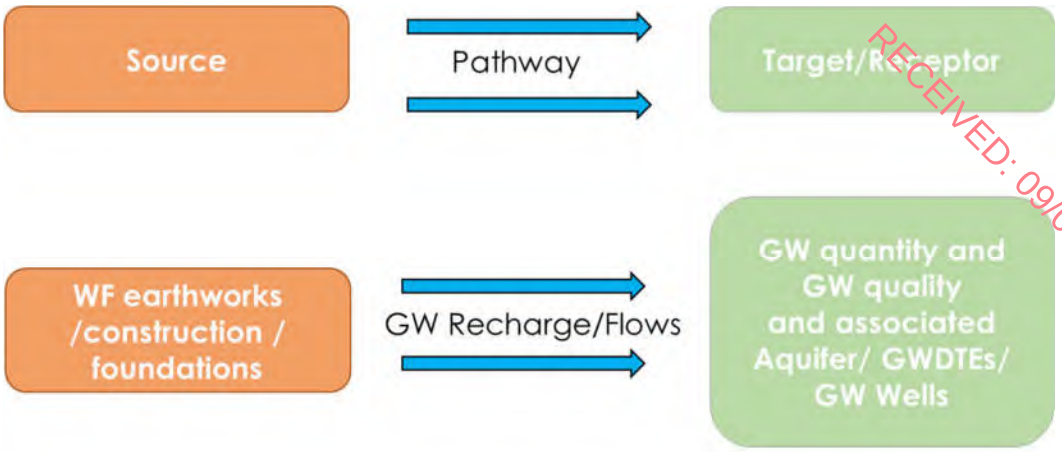
Please refer to Chapter 1 of the EIAR for details on the impact assessment methodology (EPA 2022). In addition to the above methodology, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Levels of sensitivity which are defined in

Table 9-2 are then used to assess the potential effect that the Proposed Development may have on them.

Table 9-2: Receptor Sensitivity Criteria (Adapted from www.sepa.org.uk)

Sensitivity of Receptor	
Not sensitive	Receptor is of low environmental importance (e.g. surface water quality classified by EPA as A3 waters or seriously polluted), fish sporadically present or restricted). Heavily engineered or artificially modified and may dry up during summer months. Environmental equilibrium is stable and is resilient to changes that are considerably greater than natural fluctuations, without detriment to its present character. No abstractions for public or private water supplies. GSI groundwater vulnerability "Low" – "Medium" classification and "Poor" aquifer importance.
Sensitive	Receptor is of medium environmental importance or of regional value. Surface water quality classified by EPA as A2. Salmonid species may be present and may be locally important for fisheries. Abstractions for private water supplies. Environmental equilibrium copes well with all natural fluctuations but cannot absorb some changes greater than this without altering part of its present character. GSI groundwater vulnerability "High" classification and "Locally" important aquifer.
Very sensitive	Receptor is of high environmental importance or of national or international value i.e. NHA or SAC. Surface water quality classified by EPA as A1 and salmonid spawning grounds present. Abstractions for public drinking water supply. GSI groundwater vulnerability "Extreme" classification and "Regionally" important aquifer

The conventional source-pathway-target (receptor) model (see below, top) was applied to assess potential effects on downstream environmental receptors (see below, bottom as an example) as a result of the Proposed Development.



Where potential effects are identified, the classification of effects in the assessment follows the descriptors provided in the Glossary of Impacts contained in the following guidance documents produced by the Environmental Protection Agency (EPA):

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022); and,
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003).

The description process clearly and consistently identifies the key aspects of any potential effect source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

In order to provide an understanding of the stepwise impact assessment process applied below (Section 9.4.2 and 9.4.3), we have firstly presented below a summary guide that defines the steps (1 to 7) taken in each element of the impact assessment process (refer to Table 9-3). The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA effect descriptors are combined.

Using this defined approach, this impact assessment process is then applied to all wind farm construction and operation activities which have the potential to generate a source of significant adverse impact on the geological and hydrological/ hydrogeological (including water quality) environments.

Table 9-3: Summary guide for stepwise assessment of impact assessment process

Step 1	Identification and Description of Potential Impact Source: This section presents and describes the activity that brings about the potential impact or the potential source of pollution. The pre mitigation significance of effects is briefly described.	
Step 2	Pathway / Mechanism:	The route by which a potential source of impact can transfer or migrate to an identified receptor. In terms of this type of development, surface water and groundwater flows are the primary pathways, or for example, excavation or soil erosion are physical mechanisms by which a potential impact is generated.
Step 3	Receptor:	A receptor is a part of the natural environment which could potentially be impacted upon, e.g. human health, plant / animal species, aquatic habitats, soils/geology, water resources, water sources. The potential impact can only arise as a result of a source and pathway being present.

Step 4	Pre-mitigation Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact before mitigation is put in place.
Step 5	Proposed Mitigation Measures:	Control measures that will be put in place to prevent or reduce all identified significant adverse effects. In relation to this type of development, these measures are generally provided in two types: (1) mitigation by avoidance, and (2) mitigation by engineering design.
Step 6	Post-Mitigation Residual Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential effects after mitigation is put in place.
Step 7	Significance of Effects:	Describes the likely significant post mitigation effects of the identified potential impact source on the receiving environment.

9.2.5 Limitations and Difficulties Encountered

Access to groundwater wells was limited to those where permission could be gained from the owners to inspect the well construction, measure and record water levels and take water samples where necessary.

However, access was gained to a suitable geographical spread of groundwater wells surrounding the Proposed Wind Farm site, which provide a large database of groundwater data in order to gain a robust, scientific understanding of groundwater levels and groundwater flows across the Proposed Wind Farm site.

A difficulty was encountered in April 2025, whereby 2 no. groundwater loggers in Tirlán GW1 and GW3 were found to be missing. As such, the data for these wells only exists for a period of 5 months, rather than 12 months. However, the available 5 months of data provide sufficient information to characterise the groundwater responses at those water supplies.

9.3 Receiving Environment

9.3.1 General Site Description

The Site is located between the villages of Durrow in Co. Laois and Ballyragget in Co. Kilkenny. The approximate centre of the Site is located at E241903, N174035. The northwest and centre of the Site are situated within an elevated area of ground (~150-200mOD (metres above Ordnance Datum)) within a broader area that slopes to the east and south to elevations of ~80-90mOD. The Grid Connection underground cabling route is situated along the N77 road, along the eastern margin of the Site at elevations of ~80mOD.The southern section of the Site extends towards Ballyragget along the N77 road and consists of mainly flat agricultural lands. The land is mainly agricultural improved grassland, primarily used for grazing.

A site location map is included as Figure 1-1 of Chapter 1.

9.3.1.1 Proposed Wind Farm site

The Proposed Wind Farm is located approximately 2.5 kilometres south of the village Durrow, Co. Laois, 3.2 kilometres northwest of the town of Ballyragget, Co Kilkenny and 5.8 kilometres east of the village of Cullahill, Co. Laois. The N77 National Secondary Road runs in a north-south orientation, east of the Site. It is proposed to access the Proposed Development via a new access junction off the L58333 Local Road, part of the old N77, on the eastern side of the Site.

A site location map of the Proposed Wind Farm site is given in Figure 1-1 of Chapter 1.

9.3.1.2 Proposed Grid Connection

The Proposed Wind Farm will connect into the proposed onsite 38kV substation, which is located in the east of the Proposed Wind Farm site. This substation will be connected to the existing 110kV Ballyragget Substation via a c. 3.4km long underground cabling route. The existing Ballyragget 110kV Substation is located approximately 1.8km southeast of the Proposed Wind Farm site. The proposed onsite 38kV Substation, BESS, adjacent temporary construction compound and the first c. 0.3km of the underground cabling route to Ballyragget Substation are elements of the Proposed Grid Connection which overlap with the Proposed Wind Farm site.

A site location map of the Proposed Grid Connection is given in Figure 4-1 of Chapter 4.

9.3.2 Water Balance

9.3.2.1 Proposed Wind Farm site

Long-term rainfall and evaporation data was sourced from Met Éireann. Met Éireann has compiled a set of climate averages for the period 1991-2020 for a range of parameters including air temperature, precipitation, sunshine and wind. Annual, seasonal, and monthly average values for the period 1991-2020 were compiled using high quality data obtained from Met Éireann's observation network. Long-term averages for stations are then used to generate maps and gridded data at a 1km resolution for air temperature and rainfall. A grid data point is used in Table 9-4 below.

The 30-year annual average rainfall (AAR) (1991 - 2020) for the Site are presented in Table 9-4.

Table 9-4: Local Average long-term Rainfall Data (mm)

Location: Durrow (E240882 , N177140)												
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
95	70	66	56	68	56	57	73	75	88	79	95	879

The closest synoptic weather station where the average potential evapotranspiration (PE) is recorded is at Kilkenny, approximately 18 kilometres southwest of the Site. The long-term average PE for this station is 458.8mm/yr. This value is used as the best estimate of the Site PE. Actual Evaporation (AE) at the Site is estimated as 435.9mm/yr (which is 0.95 × PE).

The effective rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the Site is calculated as follows:

$$\text{Effective rainfall (ER)} = \text{AAR} - \text{AE}$$

$$= 879\text{mm/yr} - 435.9\text{mm/yr}$$

$$\text{ER} = 443.1\text{mm/yr}$$

The recharge coefficient estimates from the GSI (www.gsi.ie), range between 22.5-85%, based on the expected or observed outcrop/subcrop near the surface. Based on the GSI mapping, a groundwater recharge cap of 100 mm/year is applied to the majority of the site's aquifers in the western, northeastern and central areas. Therefore, surface runoff rates for these areas of the Wind Farm Site are estimated to be 343.1mm/year. A groundwater recharge cap is not applied to the aquifers in the central and southeastern areas of the Site. Therefore, surface runoff rates in these areas of the site are expected to be

near 0 mm/year, which broadly aligns with the lack of surface water drainage features across this portion of the site. The only area where surface water drainage features is seen is at the faulted boundary between the sandstone/siltstone/shale formations and the Carboniferous Limestone rocks.

Table 9-5 presents return period rainfall depths for the centre of the Proposed Wind Farm site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 50-year, 100-year). These extreme rainfall data will be used for wind farm drainage design and not the long-term averages.

Table 9-5: Return Period Rainfall Depths for the Proposed Wind Farm site

Duration	1-year Return Period	5-year Return Period	10-year Return Period	50-Year Return Period	100-Year Return Period
15 min	6.5	11.2	14.1	22.8	27.9
1 hour	10.5	16.8	20.5	31.0	36.9
6 hour	19.4	28.3	33.2	46.1	52.9
12 hour	24.7	34.7	40.0	53.8	60.9
24 hour	31.4	42.4	48.1	62.7	70.0
48 hour	38.3	50.7	57.0	72.9	80.7

Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM's). Projections for the period 2041-2060 (mid-century) are available from Met Eireann. The data indicates a projected decrease in summer rainfall from 0 to 13% under the medium-low emission range scenario and an increase in the frequency of heavy precipitation events of 20%. In total, the projected annual reduction in rainfall near the Wind Farm Site is 8% under the medium-low emission scenario and 4% under the high emissions scenario. As stated above the local average long term rainfall data for the Wind Farm Site is estimated to be 879mm/yr. Under the medium-low emissions scenario this may reduce to~809mm/yr, while under the high emissions scenario this figure may change to ~844mm/yr.

9.3.2.2 Proposed Grid Connection

The Proposed Grid Connection overlaps with the Proposed Wind Farm, further southeast, along the Proposed Grid Connection underground cabling route. The recharge coefficient estimates are mapped as ~85% along the majority of the route, until the southeastern section of the route near the townlands of Ballyragget and Ballyconra, where the recharge coefficient is reduced to ~22.5%.

The effective rainfall along the Proposed Grid Connection underground cabling route is mapped as 914-924mm, meaning after subtracting the Actual Evaporation (AE) of the route, the Effective Rainfall (ER) is calculated as 478.1-488.1mm/year. For the majority of the route, where recharge is estimated at ~85%, the split between recharge and runoff will be 406.4-414.9.9mm/year and 71.7-73.2 mm/year respectively. Where recharge measures ~22.5%, the split between recharge and runoff will be 107.6-109.8mm/year and 370.5-378.3mm/year respectively.

9.3.3 Regional and Local Hydrology

9.3.3.1 Regional Hydrology

9.3.3.1.1 *Proposed Wind Farm site*

The WFD hierarchy of watercourses and catchment units comprise of river waterbodies (short sections of rivers, typically 1-10km) located in river sub-basins (which are typically 10-50km^2). These sub-basins are located within larger sub-catchments (typically 100-200km^2) denoted with _SC within the nomenclature. The sub-catchments such as the Nore_SC_70 below, contain various sub-basins (such as the Nore_120) and accompanying sections of river waterbodies. The sub-catchments are located within larger catchments (such as the Nore catchment), and these catchments are in turn located within Hydrometric areas.

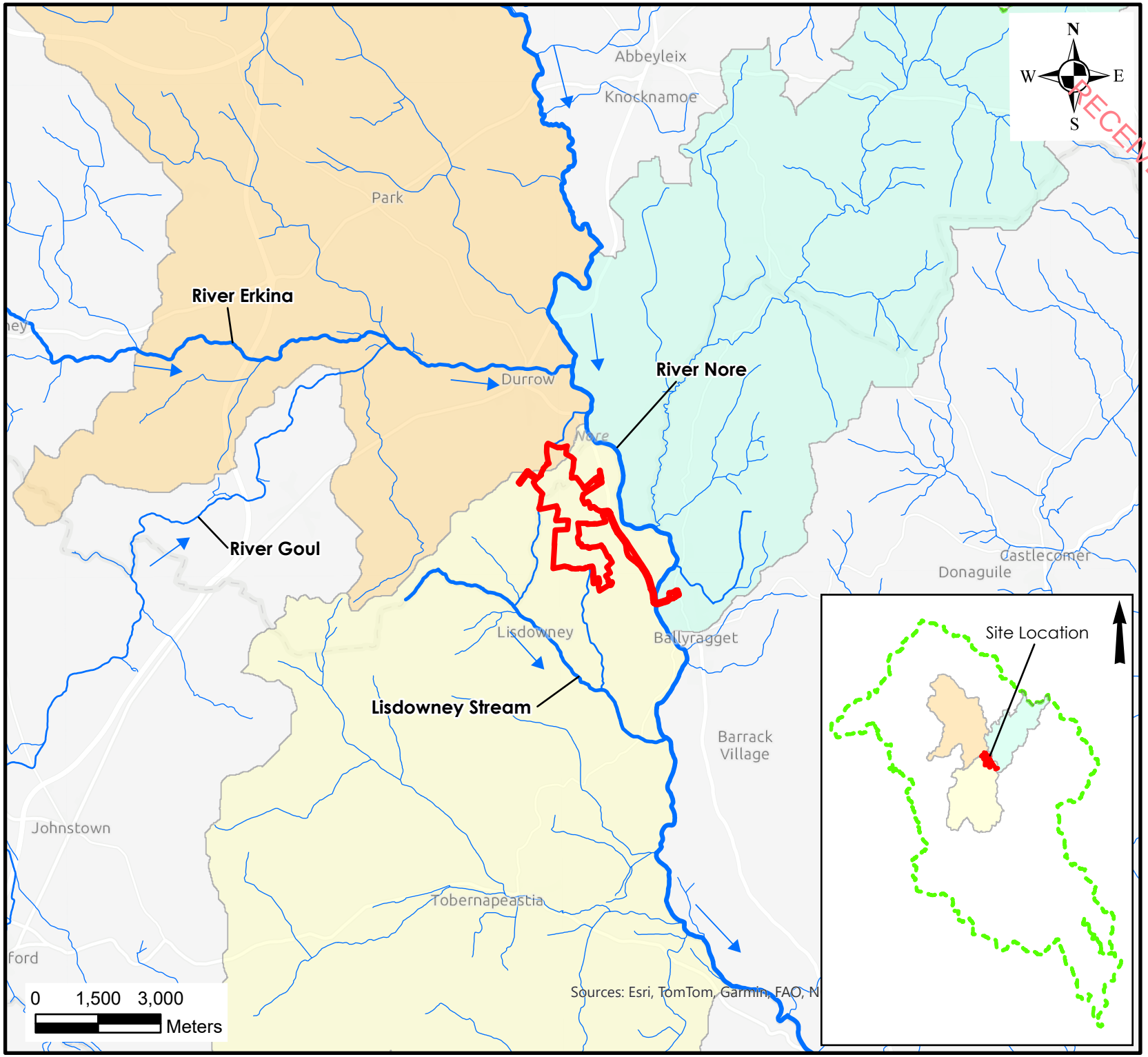
With respect to regional hydrology, the Proposed Wind Farm site is located within the Nore catchment, within Hydrometric Area 15 (Nore) of the Irish River Basin district. On a more local scale, the Proposed Wind Farm site is contained within the Nore_SC_070 sub-catchment, with a small section to the north of the site located in the Nore_SC_050 sub-catchment. The River Nore is located ~450 meters east of the Proposed Wind Farm site (parallel to N77 road) and flows south through Ballyragget. The majority of the Proposed Wind Farm site drains into the River Nore via the Lisdowney Stream, including its tributaries: Archerstown stream, Aharney stream, and the Ballyconra stream. The Durrow Townparks watercourse drains the northeast of the site to the River Nore just south of Durrow.

The closest major watercourse to the Proposed Wind Farm site is the River Nore situated 450 meters to the east. The river is monitored with measurements by the EPA located at a bridge at E244048, N171562. An average flow of 2.720 m^3/s is recorded, with a range between 0.078 – 4.1 m^3/s.

The River Erkina is located ~2km north of the site and flows east before discharging into the River Nore approximately ~1.2km north of the Site. The Newtown stream is mapped ~1.8km west of the Proposed Wind Farm site, which flows north before discharging to the River Goul which flows east and discharges to the River Erkina. The Lisdowney stream is mapped directly south of the Site, which flows southeast and discharges into the River Nore approximately ~4km south of the Proposed Wind Farm site. The Loughill river is mapped ~1km east of the site, which flows west and discharges into the River Nore.

Water levels in the River Nore are measured at station 15012 with a 50%ile water level of ~62 mOD. Station 15012 is located near the proposed grid connection crossing along the River Nore, in the townland of Ballyragget at E244048, N171562.

A regional hydrology map is shown in Figure 9-1.



Legend

- EIAR Site Boundary
- Watercourses

WFD Subcatchments

- Nore_SC_050
- Nore_SC_060
- Nore_SC_070

WFD Catchments

- Nore

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Client: Seskin Renewable Energy Ltd	
Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois	
Title: Regional Hydrology Map	
Figure No: 9-1	
Drawing No: P1653-1-0625-A4-901-00A	
Sheet Size: A4	Project No: P1653-1
Scale: 1:125,000	Drawn By: GA
Date: 26/06/2025	Checked By: MG

9.3.3.1.2 *Proposed Grid Connection*

The Proposed Grid Connection underground cabling route is located within the catchments of the Nore_120 and Nore_130 waterbodies, i.e. within the Nore_SC_060, Nore_SC_070 and Nore_SC_080 subcatchments. These surface water catchment areas and waterbodies are illustrated in Figure 9-1. The Proposed Grid Connection underground cabling route runs south along the N77 and crosses the River Nore. There is 1 no. watercourse crossings along the Proposed Grid Connection underground cabling route. The co-ordinates of the Proposed Grid Connection underground cabling route crossings is given below in Table 9-6 and can be seen towards the north of the black dashed line in Figure 9-1.

Table 9-6: Watercourse crossing

Townland	River	Easting	Northing
Ballyragget	Nore_130 – River Nore	E243998	N171854

9.3.3.2 Local Hydrology

9.3.3.2.1 *Proposed Wind Farm site*

Within the Proposed Wind Farm, there is 1 no. mapped small stream. The Ballyconra stream is mapped by the EPA as beginning in a field ~15m south of the Site boundary and ~480m southeast of turbine T8, however there is also a seepage face leading to a field drain situated ~500m northwest of this point. This seepage face exists along the approximate location of the mapped fault, and the topography and overall nature of the ground near this stream indicates that the seepage face is associated with the transition between the Bregaun flagstone Fm[1]/Kileshin Siltstone Fm and the Carboniferous Limestones of the Clogrenan Fm and Ballyadams Fm. Generally, the flow rate from this seepage face is low, typically 0.25-0.5 l/s.

There is a further unmapped short watercourse north of the Ballyconra stream (discussed further in Section 9.3.6.4.1). This unmapped stream emerges as a small seepage face near E241750, N173608. This seepage then travels along a relatively steep stream channel towards a swallow hole at E241925, N173397, located ~180m north of turbine T6. This stream exists along the mapped fault between the sandstone/shale to the west/northwest and the Limestone to the east, which is further supported with drilling data from MW3 at Turbine T6 (located 140m southwest of swallow hole) and geophysics conducted at the proposed turbine location and across the area of the swallow hole.

The Ballyconra stream is a tributary to the Lisdowney stream.

The Archerstown 15 stream flows south from the northwestern edge of the Wind Farm. The Archerstown 15 stream is not located within the Wind Farm, with the origin point situated ~30m from the site boundary and ~380m southwest of turbine T4. The Archerstown 15 stream flows south where it discharges into the Lisdowney stream.

[1] *Fm – Bedrock Formation; consists of a certain number of bedrock strata that have a comparable lithology, facies or other similar properties.*

Plate 9-1:Left - Upper reaches of Archerstown stream; Right – Field drain at head of Ballyconra stream

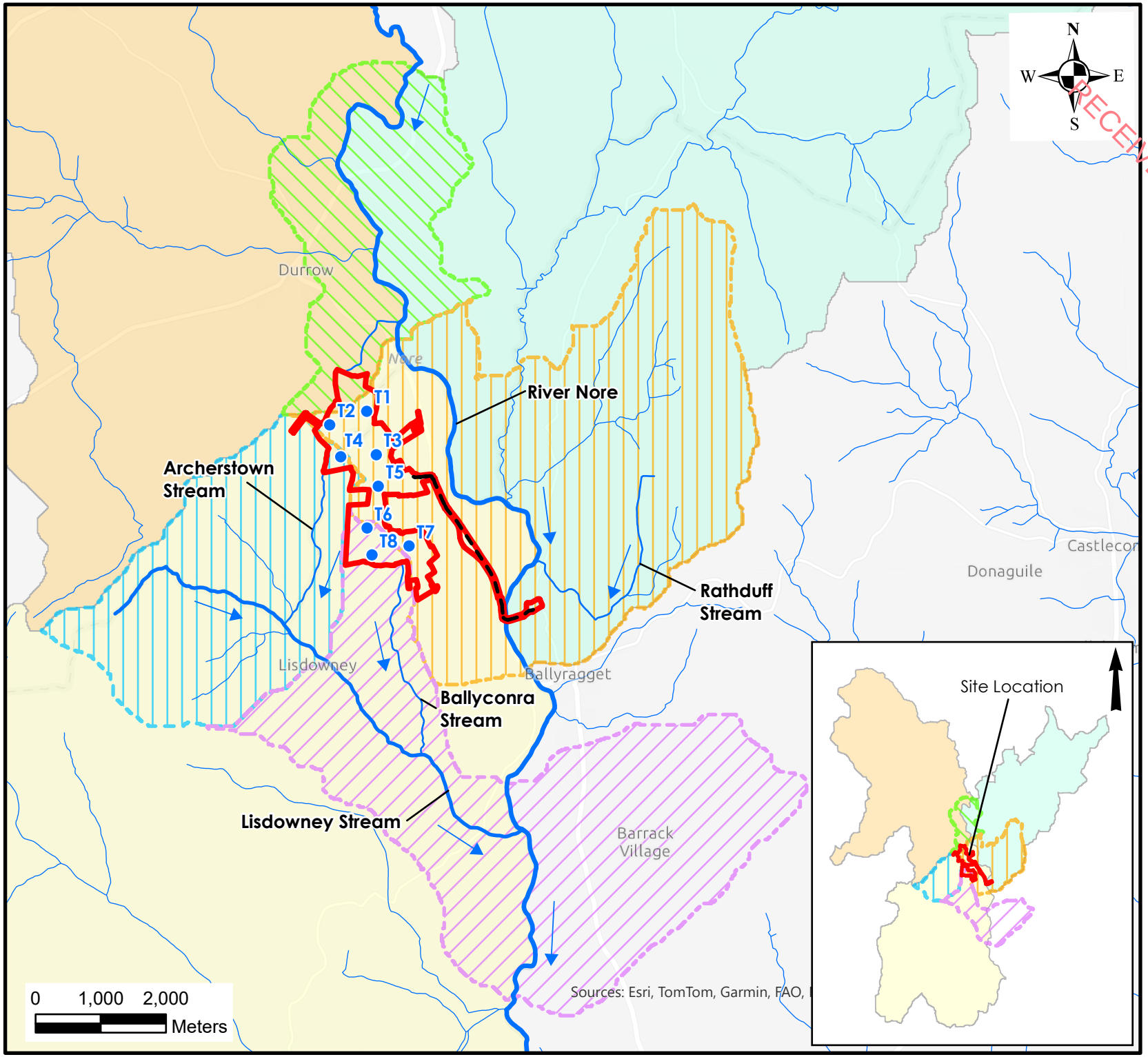
The topography broadly slopes southeast across the site, although local variations do exist. Any surface water runoff from the Proposed Wind Farm site is expected to flow in this direction (apart from at T4 where the ground slopes southwest).

No field drains were observed across the site, apart from at the origin point of the Ballyconra stream, where it appears the channel has been dug out to encourage drainage from the spring seepage which emerges to the northwest. The agricultural fields are primarily improved grassland, which are well drained.

A local hydrology map including mapped surface water bodies is shown in Figure 9-2.

9.3.3.2.2 Proposed Grid Connection

Drainage along the Proposed Grid Connection underground cabling route is broadly localised to the River Nore which flows along the N77 road. The River Nore meets the N77 National Road approximately ~2.3km north of the Proposed Wind Farm site, and subsequently runs approximately parallel to the N77 road, varying between 0.1-1km east of the road carriageway. Drainage from the road carriageway will primarily drain in the direction of the River Nore, however under typical moderate rainfall conditions, the surface water will likely infiltrate through the soil/subsoil before reaching the river as shallow baseflow, due to the soils (Sand and gravel) and subsoils (High permeability) along the Proposed Grid Connection underground cabling route.



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Client: Seskin Renewable Energy Ltd

Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois

Title: Local Hydrology Map

Figure No: 9-2

Drawing No: P1653-1-0625-A4-902-00A

Sheet Size: A4	Project No: P1653-1
Scale: 1:80,000	Drawn By: GA
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9.3.4 Flood Risk Identification

9.3.4.1 Proposed Wind Farm site

OPW's indicative river and coastal flood map (www.floodmaps.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie), Department of Environment, Community and Local Government on-line planning mapping (www.myplan.ie) and historical mapping (i.e., 6" & 25" base maps) were consulted to identify those areas as being at risk of flooding. A Flood Risk Assessment for the Proposed Development is included as Appendix 9-1.

No recurring flood incidents within the Proposed Wind Farm site were identified from OPW's indicative river and coastal flood map. There are several recurring flood incidents surrounding the Proposed Wind Farm site, which are mapped along the River Nore to the north, east and south. The nearest recurring flood incident is mapped ~0.2km from the north of the site. This flooding is noted as recurring after heavy rainfall in the area.

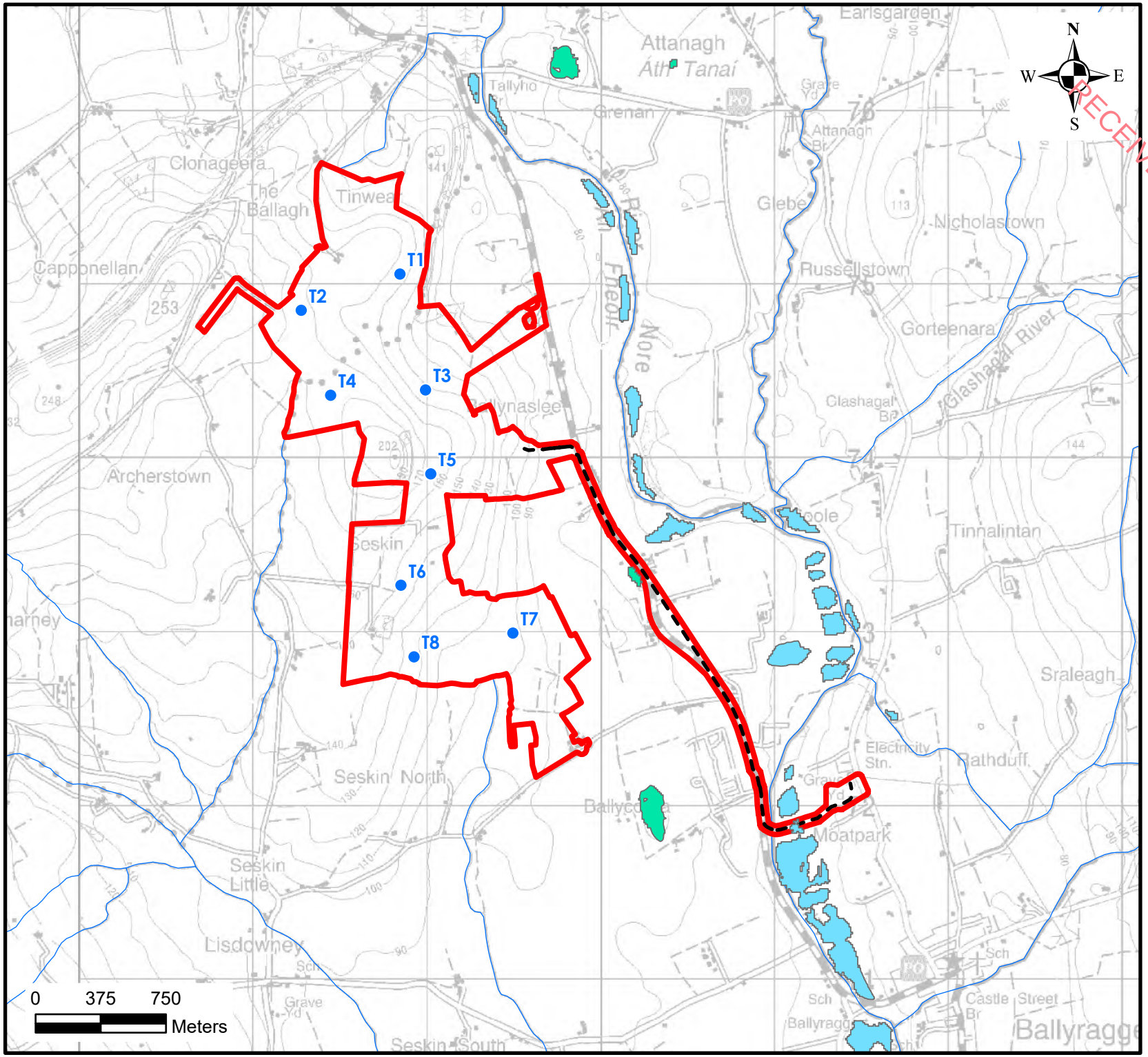
Groundwater flooding is mapped by the GSI (GSI GWFlood Project)[2]. The groundwater flood modelling highlights areas ~12.5km southwest of the Proposed Wind Farm site which corresponds to mapped turloughs and springs. There are no areas within the site which are mapped within a groundwater flood zone.

The GSI Groundwater Flooding Data Viewer was also accessed to provide details on the extent of historical groundwater flooding in the area. The data viewer provides maximum historic groundwater flooding extents which are shown in Figure 9-3. These extents generally coincide with the River Nore that runs adjacent to the east of the Proposed Wind Farm site. There is also a groundwater historic flood extent located to the south of the site in the townland of Ballyconra. The proposed turbines and other Proposed Wind Farm site infrastructure are topographically upgradient of these groundwater flood zones, with the closest point of infrastructure being T2, situated ~ 250m from a historic maximum groundwater flooding area mapped as a ~ 1 hectare (ha) area east of T2.

The available PFRA mapping shows the extent of the indicative 100-year flood zone which relates to fluvial (i.e. river) and pluvial (i.e. rainfall) flood events. There are 100-year fluvial zones mapped within the Proposed Wind Farm site. These zones are located along the eastern boundary of the site, where the site crosses the N77 National Road and runs along the border of the River Nore. All proposed turbine locations, substation, construction compounds, met mast and access roads are located at least 50m away from streams and are outside of the fluvial indicative 100-year flood zone.

There is no text on local available historical 6" or 25" mapping for the area that identify areas that are "*prone to flooding*" within the Site (www.geohove.ie).

[2] https://www.gsi.ie/en-ie/programmes-and-projects/groundwater-and-geothermal-unit/activities/groundwater-flooding/gwflood-project-2016-2019/Pages/default.aspx



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Potential Grid Route
- Watercourses
- GSI Historic Groundwater Flooding
- GSI 2015/2016 Surface Water Flooding

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Client: Seskin Renewable Energy Ltd	
Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois	
Title: Groundwater Flooding Map	
Figure No: 9-3	
Drawing No: P1653-1-0625-A4-903-00A	
Sheet Size: A4	Project No: P1653-1
Scale: 1:30,000	Drawn By: GA
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9.3.4.2 Proposed Grid Connection

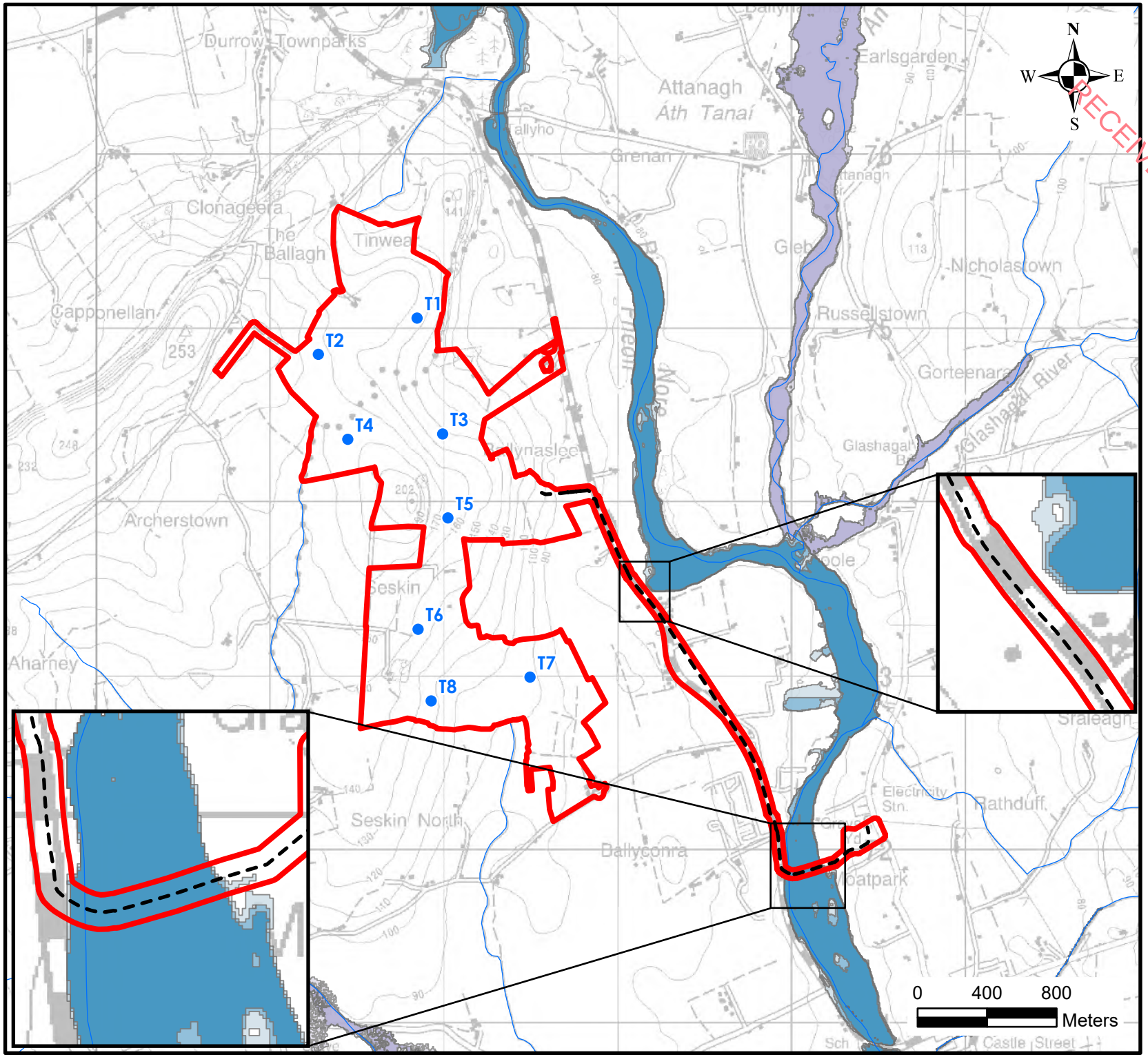
OPW's indicative river and coastal flood map (www.floodmaps.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie), Department of Environment, Community and Local Government on-line planning mapping (www.myplan.ie) and historical mapping (i.e., 6" & 25" base maps) were consulted to identify those areas as being at risk of flooding along the Proposed Grid Connection underground cabling route.

There are no recurring flood zones mapped along the Proposed Grid Connection route. There is 1 no. recurring flood zone recorded ~ 800m south of the Proposed Grid Connection route, just north of Ballyragget Bridge, where the N77 National Road crosses the River Nore. This is noted as recurring after heavy rainfall in the area.

Surface water and groundwater flooding was investigated along the Proposed Grid Connection underground cabling route during walkover surveys. No evidence of groundwater or surface water flooding were observed during these surveys.

The GSI Groundwater Flooding Probability map shows no locations along the Proposed Grid Connection underground cabling route where groundwater flooding may occur.

The CFRAM river extents have been modelled along the River Nore and its tributaries, shown in Figure 9-4. The 10% AEP flood shows areas along the southern section of the Proposed Grid Connection underground cabling route are prone to flooding, along the N77 road carriageway, although as noted above there is only 1 no. location where historic flooding has been recorded. The impact of this flooding along the Proposed Grid Connection is discussed further in Section 9.4.2.5 below and within the Flood Risk Assessment included as Appendix 9-1, however it should be noted that the proposed underground cabling will be installed within an excavated and backfilled trench, and as such there is no potential for effects on or residual effects from the underground cabling. The only potential for effects exists where the installation of the cabling coincides with a flood event along this route. In this instance the installation will be suspended until the flood water recedes.



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Potential Grid Route
- Watercourses

CFRAM River Flood Extents - Present Day

- 0.1% AEP (1 in 1000 yr) Flood Events
- 1% AEP (1 in 100 yr) Flood Events
- 10% AEP (1 in 10 yr) Flood Events

National Indicative Fluvial Mapping (NIFM) River Flood Extents - Present Day

- Low Probability
- Medium Probability

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Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois

Title: Flood Mapping - Proposed Grid Connection Underground Cabling

Figure No: 9-4

Drawing No: P1653-1-0625-A4-904-00A

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9.3.5 Surface Water Quality

Biological Q-rating data[3] for EPA monitoring points are available from locations along the River Nore, as well as the River Erkina, River Goul and the Lisdowney stream.

The River Nore achieved a Q3-Q4 (Moderate) rating ~ 0.3km to the southeast of the Wind Farm site and a Q4 (Good) rating ~0.7km to the northeast of the Proposed Wind Farm site. These ratings were achieved in 2020 and 2022 respectively.

The River Erkina achieved a Q3 (Poor) status based on sampling from 2022. The River Goul also achieved a Q3 (Poor) rating from sampling completed in 2022. The Lisdowney stream achieved a Q3-Q4 (Moderate) rating from sampling completed in 2022.

A summary of the Q ratings is given below in Table 9-7. EPA monitoring locations are shown in Figure 9-5.

Table 9-7: River Q ratings

River	Station Code	Q rating	Status	Sampling Round
R. Nore	RS15N011380	3-4	Moderate	2020
R. Nore	RS15N011300	4	Good	2022
R. Erkina	RS15E010300	3	Poor	2022
R. Goul	RS15G020500	3	Poor	2022
Lisdowney stream	RS15L020100	3-4	Moderate	2022

HES completed a round of surface water sampling on 09th April 2025 at SW1 and SW2, while data from the River Nore (SW3) was taken from www.catchments.ie for comparison with these data. The recorded field chemistry data, taken with a calibrated YSI ProDSS, are given below in Table 9-8. The laboratory data are shown in

Table 9-9, the full laboratory reports are included in Appendix 9-2. Sampling locations are shown in Figure 9-5. Surface water quality sampling was also carried out at SW4, a seepage face located near the fault zone/swallow hole (discussed in Section 9.3.6.4.1) on 21st August 2024. The results of this sampling is also included in Appendix 9-2 and demonstrates a low conductivity water (260 µS/cm), with low hardness (103 mg/L as CaCO3) and calcium (41.1mg/L).

[3] *The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from 0-1 (Poor) to 4-5 (Good/High).*

Table 9-8: Field Hydrochemistry from surface water courses 09/04/2025

Location	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH
SW1	8.9	7.81	207	7.05
SW2	9.2	9.21	399	6.96
SW3	10.4	9.3	612	8.14

The surface water samples indicate a neutral-basic type surface water, with pH ranging between 6.96-7.05. Dissolved oxygen ranges between 7.81-9.21 mg/L, with electrical conductivity ranging between 207-399 µS/cm demonstrating more groundwater input at SW2 (which is a spring at fault zone between limestone and sandstone) compared to the more typical surface water at SW1 comprising mostly recent rainfall. The hydrochemistry at SW3 along the River Nore, demonstrates a high pH and high conductivity watercourse, likely due to groundwater baseflow inputs from the gravel aquifer along the banks of the River Nore.

Table 9-9: Summary of Laboratory Analysis results

Parameter	EQS	Sample ID		
		SW1	SW2	SW3 (River Nore) **
Ammonia (mg/L)	≤0.065 to ≤ 0.04(*)	<0.02	0.02	0.022
Nitrite – N (mg/L)	≤0.01 – ≤0.03 +	<0.05	<0.05	<0.04
Ortho-Phosphate – P (mg/L)	-≤ 0.035 to ≤0.025(*)	<0.02	0.06	0.017
Nitrate - NO_3 (mg/L)	-	<5.0	10.2	7.8
Chloride (mg/L)		10.5	29.8	22.6
TSS (mg/L)	25+	<5	10	<5
BOD	≤1.5 (mean) or ≤2.6 (95%ile)*	6	<2	<1
Nitrogen (total)		0.43	2.26	-

(*) S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy).

\+ *Directive 2006/44/EC on the quality of fresh waters needing protection or improvement to support fish life.*

*** Chemistry data sourced from www.catchments.ie*

The laboratory analysis of surface water samples indicates broadly moderate - good quality surface waters.

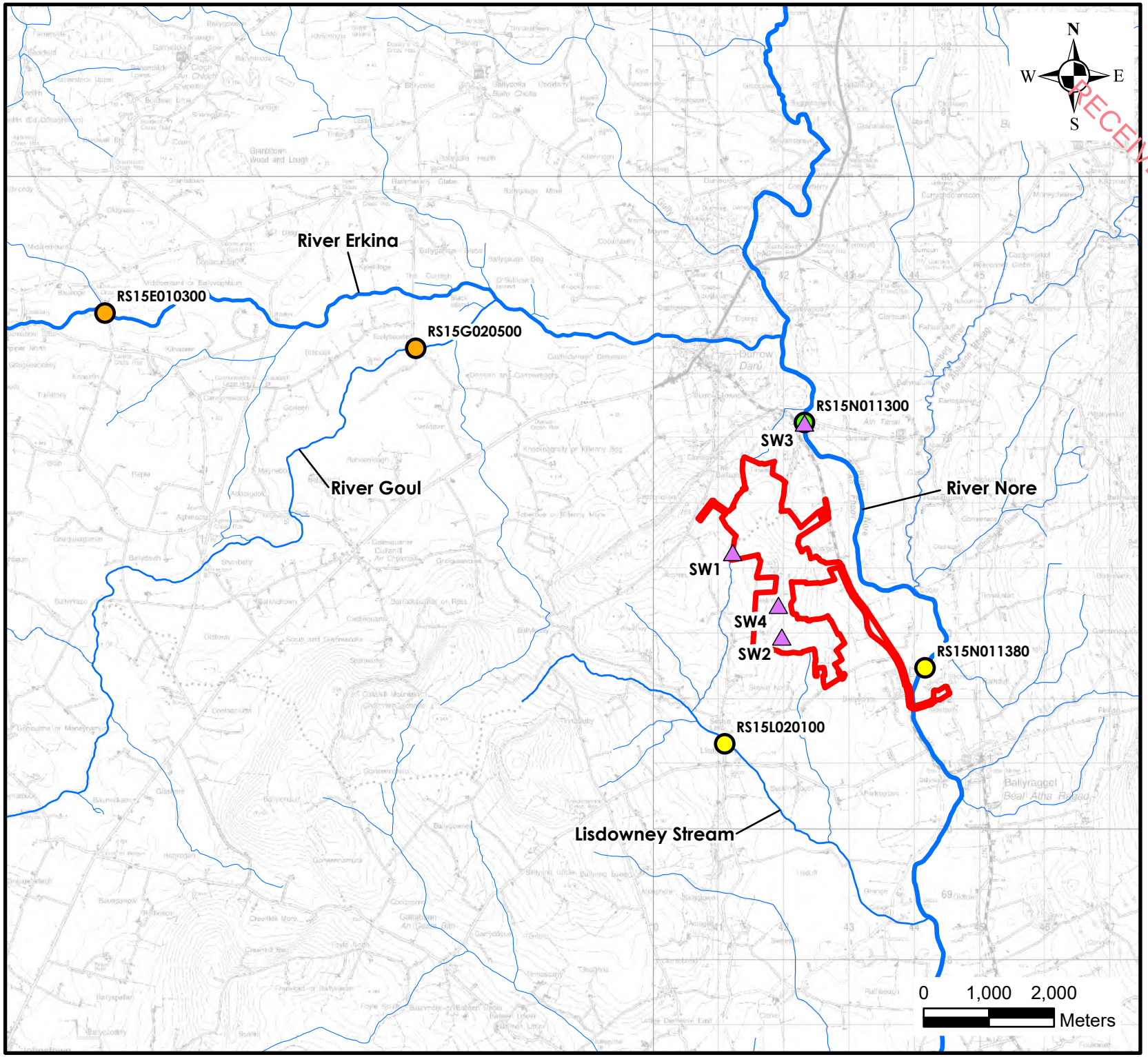
Ammonia was below the laboratory detection limit at >0.02 mg/L at SW1, while a value of 0.02 and 0.022 mg/L was reported at SW2 and SW3 respectively. These values are below the High status and Good status mean threshold of 0.04 mg/L and 0.065 mg/L respectively.

Nitrite was below the detection limit of <0.05mg/L in SW1 and SW2, and below the detection level of 0.04mbgl at SW3. The threshold values for Salmonid and Cyprinid waters are 0.01 and 0.03mg/L respectively.

Orthophosphate was measured at <0.02 and 0.06 mg/L in SW1 and SW2 respectively and at 0.017mg/l at SW3. The result from SW2 exceeds the threshold limit for both “High” and “Good” status under SI 272/2009. The results from SW1 and SW3 are below both these threshold values.

Total Suspended Solids was measured at <5mg/L at SW1 and SW3 respectively, while the sample from SW2 returned a result of 10 mg/L. All values are below the Freshwater Fish directive limit of 25 mg/L for both Cyprinid and Salmonid waters.

BOD was measured at 6 mg/L in SW1, while SW2 returned a reported value of <2 mg/L. The EPA sample from SW3 measured <1 mg/L.



Legend

- EIAR Site Boundary
- Watercourses

River Q-ratings

- 4 (Good)
- 3-4 (Moderate)
- 3 (Poor)
- Surface Water Sample Locations_HES

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Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois	
Title: Surface Water Quality locations (Q- ratings & HES sampling locations)	
Figure No: 9-5	
Drawing No: P1653-1-0625-A4-905-00A	
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9.3.6 Hydrogeology

9.3.6.1 Desk Study Hydrogeological Data

9.3.6.1.1 *Bedrock Aquifers*

The Proposed Wind Farm is situated within 2 no. bedrock Groundwater Bodies (GWB), the Lisdowney GWB and the Durrow GWB. The western half of the site is located on the Lisdowney GWB, which extends over an area of ~54 km^2, stretching from Durrow Townparks in Co. Laois to Clomantagh in Co. Kilkenny. The Lisdowney Groundwater Body is underlain by the Bregaun Sandstone and Kileshin Siltstone Formations and is classified as a poor aquifer and generally unproductive.

The eastern half of the site is located within the Durrow GWB, which extends over an area of ~217 km^2, stretching from Ballyruin in Co. Laois to Clonamicklon in Co. Tipperary. The Durrow Groundwater Body is underlain by the Clogrenan Limestone and Ballyadams Limestone Formations and is classified as a Regionally Important Aquifer (karstified conduit).

A map of the aquifer types underlying the Site is shown in Figure 9-6. The hydrogeological description of these Groundwater Bodies provides a preliminary conceptual model for the hydrogeological environment at the Proposed Wind Farm site and Proposed Grid Connection underground cabling route.

A description of the Lisdowney GWB and the Durrow GWB is provided in the Initial Characterisation Summary sheet for the Groundwater Bodies (www.gsi.ie). The details within these texts have been summarised below, with the addition of context with respect to the Proposed Development.

The topography at the Durrow Groundwater Body is characterized by Cullahill Mountain, which is located at the centre of the body and dominates the topography of the area. The hills, whose elevations reach up to 350m OD, are actually outside the GWB but the surface drainage from these hills flows towards this groundwater body. The topography at the Lisdowney Groundwater Body comprises the elevated hills between Urlingford and Durrow. The overall shape of the hill is a pear-shaped lobe with its tip at Durrow running southwest to Urlingford, with the highest elevation being 349m OD at Spa Hill. The surface drainage from the area flows mostly to the south except for a tributary of the River Goul, which flows north.

The bedrock geology at the Durrow GWB comprises Ballyadams thick-bedded, pure Limestone, with areas of Clogrenan thinly-bedded, pure Limestone. Karstification is widespread in this GWB with recorded Karst features such as enclosed depressions, springs, swallow holes and caves mapped by the GSI. The frequency of the mapped karst features is greatest in the southwestern section of the GWB, west of the River Nore and between 2-12km west of the Site. The bedrock geology at the Lisdowney GWB is characterized as Thick-Bedded Bregaun Flagstone, Killeshin Siltstone and Moyadd Coal Formation Black Shale and Siltstone. There is a distinct lack of karstification in this area with no karst features mapped by the GSI.

Well yields across the Durrow GWB range from poor (<40m^3/day) to excellent (>400 m^3/day). The groundwater table has a high annual variation and large fluctuations in water table levels are expected, indicating relatively low groundwater storage potential. Overall, groundwater in the Durrow GWB is discharged via numerous large springs close to the main river channels or directly into the rivers via baseflow. Well yields across the Lisdowney GWB from poor (<40m^3/day) to moderate (40-100m^3/day). The groundwater table has low annual variations and fluctuations, due to its low transmissivity (1-10m^2/d), low recharge and discharge capacity and shallow nature. This is considered to be a poor aquifer with minimal potential for groundwater development. Overall, groundwater flow directions are to the southwest in short paths, due to the small area of the GWB, with all groundwater discharging to local surface waterbodies and to the surrounding karstic aquifer.

In the Durrow GWB, the Ballyadams and Clogrenan Limestones are generally 75m thick. Most groundwater flows in a karstified zone located in the upper 20m of this rock formation. Limestone till and outcrop is the dominant subsoil type, with a thin layer of this subsoil covering the majority of the aquifer. The subsoil thickness increases away from the Culahill mountains while there is a thicker layer of gravel to the east and some areas in the north. In the Lisdowney GWB, the effective thickness of this GWB is not expected to be deep and most groundwater flow will occur in the upper 10m of saturated rock. Till derived from Namurian sandstones and shales is the dominant soil type, with an average thickness of 3m< along with large areas where there is 1m< of subsoil.

Both point and diffuse recharge occurs over the Durrow GWB with rainfall percolating through the permeable subsoil. Point recharge to the underlying aquifer occurs by means of swallow holes and collapse features/dolines in the southeast and southwest (there is only one point recharge source identified at the site, discussed in Section 9.3.6.4). Diffuse recharge will also occur at the contact with the Namurian shales where there are likely to be streams flowing over outcrop, as evidenced by seepage faces at the Site along the mapped fault boundary. Diffuse local recharge occurs over the Lisdowney GWB, which enters the bedrock from the thin overlying subsoil. There are no point recharge features present throughout the Lisdowney GWB.

The Durrow GWB report[4] states the following:

> *"Waters are typically 'hard' to 'very hard', with a neutral pH and calcium and bicarbonate as the dominant ions. This signature is thought to reflect the generally shallow nature of flows within the karst aquifer. The average conductivity is 643 µS/cm. The aquifer is Calcareous.*
>
> *Where the aquifer occurs close to the surface, stream densities are low. Surface water sinks underground in many areas where the aquifer is at surface e.g. sinking streams in the Borrismore and Nuenna catchments, near Freshford. Cawley (1990) found that the upper portions of the main channels frequently go dry in the summer months. These occur where streams, flowing off areas of thicker subsoil to the west, meet an area where the karst aquifer comes very close to the surface. This aquifer makes a major contribution to the baseflow of the Nore River (Daly 1994).".*

The Lisdowney GWB report[5] states the following:

> *"The bedrock strata of this groundwater body are siliceous.*
>
> *Groundwater will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low.".*

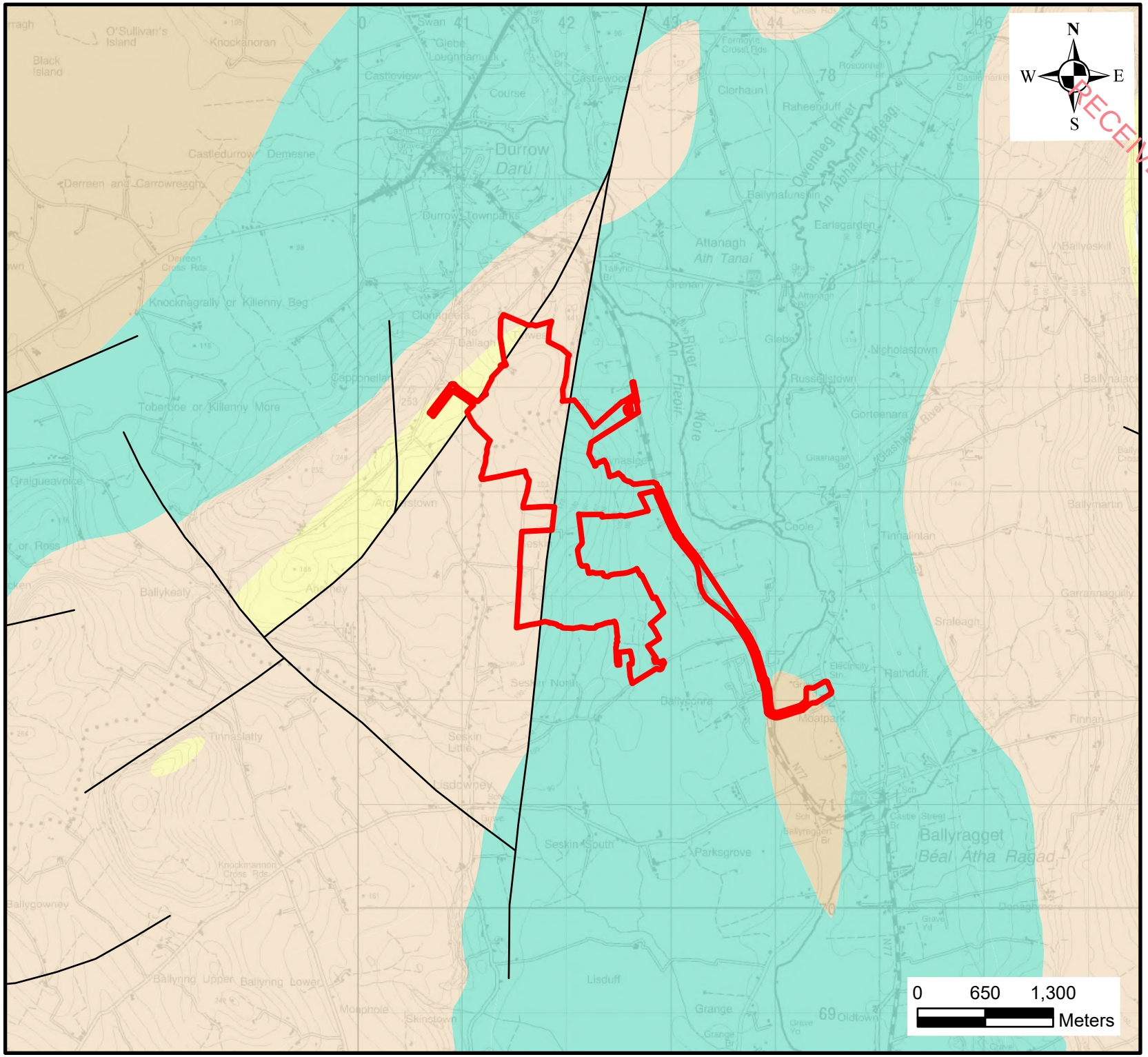
[4] *Durrow Groundwater Body Initial Characterisation Report, GSI., 2004*
[5] *Lisdowney Groundwater Body Initial Characterisation Report, GSI., 2004*

9.3.6.1.2 *Gravel Aquifers*

A Regionally Important Sand and Gravel Aquifer (Rg), the River Nore Upper Sand & Gravel[6], is mapped east of the Wind Farm along the banks of the River Nore. This sand and gravel deposit was formed during the last deglaciation period, with a resultant flat alluvial-glaciofluvial plain type topography along the margins of the River Nore. The main lithologies present in the deposit are glaciofluvial sand and gravels derived from Limestones (GLs) with some sand and gravel derived from Namurian sandstones and shales to the northeast of the aquifer.

The sand and gravel aquifer boundary is mapped ~800m east of the nearest proposed turbine (T7), but coincides with ~1,800 metres of the proposed grid connection route. A map of the sand and gravel aquifer is shown in Figure 9-7.

[6] *River Nore (Upper) Sand and Gravel Aquifer Summary of Initial Characterisation, GSI., 2023*



Legend

EIAR Site Boundary

Bedrock Aquifer

Rkd - Regionally Important Aquifer - Karstified (diffuse)

Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones

Pu - Poor Aquifer - Bedrock which is Generally Unproductive

Mapped Faults

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Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois

Title: Local Bedrock Aquifer Map

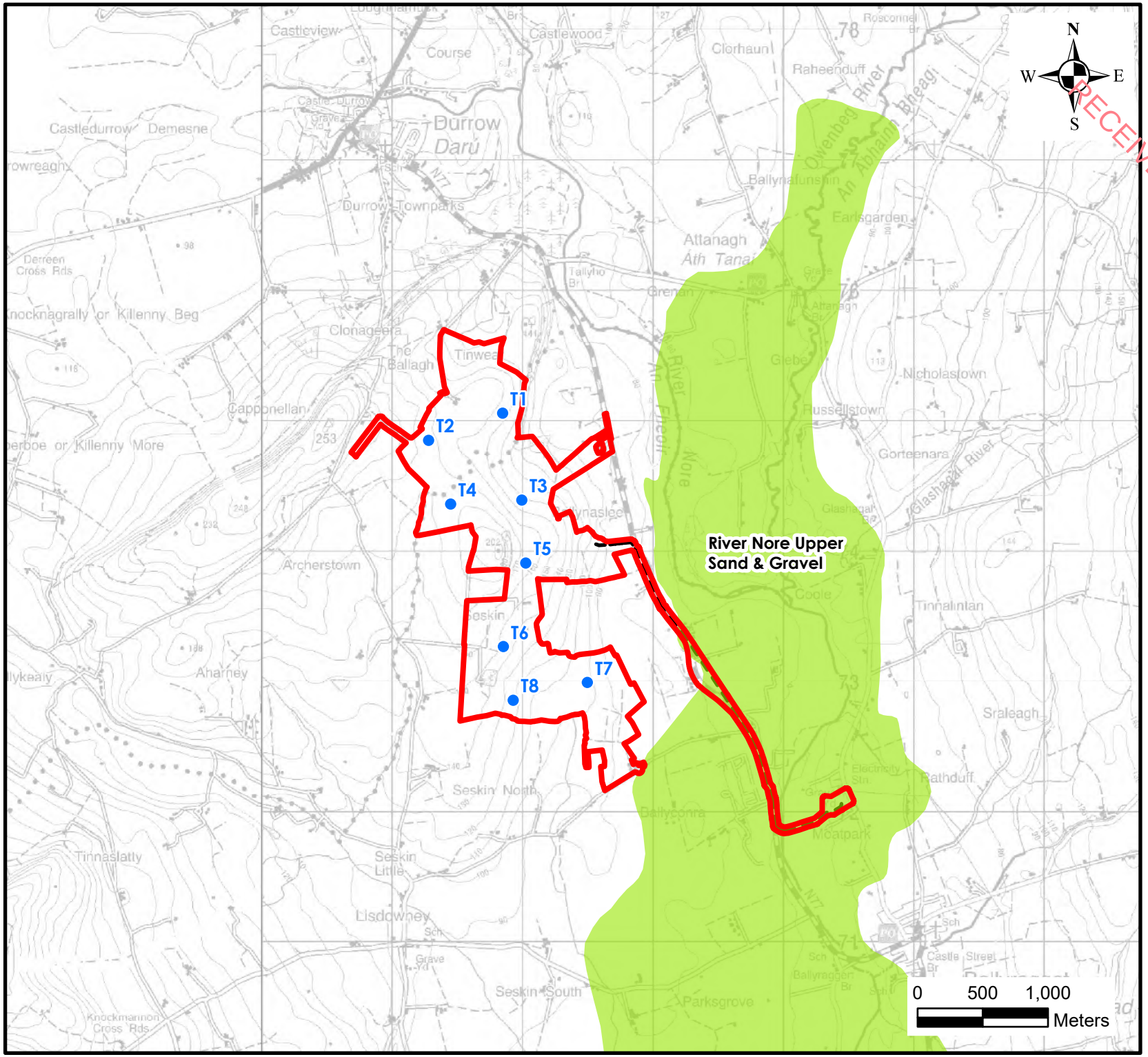
Figure No: 9-6

Drawing No: P1653-1-0625-A4-906-00A

Sheet Size: A4 | Project No: P1653-1

Scale: 1:50,000 | Drawn By: GA

Date: 26/06/2025 | Checked By: MG



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Potential Grid Route

Sand and Gravel Aquifer

- Regionally important gravel aquifer

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Title: Local Gravel Aquifer Map	
Figure No: 9-7	
Drawing No: P1653-1-0625-A4-907-00A	
Sheet Size: A4	Project No: P1653-1
Scale: 1:40,000	Drawn By: GA
Date: 26/06/2025	Checked By: MG

9.3.6.2 Summary of Geological Data

9.3.6.2.1 *Proposed Wind Farm*

A detailed description of the Site geology is presented in Chapter 8. A summary is presented here to aid the discussion on hydrogeology that follows.

Baseline geological data is available from the GSI through their online Mapviewer[7]. This bedrock mapping is completed at a broad regional scale and is considered to be indicative of the bedrock type but is superseded by the collection of site investigation data which is site-specific and completed at a much finer scale. Bedrock geology across the Proposed Wind Farm site consists of 5 no. types of bedrock. The east of the site is mapped as Clogrenan Formation Limestone, which consists of cherty, muddy calcarenitic limestone. The southeast of the site is mapped as Ballyadams Formation Limestone, which consists of crinoidal wackestone/packstone and cleaner limestone. The west of the site is mapped as predominantly Bregaun Flagstone Formation sandstone, which consists of thick, flaggy sandstone and siltstone, Kileshin Siltstone Formation which consists of muddy siltstone and silty mudstone, along with an area of Moyadd Coal Formation Shale, which consists of shale, siltstone and minor sandstone. There are 2 faults at the site that run from north to south and from north to southwest. The Ballyadams limestone bedrock is mapped as dipping 26° to the southeast, while the Bregaun flagstone/sandstone bedrock is mapped as dipping 50° along a fault to the northwest. A bedrock aquifer map is included in Figure 9-6.

The GSI has classified the Ballyadams Formation and the Clogrenan Formation as a Regionally Important Aquifer – Karstified (conduit). The Bregaun Flagstone, KIleshin siltstone and Moyadd Coal Formations are mapped as a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones. The western half of the site is located within the Lisdowney GWB, while the eastern half of the site is located within the Durrow GWB

The site-specific data on the geology of the Proposed Wind Farm site is included within Sections 8.3.3 and 8.3.4 in Chapter 8 of this EIAR and is summarised into a geological conceptual model in Section 8.3.9. The conceptual model of the geology of the Proposed Wind Farm site, including the soils, subsoils and bedrock types, thicknesses and areal extent are briefly summarised below:

- There is no peat present at the Proposed Wind Farm Site. No peat was recorded in any of the site investigation data, and no peat was observed on site during any of the site walkover survey;
- There are shallow soils/subsoils across the Proposed Wind Farm site, which are derived from a mixture of Namurian sandstone/shale (predominantly to northwest) and/or limestone parent material (predominantly to southeast) and are typically 0.5-2.0m thick, but extend deeper to ~12.5m depth in parts (as at MW1);
- The soils/subsoils are underlain by a layer of typically moderately weathered bedrock at surface (both the Namurian sandstone/shale and the limestone are typically weathered/fractured near surface) which generally exists within the top 1-3m of the bedrock; and,
- Below this zone of moderate weathering, the bedrock becomes hard and competent. This is evident from the monitoring well drilling and rotary core drilling. No evidence of wide scale karstification was observed. No karst type water strikes (*i.e.* significant water with clay returns) were encountered during the drilling of the monitoring wells.

The site-specific investigations comprise an exhaustive list of intrusive and non-intrusive works carried out at the Proposed Wind Farm site which include:

[7] *https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228*

- 4 no. groundwater monitoring boreholes drilled at locations MW1-MW4 in May 2024;
- 1 no. geophysical survey completed by Apex Geophysics at 12 no. locations between 14th – 21st October 2024;
- 1 no. rotary core borehole drilled between 08th -11th November 2024;
- 27 no. trial pits excavated by machine between 04th – 11th November 2024;
- 10 no. infiltration tests carried out between 04th -11th November 2024;
- A further 4 no. trial pits excavated near Turbine T3 in January 2025; and,
- 4 no. groundwater monitoring wells drilled at locations MW1, MW2 and MW3 and MW4 in May 2024;

A geological conceptual model has been developed for each of the 8 no. turbine locations and the substation within the Proposed Wind Farm site. This is crucially important when considering the hydrogeological impact or potential effects of the Proposed Development on the hydrogeological environment. The primary control on these potential effects is the type of basal material underlying the major infrastructure. Competent, hard limestone or firm subsoil underlies the turbine bases and substation, with groundwater levels at depth below these pieces of infrastructure.

The data gathered from site investigations and geophysical investigations has built up the following model:

- Turbine T1 – Soft to firm brown slightly sandy, slightly gravelly clay to 0.4m. Weathered bedrock encountered from 0.4-0.9m. Competent mudstone/shale below 0.9m;

- Turbine T2 – Soft to firm brown slightly sandy, slightly gravelly CLAY to 2.0m. Weathered mudstone/shale from 2.0-2.3m. Competent mudstone/shale below 2.3m;

- Turbine T3 – 0.8m of soft brown, slightly gravelly CLAY logged during trial pitting. Firm CLAY from 0.8-3.2mbgl. Geophysics interprets bedrock at 10m, while trial pitting at 4 no. locations in same field met bedrock between 0.25-1.75mbgl. Bedrock most likely at 4-5mbgl. Competent firm subsoil from 0.8mbgl.

- Turbine T4 – 0.8m of soft sandy gravelly CLAY over firm to stiff sandy gravelly CLAY from 0.8-3.2mbgl. Moderately weathered mudstone shale interpreted by geophysics between 2.6-8.7mbgl.

- Turbine T5 – 0.7m of loose clayey sand and gravel. Weathered Limestone met during trial pitting from 0.5-0.7m. 2 trial pits excavated near T5, both terminated shallow due to Limestone bedrock.

- Turbine T6 – 0.7m of soft to firm slightly sandy gravelly CLAY logged during trial pitting. Firm to stiff CLAY logged from 0.7-3.1mbgl. Geophysics interprets moderately weathered mudstone/shale between 2.6-5.7mbgl. Borehole MW3 drilled 23m south of T6 met mudstone at 2.9mbgl.

- Turbine T7 – 0.7m of soft to firm slightly sandy gravelly CLAY met during trial pitting. Firm to stiff greyish brown slightly sandy, gravelly CLAY logged from 0.7-2.8mbgl. Bedrock met in nearby MW4 (130m from turbine T7) at 10.6mbgl.

- Turbine T8 – 0.6m of soft to firm slightly sandy gravelly CLAY met during trial pitting over firm to stiff slightly sandy gravelly CLAY from 0.6-3.5mbgl. No bedrock met at T8. Moderately weathered Limestone interpreted by geophysics at 18.2mbgl.

- Substation – Bedrock met at 0.2mbgl and 0.25mbgl in both trial pits excavated at the proposed substation location.

The subsoils across the Proposed Wind Farm site are logged as slightly silty, slightly gravelly CLAY which are generally soft to between 0.5-0.7m, becoming firm to stiff below this depth. The bedrock consists of siltstone/mudstone/shale underlying T1, T2, T4 and T6, while T3, T5, T7 and T8 are underlain by Limestone bedrock. Subsoil depths are typically 0.5-2.0mbgl but extend to 12.5mbgl from intrusive site investigations and may be deeper based on the geophysical interpretation.

Although the subsoils are typically logged as slightly sandy, slightly gravelly CLAY, there is evidently sufficient permeability in the subsoils to allow the majority of rainfall to infiltrate to ground, given the lack of surface water features.

9.3.6.2.2 *Proposed Grid Connection*

Site investigation works along the Proposed Grid Connection underground cabling route include Site walkover survey of ground conditions and topography along the Proposed Grid Connection underground cabling route.

The proposed grid connection is situated along an area predominantly mapped as a regionally important gravel aquifer. There is ~2.2km of the proposed route located along the existing road carriageway, while the remaining ~1.2km is located within agricultural lands. Due to the nature of the Proposed Grid Connection underground cabling works, essentially a temporary excavation and reinstatement, the limited nature of the works will not have a major bearing on the potential effects in terms of the water environment and the local hydrogeology. Nonetheless, all of these works are included within the assessment of significant effects (Section 9.4). The only exception to this is where the proposed grid connection crosses the River Nore. At this point, site specific mitigation measures will be put in place to ensure the protection of this watercourse (Sections 9.4.2.1, 9.4.2.4, 9.4.2.9 and 9.4.2.12)

9.3.6.3 Proposed Wind Farm Field Hydrogeological Data

9.3.6.3.1 *Site Investigation Data*

Monitoring well drilling was undertaken at 4 no. locations (MW1-MW4) across the Proposed Wind Farm site. These monitoring wells were drilled to provide details on the depth of overburden, the bedrock lithology/type for engineering design, to provide information on any groundwater met during the drilling and to allow long term monitoring of groundwater levels underlying the site. A summary of these boreholes and the hydrogeological information gained is included below as Table 9-10.

Table 9-10: Proposed Wind Farm Hydrogeological Data from Site Investigations

Location	BH Drilling	Overburden	Bedrock Geology	Karst or hydrogeologically significant feature	Groundwater Strike/GW Level
Turbine Base T1	N/A	**Geophysics** 0.1 – 1.0m: Soft, sandy, gravelly Clay with pockets of loose clayey sand/gravel. **Trial Pitting:** 0.15 – 0.4m: Soft to firm brown slightly sandy slightly gravelly CLAY 0.4 – 0.9m: Presumed Weathered Bedrock recovered as grey slightly sandy clayey angular fine to coarse Gravel with low cobble content	**Geophysics** 1.0-3.5m: Weathered mudstone/shale **Trial Pitting** Weathered bedrock from 0.4-0.9m	None observed near T1 No karst interpreted on geophysics as Limestone bedrock not present	No groundwater seepage during trial pitting
Turbine Base T2	N/A	**Geophysics** 0 – 0.9m: Soft, sandy, gravelly Clay with pockets of loose clayey sand/gravel. 0.5m thick at turbine base 0.9 – 2.9m: Firm, sandy, gravelly CLAY 2.9m: Weathered mudstone/shale bedrock **Trial Pitting:** 0-0.2m: Topsoil 0.20 – 2.0m: Soft to firm brown slightly sandy slightly gravelly CLAY 2.0-2.3m: Presumed Weathered Bedrock recovered as grey slightly sandy clayey angular fine to coarse Gravel with low cobble content	**Geophysics** 2.9m: Weathered mudstone/shale **Trial Pitting** 2.0m: Weathered bedrock	None observed near T2 No karst interpreted on geophysics as Limestone bedrock not present	No groundwater seepage during trial pitting
Turbine Base T3	N/A	**Geophysics** 0-1.4m: Soft sandy gravelly clay 1.4-4.1m: Firm sandy gravelly Clay 4.1-21m: stiff to very stiff sandy gravelly clay **Trial Pitting:** 0-0.2m: Topsoil 0.20 – 0.8m: Soft brown slightly sandy slightly gravelly CLAY	**Geophysics** Bedrock interpreted at 10-32.7mbgl. **Trial Pitting** Limestone bedrock met between 0.25-1.7mbgl during trial pitting for borrow pit in same field.	None observed near T3 No karst interpreted on geophysics	No groundwater seepage during trial pitting

Location	BH Drilling	Overburden	Bedrock Geology	Karst or hydrogeologically significant feature	Groundwater Strike/GW Level
		0.8-3.2m: Firm to stiff brownish grey slightly gravelly CLAY	The site-specific trial pitting data contradicts the Geophysical interpretation in terms of bedrock depth.		
Turbine Base T4	MW1 120m from T4	**Geophysics** 0-0.6m: Soft sandy gravelly clay 0.6-2.6m: Firm sandy gravelly Clay 2.6-8.7m: Moderately weathered mudstone/shale **Trial Pitting:** 0-0.2m: Topsoil 0.20 – 0.8m: Soft brown slightly sandy slightly gravelly CLAY 0.8-3.2m: Firm to stiff brownish grey slightly gravelly CLAY	**Geophysics** Moderately weathered mudstone/shale interpreted from ~2.6mbgl **Trial Pitting** Bedrock not met during trial pitting **Drilling** Borehole MW1 drilled 120m from T4. Limestone bedrock met at 12.5mbl, consisting of medium strong grey siltstone/mudstone Rotary core borehole (BH1) drilled near T4 also. Siltstone and sandstone logged from 2-30.2mbgl.	No evidence of karstification during drilling as no Limestone present. Very little water strikes met.	Very small water strike met at 8mbgl. No water strikes below this point. Very slow to fill borehole after drilling. Groundwater level ranges between 0.7-4.2mbgl inflowing from top of soft rock at 8mbgl. No seepage recorded during trial pitting.
Turbine Base T5	MW2 110m from T5	**Geophysics** 0-0.7m: Loose clayey sand and gravel 0.6-2.2m: Weathered Limestone with firm sandy gravelly Clay 2.2-5.1m: Moderately weathered Limestone **Trial Pitting:** 0-0.2m: Topsoil 0.3 – 0.6m: Firm brown slightly sandy slightly gravelly CLAY 0.5-0.7m: Weathered bedrock	**Geophysics** Moderately weathered Limestone from 2.2-5.1m. Slightly weathered to fresh Limestone from 5.1mbgl **Trial Pitting** Presumed weathered bedrock met at 0.5m in TP-T05 and at 0.6mbgl in TP-T05A. Both trial pits terminated	Borehole MW2 drilled 110m southeast of T5. Weak weathered Limestone logged from 2.6-3.5m overlying strong Limestone from 3.5-51mbgl. No groundwater strikes recorded. No karst Limestone recorded.	No water strike noted in MW2. Took some time for groundwater to fill hole (~3 days). Groundwater level ranges between 27.8-38.95mbgl.

Location	BH Drilling	Overburden	Bedrock Geology	Karst or hydrogeologically significant feature	Groundwater Strike/GW Level
			shallow due to bedrock.		
Turbine Base T6	MW3 drilled 23m south of T6	**Geophysics** 0-1.0m: Soft, sandy gravelly Clay 1.0-2.6m: Firm sandy gravelly Clay with possibly weathered bedrock 2.6-5.7m: moderately weathered mudstone/shale **Trial Pitting** 0-0.15m: Topsoil 0.15-0.7m: Soft to firm slightly sandy gravelly Clay 0.70 – 2.60: Firm brown slightly sandy gravelly CLAY with medium cobble and boulder content 2.60 – 3.10: Very stiff light grey slightly sandy gravelly CLAY with medium cobble and boulder content	**Geophysics** Moderately weathered mudstone/shale from 2.6-5.7m Slightly weathered to fresh mudstone/shale from 5.7m. Change to limestone noted 25m east of turbine where possible fault contact exists. **Trial Pitting** No bedrock met during trial pitting	MW3 drilled 23m south of T6. Soft black mudstone logged from 2.9-17.5m. Strong grey Limestone logged from 17.5-45mbgl. No significant fault zone mapped in the contact between both lithologies. Bedrock remained relatively hard during the change. No karst limestone recorded during drilling	Small water strike at 5mbgl, medium water strike at 17.5mbgl at transition between mudstone and limestone. Groundwater levels range between 17.7-21mbgl.
Turbine Base T7	MW4 drilled 130m northwest of T7	**Geophysics** 0-0.9m: Soft sandy gravelly Clay 0.9-3.4m: Firm sandy gravelly clay 3.4-21.4m: stiff to very stiff sandy gravelly clay 21.4-27mbgl: Moderately weathered Limestone **Trial Pitting** 0 – 0.30: TOPSOIL 0.30 – 0.70: Soft to firm brown slightly sandy slightly gravelly CLAY 0.70 – 2.80: Firm to stiff greyish brown slightly sandy gravelly CLAY with medium cobble and boulder content	**Geophysics** 21.4-27mbgl: Moderately weathered Limestone >27.0mbgl: Slightly weathered to fresh Limestone **Trial Pitting** No bedrock encountered during the trial pitting **Drilling** Medium strong weathered Limestone at 10.5m, strong Limestone from 13mbgl.	Medium strong grey Limestone logged from 10.5mbgl at MW4, with strong grey Limestone logged from 13-45.5mbgl. No evidence of karst from drilling.	Seepage met at 15mbgl. Very slow groundwater strike at 24.5mbgl and medium groundwater strike met at 43.5mbgl. Groundwater levels range between 22.7-31.1mbgl.

Location	BH Drilling	Overburden	Bedrock Geology	Karst or hydrogeologically significant feature	Groundwater Strike/GW Level
Turbine Base T8	MW3 drilled 300m north of T8	**Geophysics** 0-1.2m: Soft sandy gravelly clay 1.2-4.0m: Firm sandy gravelly Clay 4.0-18.2m: Stiff to very stiff gravelly clay **Trial Pitting** 0 – 0.15: TOPSOIL 0.15 – 0.60: Soft to firm brown slightly sandy slightly gravelly CLAY 0.60 – 2.90: Firm to stiff greyish brown slightly sandy gravelly CLAY with medium cobble and boulder content 2.90 – 3.5: Stiff grey slightly sandy gravelly CLAY with low cobble content	**Geophysics** 18.2-27mbgl Moderately weathered Limestone >27mbgl: Slightly weathered to fresh Limestone **Trial Pitting** No bedrock encountered during trial pitting	No karst features present at T8 or in surrounding area, despite karst feature mapped by GSI (not karst, associated with mapped fault)	No groundwater met during trial pitting. Groundwater levels at MW3 (300m) north at 22.7-31.1mbgl. Expected same at T8.
Substation	N/A	**Geophysics** 0-0.7m: Loose clayey sand/gravel 0.7-2.5m: Highly weathered Limestone 2.5-6.1mbgl: Moderately weathered Limestone **Trial Pitting** Bedrock met at 0.2m and 0.25m respectively in TP-SS01 and TP-SS02. Refusal at these depths due to bedrock.	**Geophysics** 0.7-2.5mbgl: Highly Weathered Limestone 2.6-61mbgl: Moderately weathered Limestone **Trial Pitting** Bedrock met at 0.2m in TP-SS01 and at 0.25m in TP-SS02	No karst features identified. No features of hydrogeological significance.	No groundwater seepage recorded during trial pitting.

There were no karst features identified during the drilling of the 4 no. groundwater monitoring wells and the 1 no. rotary core borehole. In total, 216m of drilling was carried out at the Site. The drilling was carried out through moderate to thick subsoils ranging between 2-12.5m thick and consisted primarily of sandy, gravelly clay.

Groundwater levels at MW2, MW3 and MW4, situated on Limestone, occur at depth, generally ranging between 20-30mbgl, while groundwater levels in MW1 are shallower ranging between 0.7-4.2mbgl. This is typical of a sandstone/mudstone/shale aquifer, where much recharge is rejected to the relatively impermeable nature of the rock, and the vast majority of any groundwater held in these rocks is situated within the top 3-5m of rock, where isostatic rebound (rebounding of the land surface following deglaciation) has fractured the upper layer of rock creating secondary permeability.

Typically, these aquifers are considered poor in terms of their ability to store and transmit water, as is the case at MW1 situated near the proposed turbine T4.

At MW2, MW3 and MW4, the groundwater strikes occur in Limestone bedrock. During the drilling of these wells, there was no indication of zones of karstification or weathering/clay infill which might be associated with a karst environment. The limestone was observed to be hard, competent and generally unweathered. Groundwater strikes were limited, and where they did occur, they did not generate significant volumes of water.

This demonstrates a lack of groundwater flow at these locations within the top ~20m of the bedrock aquifer, with groundwater met in narrow fissures/fractures at or below this depth.

9.3.6.3.2 Groundwater Level Monitoring Data

Groundwater level data has been collected from the 4 no. monitoring locations (MW1-MW4), from a nearby farm well (DW1), from groundwater monitoring wells at the nearby Tirlán facility and from both Seskin GWS and wells which formerly comprised the Ballyconra PWS (now used by Tirlán). This data has been plotted on individual graphs, along with the corresponding water levels in the River Nore situated east of the Proposed Wind Farm site. These graphs are included as Figure A – Figure I of Appendix 9-3, while a summary graph of all water levels is included as Figure 9-8. As the groundwater levels at Seskin Sump 1 & 2 are broadly equivalent with Seskin GWS BH over the scale of the figure, the 2 no. Seskin sump groundwater levels have been omitted from Figure 9-8 to prevent overcrowding of the graph. A summary of this data is included in Table 9-11.

Well DW1 is a farm well, used as a drinking water supply for cattle. The groundwater levels recorded in DW1, located ~420m northwest of Turbine T2 (the most northerly proposed turbine) range between 192.8-202.2mOD (or 1.8-11.2mbgl). The lower groundwater levels reflect pumping water levels. The actual static groundwater level ranges between 195-202.2mOD. This well is considerably deep according to the owner, having been drilled to ~180m to gain sufficient water, although it is quite possible that this merely provides a large reservoir for shallow groundwater inflow. The groundwater levels show a relatively slow response to rainfall. During winter, there is a significant reduction in pumping as the livestock are housed indoors.

Monitoring well MW1 is situated ~120m from turbine T4. Groundwater levels in monitoring well MW1 range between 166.3-169.8mOD (or 0.7-4.2mbgl). As discussed above in Section 9.3.6.3.1, the groundwater inflow this well occurred a relatively shallow depth of 8mbgl in soft weathered mudstone rock. There is a very slow response to rainfall and a shallow range of groundwater level variation.

Monitoring well MW2 is situated 110m from turbine T5. The groundwater levels in MW2 range between 118.7-129.8mOD (or 27.8-38.95mbgl). The bedrock drilled through was consistently hard Limestone, with no visible water strikes. Nonetheless, there is still a small seepage of groundwater and a response to winter rainfall in MW2, with a ~9m variation in groundwater levels between summer and winter.

Monitoring well MW3 is situated 23m from turbine T6, which in turn is situated near a mapped fault. The bedrock encountered during the drilling of MW3 consisted of mudstone to 17.5m, with limestone below this depth. Groundwater levels in MW3 range between 122.3 – 125.6mOD (17.7-21 mbgl) and as such are associated with the water strike in the transition zone from mudstone to limestone at 17.5mbgl. There were no karst features or karst type bedrock encountered during the drilling of MW3.

Monitoring well MW4 was drilled ~130m from turbine T7. Groundwater levels range between 76-97.5mOD (9.6-31.1mbgl). A groundwater strike was logged in MW3 at 24.5 and 43.5mbgl, with some seepage at 15mbgl.

Groundwater levels at the Tirlán monitoring well GW1 range between 68.3-72.7mOD (6.3 to 10.7mOD). This well is situated within the Tirlán plant grounds at ~79mOD.

Groundwater levels in Tirlán GW3 range between 80.4 – 85.8mOD (5.2-10.6mbgl). This well is situated further west of the plant on higher ground at ~91mOD. The logger in this well was lost/removed, therefore only 5 months of recorded data is available.

Groundwater level in Tirlán GW4 range between 67.3 – 70.1mOD (3.9-6.6mbgl). This well is situated adjacent to the N77 and ~90m from the River Nore which flows with a water level elevation of ~ 66mOD at this location. As such, the water levels in GW4 are the lowest groundwater levels recorded and are broadly contiguous with water levels in the River Nore.

The water levels at Tirlán PW, the former Ballyconra PWS well (now part of Tirlán supply) range between 65.31-72.45mOD (7.5-14.68mbgl). There is minimum drawdown in this well during pumping (~20-40cm), while it is clear that there is considerable recharge into the gravels in winter and a slow and steady decline in groundwater levels during the summer, reaching the lowest values in November.

The groundwater levels at the Seskin GWS BH well and 2 no. sumps range between 64-71.6mOD. The water levels at the Seskin GWS are contiguous with the River Nore, which is situated 50m from the GWS well and sumps. There is less drawdown observed while pumping in the sumps compared to the borehole, presumably due to a larger storage volume per unit depth in the sumps.

In summary, groundwater across the area (within ~500m radially of the Wind Farm Site) flows from northwest to southeast, from the elevated ground (~150-200m) situated north of T1 on the sandstone/siltstone/mudstone bedrock, down through bedrock along the gentler Limestone slopes (80-150mOD) before reaching the gravels along the banks of the River Nore.

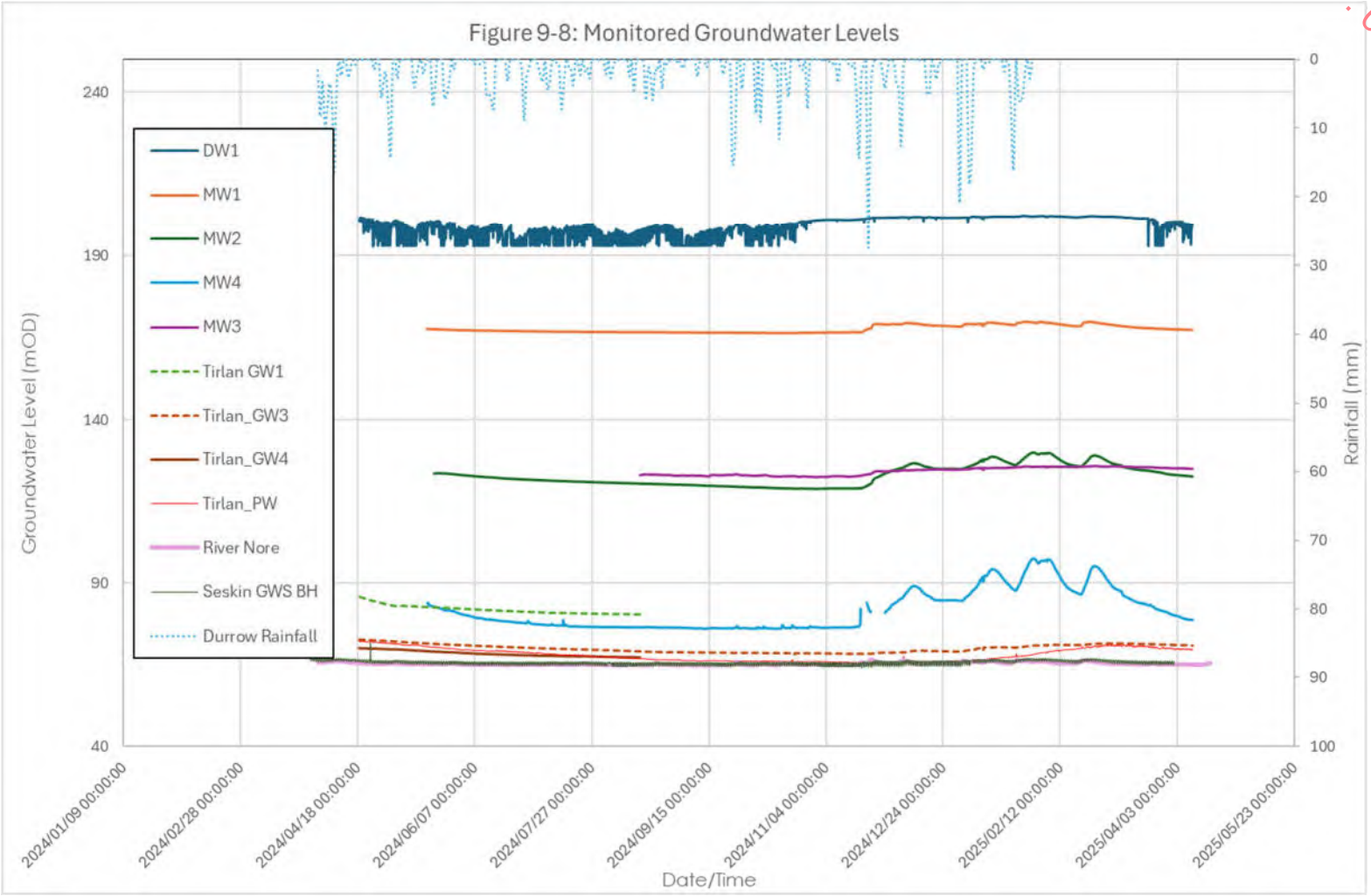
Groundwater gradients are high across the area, reflecting the topography, however groundwater velocities will be slow. The slow response to rainfall observed in the majority of monitored wells, reflects a low transmissivity environment, where groundwater slowly seeps (as opposed to a karst environment where groundwater velocities are high and water level responses sharp and instantaneous). Within the non-carbonate bedrock situated west of the mapped fault, groundwater is expected to seep along the interface between the top of bedrock the sandy, gravelly clay subsoil. Further east (east of the mapped fault) within the Limestone lands, groundwater will flow within deeper zones of moderate transmissivity in the Limestone (between ~15-40mbgl), ultimately recharging into the River Nore Gravel aquifer situated east of the Wind Farm site before discharging into the River Nore.

Table 9-11: Boreholes and available water level data

BH Number	Elevation (m OD)	Minimum Water Level (m OD)	Maximum Water Level (m OD)	Nearest Turbine
DW1	204.05	192.8	202.2	T2 (420m)
MW1	170.52	166.3	169.8	T4 (120m)
MW2	157.68	118.8	129.8	T5 (110m)
MW3	143.35	122.3	125.6	T6 (23m)
MW4	107.2	76	97.5	T7 (130m)
Tirlán GW1	79.2	68.3	72.7	T7 (1,250m)
Tirlán GW3	91.2	80.4	85.8	T7 (1,230m)
Tirlán GW4	74.1	67.3	70.1	T7 (1,680m)
Tirlán PW	80.05	65.31	72.45	T7 (1,640m)
Seskin GWS BH	70.44	56.45	66.85	T5 (1,120m)
Seskin Sump 1	70.28	64.03	71.66	T5 (1,120m)
Seskin Sump 2	70.47	64.11	71.25	T5 (1,120m)

As evident from Table 9-11 above, groundwater levels range considerably across the Wind Farm site and surrounding area, between 202.2mOD northwest of the Site and ~60mOD southeast of the Site. This high groundwater gradient is a function of the topography changes from northwest to southeast, in combination with the relatively low transmissivity. In a high transmissivity groundwater system, groundwater gradients are lower, as groundwater moves quickly through the system and equilibrates to a level with a lower gradient. A groundwater gradient of 0.023 was calculated across the Site.

Figure 9-8: Monitored groundwater levels (April 2024-April 2025)



9.3.6.3.3 *Subsoil Permeability*

Site investigation works across the Proposed Wind Farm site included 27 no. trial pits excavated across the Site in order to log the soil/subsoil as well as infiltration tests within 10 no. of these trial pits. 10 no. infiltration tests were performed at the Proposed Wind Farm site, the results of which are summarised below in

Table 9-12. The results of the infiltration test show that permeability varies across the Site, with permeability broadly low, in line with the recorded sandy, gravelly clay subsoil. The infiltration rates range between 4.52×10^{-4} - 4.79×10^{-6} m/s. Where values were not recorded, permeability rates will be lower, likely on the order of 1×10^{-7} m/s. The permeability across the Proposed Wind Farm site is low, consistent with the subsoil lithology, nonetheless it is high enough to allow for percolation of nearly all rainfall to ground, evidenced by the lack of surface water drainage features.

Table 9-12: Summary of infiltration test results

Location	Depth	Geological Description	PSD Analysis	Soakaway test (m/s)
TP-SA01	1.9	0 – 0.10: TOPSOIL 0.10 – 0.80: Soft to firm, brown, slightly sandy, slightly gravelly CLAY 0.80 – 1.90: Firm to stiff, greyish brown, slightly sandy, gravelly CLAY with low cobble and boulder content	At 1.8m Silt: 35.4% Sand: 27% Gravel: 14% Cobbles: 24%	Very Low – no value recorded
TP-SA02	1.8	0 – 0.20: TOPSOIL 0.20 – 0.60: Soft to firm, brown, slightly sandy, slightly gravelly CLAY 0.60 – 1.80: Firm, brownish grey, slightly sandy, gravelly CLAY with medium cobble and boulder content		Very Low – no value recorded
TP-SA03	1.8	0 – 0.15: TOPSOIL 0.15 – 0.80: Soft to firm, brown, slightly sandy, slightly gravelly CLAY 0.80 – 1.20: Firm, greyish brown, sandy gravelly CLAY with low cobble and boulder content 1.20 – 1.80: Brownish grey, slightly clayey, sandy, angular to subrounded fine to coarse GRAVEL with low cobble and boulder content	At 1.5m Silt: 11.6% Sand: 24% Gravel: 32% Cobbles: 32%	4.79×10^{-6}
TP-SA04	0.6	0 – 0.20: TOPSOIL 0.20 – 0.40: Brown, slightly sandy, slightly gravelly CLAY with low cobble content		6.27×10^{-5}

Location	Depth	Geological Description	PSD Analysis	Soakaway test (m/s)
		0.40 – 0.60: Presumed Weathered Bedrock recovered as grey slightly clayey, angular fine to coarse GRAVEL with medium cobble content		
TP-SA05	0.6	0 – 0.15: TOPSOIL 0.15 – 0.6: Soft to firm, brown, slightly sandy, slightly gravelly CLAY		3.09×10^{-5}
TP-SA06	1.5	0 – 0.30: TOPSOIL 0.30 – 0.80: Firm, brown, slightly sandy, slightly gravelly CLAY 0.80 – 1.5: Firm, greyish brown, slightly sandy, gravelly CLAY with low cobble and boulder content	At 0.5m Silt: 60.9% Sand: 21% Gravel: 18%	Very Low – no value recorded
TP-SA06A	1.5	0 – 0.40: TOPSOIL 0.40 – 1.50: Firm, brown, slightly sandy, slightly gravelly CLAY with medium cobble content and low boulder content		Very Low – no value recorded
TP-SA07	0.9	0 – 0.20: TOPSOIL 0.20 – 0.60: Firm, brown, slightly sandy, slightly gravelly CLAY with high cobble and boulder content 0.60 – 0.90: Presumed Weathered Bedrock recovered as angular Cobbles and Boulders		4.52×10^{-4}
TP-SA08	1.4	0 – 0.50: TOPSOIL 0.50 – 1.4: Firm, brown, slightly sandy, slightly gravelly CLAY with low cobble and boulder content		Very Low – no value recorded
TP-SA09	1.5	0 – 0.35: TOPSOIL 0.35 – 1.50: Firm, brown, slightly sandy, slightly gravelly CLAY with medium cobble and boulder content		Very Low – no value recorded
TP-SA10	1.5	0 – 0.1: TOPSOIL		Very Low – no value recorded

Location	Depth	Geological Description	PSD Analysis	Soakaway test (m/s)
		0.1 – 1.2: Firm, brown, slightly sandy, gravelly CLAY with high cobble and boulder content 1.2 – 1.5: Firm, light brown, slightly sandy, slightly gravelly CLAY with medium cobble and boulder content		

9.3.6.4 Karst Features

9.3.6.4.1 *Springs*

Karst features are mapped by the GSI and are available through the GSI online viewer. There are several karst features mapped within and near the Proposed Wind Farm site, as shown in Figure 9-9. Situated on the site are 3 no. swallow holes located in close proximity, situated between T6 and T8. Elsewhere, the closest mapped karst feature near the Proposed Wind Farm site is a spring mapped ~1.85km east of the site. There are also 8 no. springs mapped ~2.2km west of the northwestern corner of the Proposed Wind Farm site (refer to Figure 9-9).

The swallow holes mapped between T6 and T8 have been investigated during the walkover surveys of the Proposed Wind Farm site. There are 3 no. swallow holes mapped within 50m of each other, however having walked the area extensively, it is evident that these all refer to only the one feature.

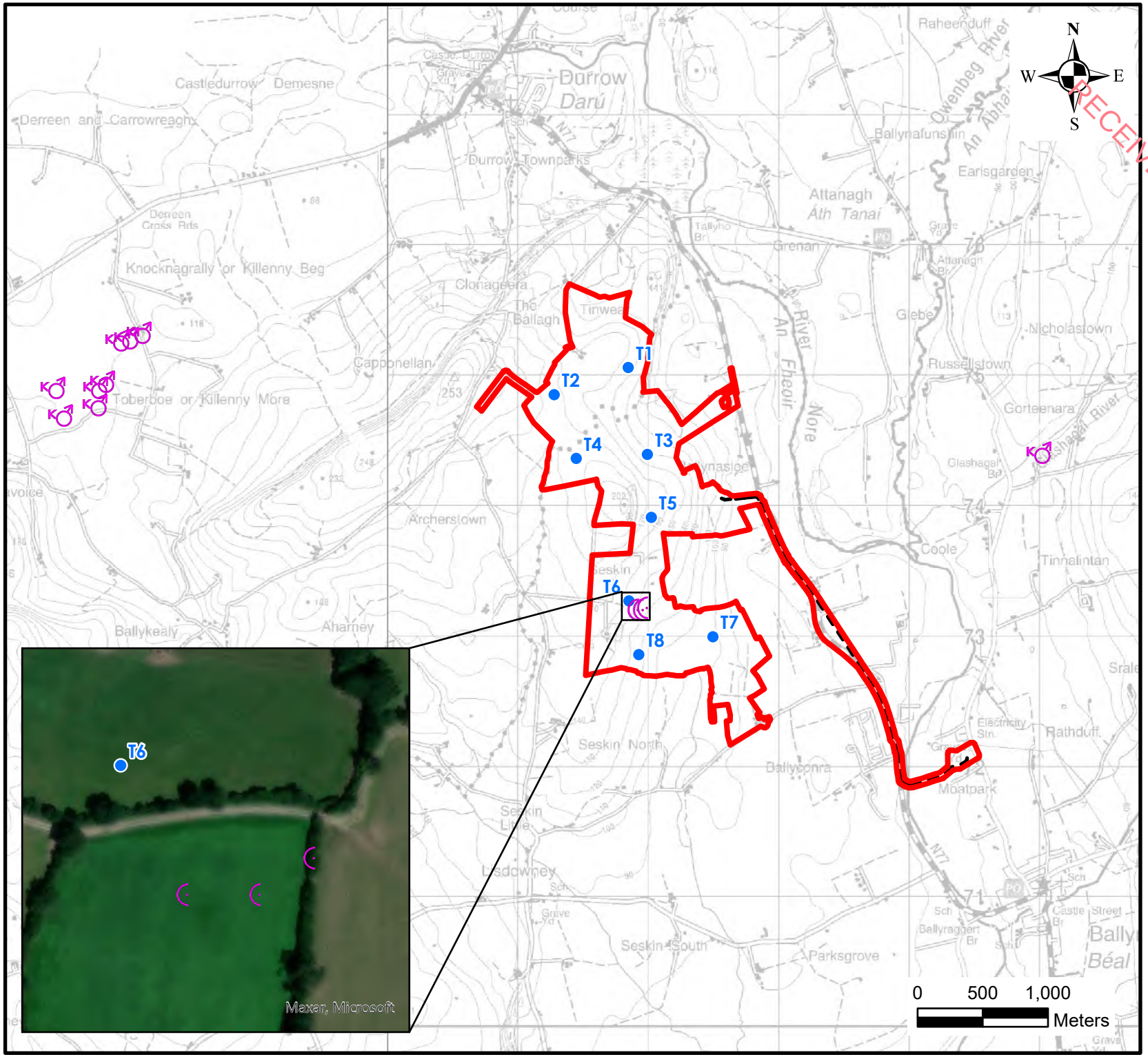
During a site visit, the wooded/scrub area north and northeast of T6 was investigated. A small spring emerges as a seepage face near a farm track. This then flows down a stream channel which becomes increasingly steep as it flows south. The channel ravine becomes 2-3m deep in sections. The hydrochemistry of this water indicates it is derived from or flowing over the siltstone/mudstone rather than limestone (*i.e.* low conductivity water between 150-200 µS/cm).

The water then flows into a swallow hole situated north of T6 (~1-2 L/s), while some of the water (~0.25 L/s) cascades over a limestone face and seeps back to ground. The orange deposit which has built up on this face was tested with 10% hydrochloric acid and did not react, therefore it is not a calcium carbonate deposit (not tufa). The swallow hole was measured at ~6m deep. Fracturing and faulting of the rock can be observed in this area, with limestone blocks showing displacement of 10-20cm. There was no visible discharge point after the swallow hole. The swallow hole is attributed to the mapped fault in this area, rather than a karst feature. There are no indications of any other karst features at ground surface, and none were observed during the monitoring well drilling. MW3 was drilled at the proposed location of T6 (~100m from swallow hole) which encountered dark shaley mudstone to 17.5m, underlain by competent limestone with no evidence of karstification.

Plate 9-2: Swallow hole (left and centre) and limestone face with seepage (right)

The topography at T6 slopes to the east, therefore drainage from the turbine will not flow in the direction of the swallow hole.

There are no other karst features situated within fields adjacent to the N77 road along the Proposed Grid Connection underground cabling route. The mapped karst features are included below in Figure 9–9.



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Client: Seskin Renewable Energy Ltd	
Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois	
Title: Karst Features Map	
Figure No: 9-9	
Drawing No: P1653-1-0625-A4-909-00A	
Sheet Size: A4	Project No: P1653-1
Scale: 1:40,000	Drawn By: GA
Date: 26/06/2025	Checked By: MG

9.3.6.4.2 Turloughs

There are no turloughs situated at the Proposed Development site or within 2km of the Site.

9.3.6.5 Water Supplies

9.3.6.5.1 Group Water Schemes Summary Information

There are 3 no. mapped public water schemes (PWS) and 2 no. mapped group water schemes (GWS) within 5km of the Proposed Wind Farm site. The GWS and PWS are listed below, beginning with the most proximal to the Proposed Wind Farm site.

- Ballyconra PWS – 0.9km south of the Site.
- Seskin GWS – 0.15km east of the Site (east of grid connection along N77).
- Durrow PWS – 0.8km north of the Site.
- Cullahill GWS – 3.4kmwest of the Site.
- Fermoyle PWS – 2.2km.

The Ballyconra PWS scheme does not exist anymore, however the wells are still in use by Tirlán to supply the plant at Ballyragget. The mapped Ballyconra Public Water Scheme (PWS) is supplied from 4 no. boreholes in the townland of Ballyconra, County Kilkenny, 1.7 km northwest of Ballyragget Village. The current scheme demand is 3,120 m^3/day, which supplies water to the Glanbia (Tirlán) Ingredients Plant at Ballyragget. The 4 no. boreholes are located in close proximity in a well-field located ~1.7km northwest of the centre of Ballyragget Village, which can be accessed via a trackway leading off to the west of the main N77 road (through the Tirlán plant grounds). The PWS pumphouses are small 2.9 m by 2.6 m roofed structures situated in the northwestern corner of an agricultural field. A maximum daily usage of 3,840 m^3 is recorded from the site. There is no estimate of potential maximum borehole yield. The groundwater is pumped to a reservoir with a storage capacity of approximately 3,800m^3 where it is subsequently chlorinated and fluoridated.

As outlined in Section 9.3.6.3.2, groundwater levels at Ballyconra PWS (Tirlán PW) range between 65.31-72.45mOD, with groundwater flowing in an easterly direction towards the River Nore.

The Seskin GWS is supplied by 2 no. sumps and 1 no. borehole. The Seskin GWS is situated between the N77 and the River Nore, approximately 3.9km south of Durrow and ~ 1.1km from the nearest proposed turbine (T5). The 2 no. gravel sumps are shallow sources, drawing water from the gravel aquifer. The borehole is deeper, although the full depth is unknown. The borehole may be gaining water from the underlying bedrock also, but more likely it is also primarily a production well installed in the mapped gravel aquifer. Groundwater level data in the borehole and 2 no. sumps has kindly been provided to HES by the Seskin GWS committee to aid in the hydrogeological assessment within this EIA report. Groundwater levels (pumping water levels) at the site range between 64-71.6mOD.

The Durrow PWS is supplied from a borehole located in the townland of Durrow Demesne, located 29m south of the Erkina River and 0.5km west of the Durrow town. The borehole, which was drilled in 1976, is located within a small pump house. This borehole supplies drinking water for Durrow Town.

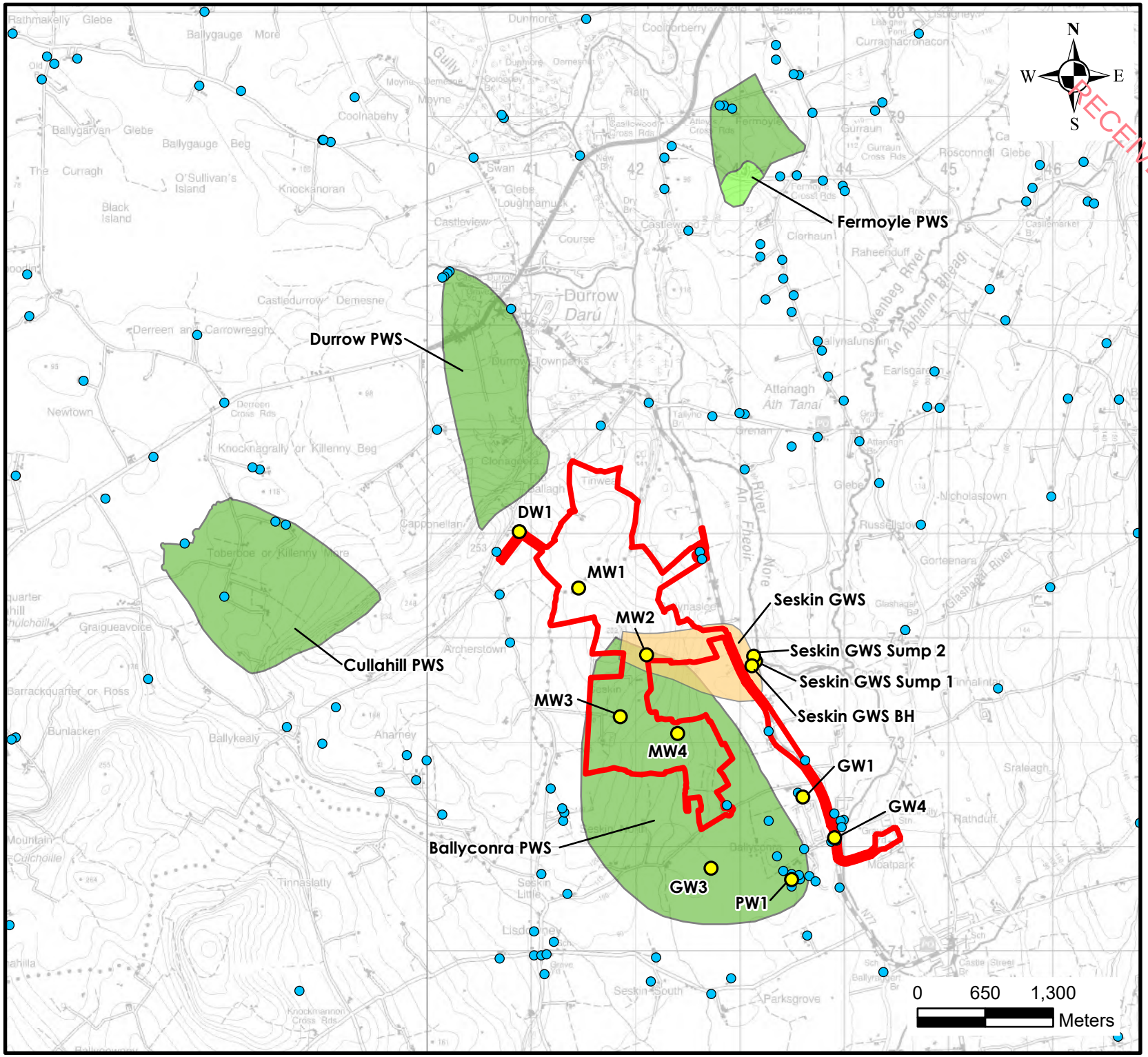
The borehole was originally 29.3m meters deep, however it is currently ~10m deep due to a collapse during testing in the early 1990s. The well is located within a small well-house, floored with concrete to a level approximately 0.2m above the surrounding field. The well head lies within a small chamber whose base lies 0.86m below the floor of the well-house. Though the well head lies above ground, the Erkina River routinely floods to within 10m of the well house and thus the well head is considered to be at considerable risk of flooding during an extreme flood event. The groundwater level is located approximately 2.4 meters below ground level. A reported average yield of approximately 200-300 m^3/day is attributed to this well, with a maximum abstraction rate of 927m^3/day. Yield from the

borehole does not appear seasonally influenced and the scheme has not experienced water supply difficulties during extended periods of dry weather. The groundwater levels at Durrow PWS are approximately 77mOD. The Durrow PWS and associated mapped Zone of Contribution is mapped on the opposite side of the Cullahill mountains to the Wind Farm site. Therefore, there is a significant topographical boundary between the Wind Farm site and this PWS.

The Culahill GWS is supplied from 8 no. springs located between 2-3km east-northeast of Cullahill Village, which is on the N9 between Durrow, Co. Laois and Johnstown, Co. Kilkenny. The spring source is one of the largest of eight springs in Toberboe, Graigueavoice, and Newtown Townlands, all of which are within 915m of each other. The second largest of these springs also forms the spring source, which has supplied Cullahill Village and its' surrounding rural area since the late 1930's. At the spring, groundwater emerges from sands and gravels along four individual subsurface conduits to collect in a circular, 0.3m thick solid concrete chamber dug into the subsoil (approximately 4m in diameter by 2.0m deep), with a solid concrete roof just above ground level. The water is then pumped to a pumphouse which is 950m to the northwest where it is chlorinated and fluorinated. The water then flows into a 40m^3 capacity storage tank before being pumped to a reservoir at Graigueavoice with a storage capacity of approximately 300m^3. The reported average yield from the 8 no. springs is 2,029m^3/day, with a maximum abstraction rate of 3,135m^3/day. The water levels in Cullahill GWS well range between 96.5 – 100mOD. As with the Durrow PWS, the Cullahill GWS is situated on the northern side of the Cullahill mountains and as such is hydrologically isolated from the Site by the topography.

The Fermoyle PWS is supplied from 2 no. bored wells in the townland of Fermoyle, Co. Laois, which is located approximately 2km northeast of Durrow. Well A, which supplies Ballinakill, is 27m deep while well B, which supplies Durrow, is 24m deep. The wells are located beside a pumphouse in an area which is fenced off from the adjacent field and both wells are completed below ground level in concrete chambers. The wells are not capped but both wells are covered and padlocked. The current scheme demand is approximately 273 m^3/day for well A and 168 m^3/day for well B. The maximum abstraction rate for well A is 920 m^3/day and 1,210 m^3/day for well B. The water levels at both wells range from 76.4-76.5mOD. The water levels across the Fermoyle area are highly variable, which may be due to the karstic nature of the limestone bedrock.

A map illustrating the source protection areas of these GWSs relative to the Proposed Wind Farm site is included in Figure 9-10.



Legend

- EIAR Site Boundary
- Public Water Schemes
- SI-Inner Protection Area
- SO-Outer Protection Area
- Group Water Schemes
- GSI Mapped Wells (1-50m accuracy)
- GW Monitoring Wells

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Client: Seskin Renewable Energy Ltd	
Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois	
Title: Source Protection Areas of local PWS and GWS schemes	
Figure No: 9-10	
Drawing No: P1653-1-0625-A4-910-00A	
Sheet Size: A4	Project No: P1653-1
Scale: 1:50,000	Drawn By: GA
Date: 26/06/2025	Checked By: MG

9.3.6.5.2 *Public Water Supplies*

A data request was submitted to Usice Eireann, requesting all water abstraction points within a 5km radius of the Site. These data were forthcoming, and an assessment was completed on the potential effects of the Proposed Development on these assests. There is 1 no. public water supply abstraction point located 2.1km southeast of the Wind Farm site and 1.05km south of the Proposed Grid Connection route. The Ballyragget infiltration gallery abstracts groundwater from an infiltration gallery along the banks of the River Nore. The average daily supply from this infiltration gallery is 1,252 m^3/day. The gallery is expected to abstract from the sand and gravel aquifer situated along the River Nore valley (similar to Seskin GWS abstraction).

A map of nearby Group Water Scheme and Public Water Supplies and their respective source protection areas is shown in Figure 9-10.

9.3.6.6 Conceptual Hydrogeological Site Model (CSM)

Groundwater level measurements at the Proposed Wind Farm site were collected at 12 no. locations over 12 months between April 2024 and April 2025. These data record the variation in groundwater levels within these monitoring points which are located both within the Proposed Wind Farm site and surrounding the Proposed Wind Farm. This provides a continuous database for groundwater levels at the Proposed Wind Farm site and also near the Proposed Grid Connection underground cabling route (using groundwater wells to the southeast of the Site) and allows an interpretation of groundwater flow across the area of the Proposed Development.

Groundwater level data has been collected from the 4 no. monitoring wells (MW1-MW4) installed at the Proposed Wind Farm site, at 4 no. wells within the Tirlán plant and surrounding lands (GW1, GW3, GW4 and PW), within one farm well (DW1) and water level data has been provided to HES by the Seskin GWS for both the 2 no. sumps and 1 no. borehole at the GWS location. Static groundwater levels range between ~ 202.4-66mOD, sloping from the high ground to the northwest near Cullahill Mountain to the River Nore towards the east/southeast.

These data have been compiled and analysed to form a conceptual model of groundwater gradients and groundwater flow directions across the Site, primarily focusing on the Proposed Wind Farm site, as the Proposed Grid Connection underground cabling route requires near surface construction works and effects on the water environment will primarily relate to surface water.

Rainfall within the Proposed Wind Farm site, infiltrates to ground through the sandy, gravelly clay subsoils. The permeability of these subsoils is variable across the Site (refer to Section 9.3.2), however the bulk permeability is sufficiently high that effectively all rainfall infiltrates to ground and there is limited surface water runoff at the site (as seen by the low drainage density).

On the higher ground towards the Cullahill mountains (northwest of Site), this rainfall can percolate through the subsoil and reach the top of the underlying bedrock of the Bregaun Flagstone Formation, Killeshin Siltstone Formation and the Moyadd Coal Formation (siliciclastic bedrock) which make up the mapped Poor Aquifer. The rainfall will not readily percolate below the top 2-3m of this rock, as it is relatively impermeable below this depth and not subject to weathering or slow dissolution over time like Limestone bedrock. The groundwater flows along the top of this bedrock, following the local topography east/southeast. At the faulted contact between the Poor Aquifer and the Regionally Important Aquifer consisting of the Clogrenan Formation (Limestone) and Ballyadams Formation (Wackestone and Packstone), there are several spring seepages which emerge from the base of the siliciclastics. This occurs north of T6, where the resulting stream from this spring flows into a swallow hole created by the faulting process, while it also occurs at the head of the Ballyconra stream. The majority of the groundwater flow from the siliciclastic bedrock however, discharges into the Limestone bedrock aquifer, where it continues east/southeast. Within the calcareous bedrock, the depth to water is lower, typically 15-40mbgl, demonstrating a slightly more permeable flow system. Rainfall across this

area of calcareous bedrock will also infiltrate to the subsoil and feed lower into the minor faults and fissures within the Limestone bedrock.

As this groundwater continues its flowpath east/southeast through the Limestone bedrock, it will do one of two things: 1) the groundwater within the Limestone will either seep out into the River Nore gravel aquifer; or 2) it is also possible that some deeper groundwater within the Limestone will flow beneath the Gravel aquifer before discharging to the River Nore. Ultimately, through either process described above, the groundwater will discharge to the River Nore.

A groundwater contour map for the Site has been developed based on the measured groundwater levels between April 2024 and April 2025. This groundwater contour map demonstrates the relatively high groundwater gradient across the site from northwest to southeast. This groundwater contour map is included as Figure 9-11.

9.3.7 Groundwater Vulnerability

The mapped vulnerability rating of the aquifer within the Site ranges between Moderate to Extreme based on regionally assumed depths of subsoil. In areas where subsoil is shallow or absent and where bedrock is outcropping an Extreme vulnerability rating is mapped. The more elevated areas towards the north, northeast, south and centre of the Proposed Wind Farm site are rated "High to Extreme" while areas of High vulnerability are mapped towards the southeast. There is a minor section of the site mapped as Moderate to the west. The mapped groundwater vulnerability of the Site (Proposed Wind Farm and Proposed Grid Connection) and surrounding area is shown on Figure 9-12.

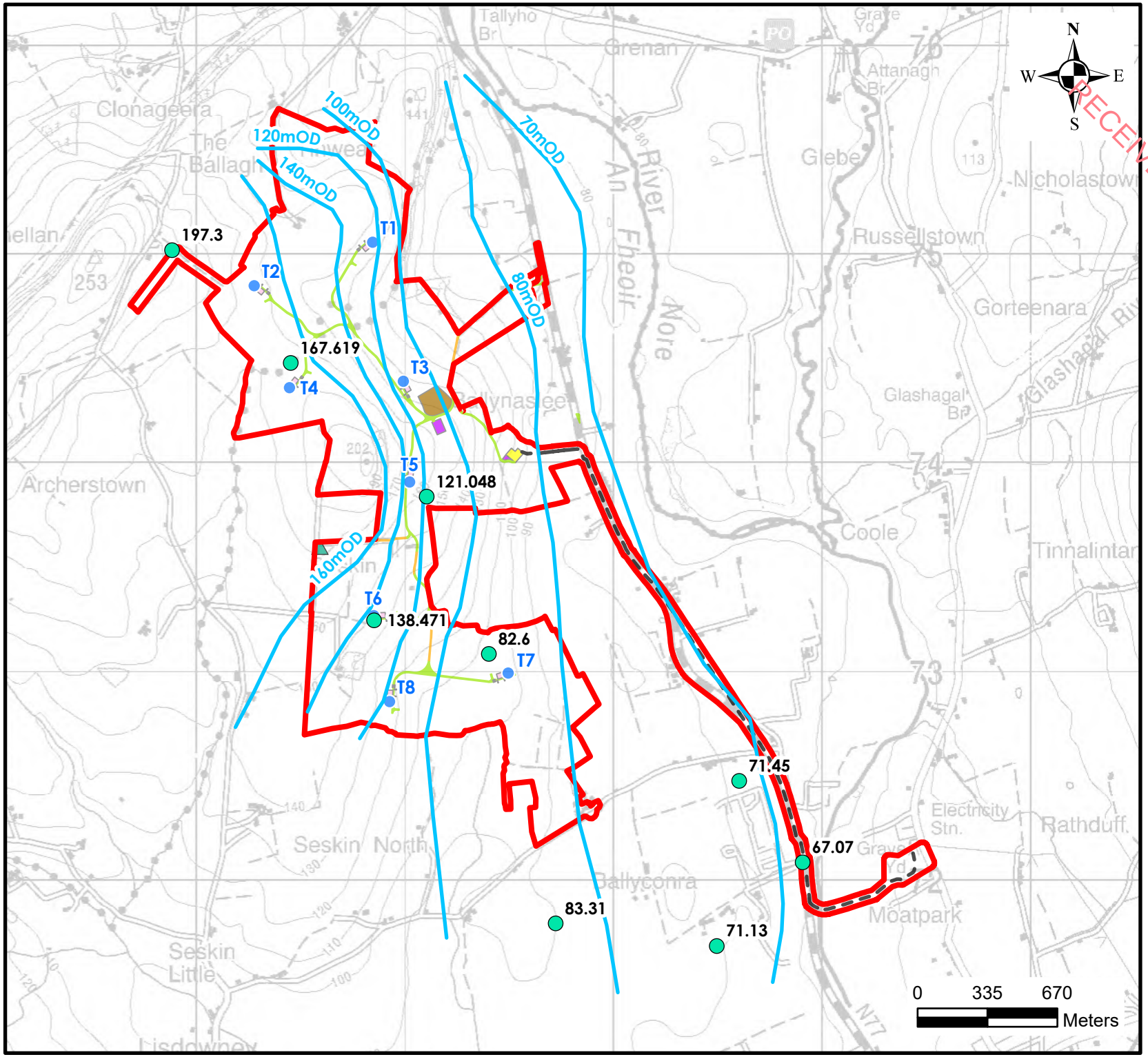
The Groundwater vulnerability ratings are based on typical overburden thicknesses which protect the underlying groundwater aquifer and are outlined in detail in DELG/EPA/GSI (1999)[8]. Plate 9-3 below outlines the decision matrix underlying the vulnerability rating.

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A
Notes: (1) N/A = not applicable. (2) Precise permeability values cannot be given at present. (3) Release point of contaminants is assumed to be 1-2 m below ground surface.					

Plate 9-3: Groundwater Vulnerability Matrix – Groundwater Protection Schemes Report 1999

The site-specific data from trial pitting and drilling across the Site, places the groundwater vulnerability within the moderate to high vulnerability rating bands, with clayey subsoil typically between 3-10m.

[8] *Groundwater Protection Schemes, DELG, EPA, GSI,. 1999*



Legend

- EIAR Site Boundary
- Met Mast Location
- Proposed Turbine Layout
- Potential Grid Route
- Proposed Hardstands
- Proposed Road Amendments Existing Roads
- Proposed New Roads
- Indicative Borrow Pit Location
- Temporary Construction Compounds
- Potential 38kV Substation with Battery Storage
- Monitoring Well Locations - GW level [mOD]
- GW Contours [mOD]

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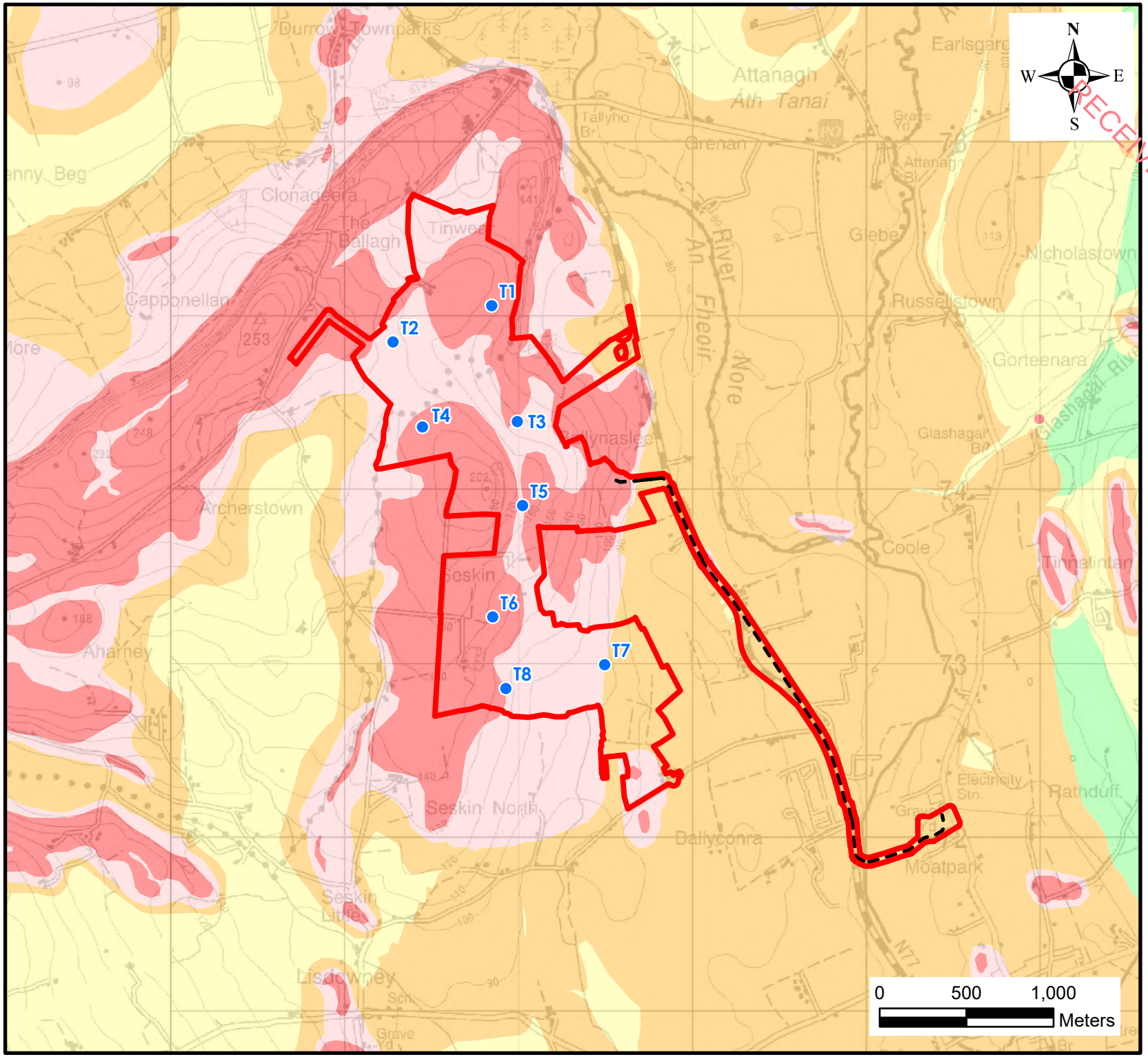
Client: Seskin Renewable Energy Ltd	
Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois	
Title: Groundwater Contour Map	
Figure No: 9-11	
Drawing No: P1653-1-0625-A4-911-00A	
Sheet Size: A4	Project No: P1653-1
Scale: 1:25,000	Drawn By: GA
Date: 26/06/2025	Checked By: MG



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Potential Grid Route

Groundwater Vulnerability

- Rock at or near Surface or Karst
- Extreme
- High
- Moderate
- Low

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Client: MKO	
Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois	
Title: Groundwater Vulnerability Map	
Figure No: 9-12	
Drawing No: P1653-1-0725-A4-912-00A	
Sheet Size: A4	Project No: P1653-1
Scale: 1:30,000	Drawn By: GA
Date: 01/07/2025	Checked By: MG

9.3.8 Groundwater Hydrochemistry

A regional characterisation of groundwater hydrochemistry is given within the draft Lisdowney GWB and Durrow GWB characterisation reports. The groundwater hydrochemistry in the Durrow GWB is described as the following:

> *"Waters are typically 'hard' to 'very hard', with a neutral pH and calcium and bicarbonate as the dominant ions. This signature is thought to reflect the generally shallow nature of flows within the karst aquifer. The average conductivity is 643 µS/cm. The aquifer is Calcareous"*

The groundwater hydrochemistry in the Lisdowney GWB is described as the following:

> *"The bedrock strata of this groundwater body are siliceous."*

Data on groundwater hydrochemistry is also available within the ZoC (Zone of Contribution) reports for the various Group Water Schemes in the area.

Table 9-13: Summary of field chemistry from GWS sample locations and from surface water

Location	Date	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH [H^+]
Seskin DW1	09/04/2025	11.6	7.1	279	8.11
Seskin MW4	09/04/2025	11.8	6.53	451	7.31
Seskin GWS BH1	01/11/2024	12.1	9.89	416.8	8.11
Seskin GWS Sump 1&2	01/11/2024	12.7	5.94	522	7.53
SW2 (Ballyconra stream)	09/04/2025	9.2	9.21	399	6.96

Groundwater quality sampling was carried at 2 no. groundwater monitoring wells, as well as field chemistry data recorded at the Seskin GWS during a site visit. Surface water quality was also undertaken at 2 no. streams (Ballyconra stream and Archerstown stream).

Field hydrochemistry from the 4 no. sampled groundwater sources shows a slight variation in groundwater chemistry from northwest to southeast. Dissolved oxygen is relatively stable, ranging between 6.53 – 9.89 mg/L, becoming more oxygenated towards the Seskin GWS wells. Conductivity values also increase from the elevated ground towards the northwest at DW1, towards the lower Limestone at MW4 and the supply sumps in the gravel aquifer at the Seskin GWS, ranging between 279-522 µS/cm.

The results of the laboratory analysed samples demonstrate that the groundwater in DW1 and MW4 have a differing chemical signature. The pH in DW1 measured 8.33, while the pH in MW4 measured 7.25. The Bicarbonate content was higher in MW4 at 276.5 mg/L, compared to 121.2 mg/L in DW1.

Nitrite was below the detection limit of 0.01 mg/L in both samples. Nitrate measured 1 mg/L in DW1 and 10 mg/L in MW4, while Chloride measured 30 mg/L in DW1 but only 15 mg/L in MW4.

Sulphate measured 14 mg/L in DW1 and 9 mg/L in MW4. Sodium measured 19 mg/L in DW1 and 6.1 mg/L in DW1. Magnesium measured 14.8 mg/L in DW1 and 7.5 mg/L in MW4.

Table 9-14: Groundwater Sampling laboratory results

Parameter	EQS	Sample ID	
		MW4 (09/04/2025)	DW1 (09/04/2025)
Bicarbonate (mg/L as $CaCO_3$)	–	276.5	121.2
Calcium (mg/L)	–	27.4	
Chloride (mg/L)	250*	15	30
Iron (µg/L)	200*		8
Magnesium (mg/L)	50+	7.5	14.8
Manganese (µg/L)	50*	183	17
Nitrate (mg/L as N)	50*/25+	10	1
Nitrite (mg/L as N)	0.5*/0.1+	<0.01	<0.01
pH	6.5-9.5	7.25	8.33
Phosphate (mg/L as P)	0.03+	0.01	0.01
Potassium (mg/L)	200*	1.6	3
Sodium (mg/L)	250*	6.1	19
TDS (mg/L)	2500	325.7	230.4
Sulphate (mg/L)	200*	9	14

(*) S.I. No. 122/2014 – Drinking Water Regulations
(+) EPA Interim Guideline Values

9.3.9 Groundwater Body Status

The Proposed Development is located in the Durrow Groundwater body and the Lisdowney Groundwater Body. The Durrow GWB (GWB: IE_SE_G_156) is assigned 'Poor Status' under the 2016-2021 WFD cycle, which is defined based on the quantitative status and chemical status of the GWB. This GWB is considered "At Risk". The Lisdowney GWB (GWB: IE_SE_G_088) is assigned 'Good Status' under the 2016-2021 WFD cycle. This GWB is considered 'Not at Risk' (see Table 9-15 below).

Table 9-15: Summary of groundwater body status.

GWB	Risk 2nd Cycle	Overall Status (2013-2018)	Risk 3rd Cycle	Overall Status (2016-2021)	Pressures
Durrow	At risk	Poor	At risk	Poor	Agriculture
Lisdowney	Not at risk	Good	Not at risk	Good	-

9.3.10 Surface Water Body Status

As outlined in Section 9.3.3, the Proposed Wind Farm site is situated within the River Nore catchment. Local Surface water Body status and WFD risk classification are available from (www.catchments.ie) and are summarised in

Table 9-16.

The Site is located in the WFD river sub basins of the Nore_120, the Nore_140, the Nore_110 and the Lisdowney_ 010. The Nore_120 is currently assigned a Moderate status in the 2016-2021 WFD Status evaluation and is assigned "At risk" for meeting the 2027 WFD objectives. The Nore_140 is currently assigned Good Status in the 2016-2021 WFD Status evaluation and is deemed to be "Not at risk" for the WFDs 2027 objectives. The Nore_110 has a WFD 2016-2021 Status of "Good" and is deemed to be "Not at risk". The Lisdowney_010 is of "Good" status and is deemed to be "At risk" of meeting the WFDs 2027 objectives.

The Nore_130 has a WFD 2016-2021 Status of "Good" and is deemed to be "Not at risk" of achieving the WFDs 2027 objectives. The Nore_150 has a WFD 2016-2021 Status of "Good" and is deemed to be "Not at risk" of achieving its WFDs 2027 objectives. The Nore_160 has a WFD 2016-2021 Status of "Good" and is deemed to be "Not at risk".

Table 9-16: Summary of surface water body status.

SWB	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk 3rd Cycle	Pressures
Nore_120	Good	Moderate	At risk	Industry
Nore_140	Good	Good	Not at risk	-
Nore_110	Good	Good	Not at risk	-
Lisdowney_010	Good	Moderate	At risk	Agriculture
Nore_130	Good	Good	Not at risk	-
Nore_150	Good	Good	Not at risk	-

Nore_160	Good	Good	Not at risk	-

9.3.11 Designated Sites & Habitats

Designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs). The Site is not located within any designated conservation-site. Designated sites in proximity to the Site are shown in Figure 9-13.

The nearest SAC is the River Barrow and River Nore SAC which runs ~0.33kmm east along the eastern boundary of the Site and ~1.8km north of the site also. The Cullahill Mountain SAC and Spahill and Clomantagh Hill SAC are located further west from the Site.

The Lisbigney Bog, which is listed as a pNHA and an SAC, is mapped ~4.3km northeast of the Site.

Wind Farm site

Designated sites located near the Proposed Wind Farm site are listed in Table 9-17. A designated sites map is included as Figure 9-13.

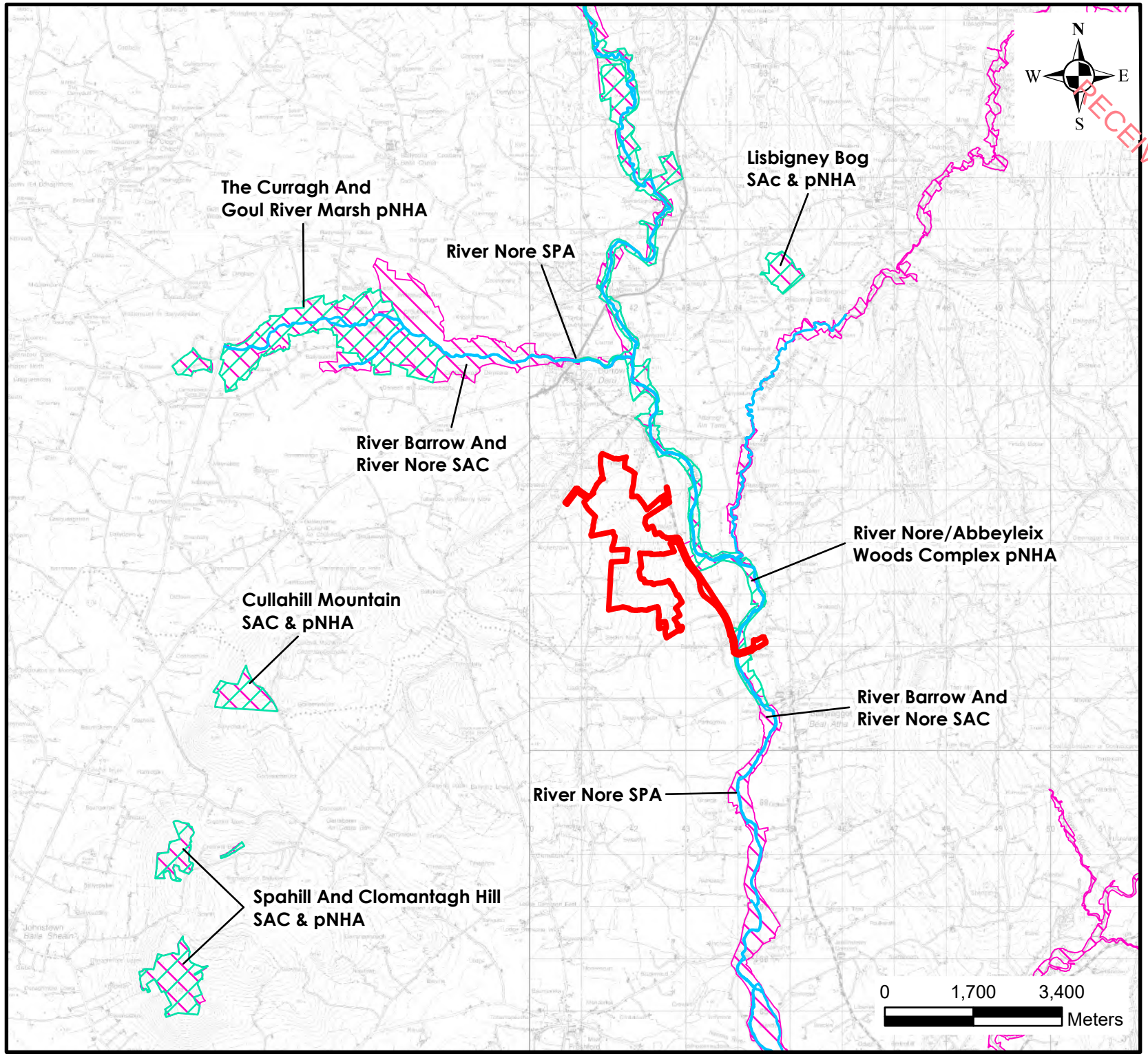
Table 9-17: Designated sites near the Proposed Wind Farm

Site	Designations	Distance from Proposed Wind Farm site
River Barrow and River Nore	SAC	0.33km from the Proposed Wind Farm site footprint Overlap with Grid Connection route along N77
River Nore	SPA	0.33km from the Proposed Wind Farm site footprint Overlap with Grid Connection route along N77
River Nore/Abbeyleix Woods Complex	pNHA	0.33km from the Proposed Wind Farm site footprint Overlap with Grid Connection route along N77
Lisbigney Bog	pNHA SAC	4.3km from the Proposed Development site (5.1km from the Proposed Grid Connection Route)
Cullahill Mountain	pNHA SAC	6.7km from the Proposed Development site. Proposed Wind Farm (8.1km from the Proposed Grid Connection Route)
Spahill and Clomantagh Hill	pNHA SAC	10.3km from Proposed Development site - Proposed Wind

		Farm (11.8km from the Proposed Grid Connection Route)

Grid Connection

The Proposed Grid Connection underground cabling route passes will be routed under the River Nore at the proposed crossing location. The River Nore is mapped as part of the River Barrow and River Nore SAC at this location.



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Title: Designates Sites Map	
Figure No: 9-13	
Drawing No: P1653-1-0725-A4-913-00A	
Sheet Size: A4	Project No: P1653-1
Scale: 1:100,000	Drawn By: GA
Date: 01/07/2025	Checked By: MG

9.3.12 Receptor Sensitivity

Due to the nature of wind farm developments, being primarily near surface construction activities i.e. (i.e. excavations are rarely >3-5m deep), effects on groundwater are generally negligible and surface water is the main sensitive receptor assessed during impact assessments. However, given the general lack of surface water features at the Proposed Wind Farm site, meaning that essentially almost all rainfall will infiltrate to ground rather than runoff to surface watercourses, and the mapping of the bedrock aquifer to the east/southeast of the Site as regionally important (karstified-diffuse), the hydrogeology of the area has been extensively monitored and synthesised using site investigation data, consisting of groundwater level data, rotary core borehole logs, monitoring well borehole logs, trial pit data, geophysics, geotechnical soil analysis and infiltration test data. The primary risk to groundwater at the Site would be from cementitious materials, hydrocarbon spillage and leakages and the potential for the turbine foundations to intercept and interfere with groundwater recharge and flows.

Based on criteria set out in Table 9-1, groundwater at the Site can be classed as Very Sensitive to pollution as the aquifer towards the east/southeast of the Site is mapped as a Regionally Important Karstified aquifer and groundwater vulnerability is mapped as High to Extreme. The site-specific data for the areas of infrastructure indicate that the groundwater aquifer is not locally karstified and that the proposed turbine locations are underlain by sandy gravelly clay which overlies either Hard, competent Limestone or hard competent Sandstone/siltstone/mudstone. Notwithstanding this, and based on the precautionary principle, groundwater is regarded as Very Sensitive.

Surface waters such as the River Nore are Sensitive to potential contamination. These rivers and associated lakes are known to be of trout potential and are important locally for fishing..

There is 1 no. designated site, the River Nore SAC, that is directly hydraulically connected by surface water paths to the Proposed Wind Farm site. Any other potential hydraulic connections are indirect and will be via groundwater flow over a generally long distance (kilometres), *i.e.* the regional groundwater flow towards the River Nore. The designated sites listed in Section 9.3.11 can be considered Very Sensitive in terms of potential effects.

Comprehensive surface water mitigation and controls are outlined in Section 9.4.2 below to ensure protection of all downgradient waterbodies (streams, rivers and lakes). Mitigation measures will ensure that surface runoff from the developed areas of the Site will be of a high quality. Runoff from the Site will percolate to ground based on the underlying site permeability. The mitigation measures outlined to protect surface water during the construction, operational and decommissioning phases will ensure that waters infiltrating to the underlying aquifer will be of a high quality and will therefore not impact on the quality of downstream water bodies. Any introduced drainage works at the Site will mimic the existing hydrological regime thereby avoiding any significant changes to recharge patterns.

9.3.13 Characteristics of the Proposed Development

The Overall Proposed Development will consist of the provision of the following:

1. *The construction of 8 no. wind turbines with an overall turbine tip height of 175 metres; a rotor blade diameter of 150 metres; and hub height of 100 metres, and associated foundations and hard standing areas;*
2. *A permanent 38kV substation compound (control building with welfare facilities, all associated electrical plant and apparatus, security fencing including vegetative screening, underground cabling, wastewater holding tank, site drainage and all ancillary works);*
3. *Permanent underground electrical (38kV) and communications cabling to the existing Ballyragget 110kV substation in the townland of Moatpark (including joint bays, communication and earth sheath link chambers and all ancillary works along the route);*

4. *Underground electrical and communications cabling connecting the wind turbines and meteorological mast to the on-site substation;*
5. *A meteorological mast with a height of 100m above ground and associated foundation and hard-standing area;*
6. *Upgrade of existing tracks and roads and the provision of new site access roads;*
7. *All works associated with the upgrade of the existing agricultural access off the L58333 local road (including the installation of fencing and steel gates);*
8. *2 no. temporary construction compounds (including temporary site offices and staff facilities);*
9. *Accommodation works along the N77 National secondary road, in the townlands of Durrow Townparks, Co. Laois and Ballynaslee, Co. Kilkenny, to facilitate the delivery of turbine components and other abnormal sized loads;*
10. *A borrow pit;*
11. *Spoil Management;*
12. *Hedgerow removal;*
13. *Biodiversity Management and Enhancement Plan measures (including establishment of new hedgerow, translocation of existing hedgerow and enhancement of existing hedgerow);*
14. *Site Drainage;*
15. *Operational stage site signage; and,*
16. *All associated site development works, ancillary works and apparatus.*

A detailed description of the Proposed Development is provided in Chapter 4 of this EIAR.

9.3.13.1 Proposed Drainage Management

Runoff control and drainage management are key elements in terms of mitigation against effects on the underlying groundwater aquifer and surface water courses. Two distinct methods will be employed to manage drainage water within the Proposed Development. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage and recharge patterns. The second method involves collecting any drainage/runoff waters from works areas within the Wind Farm site that might carry silt or sediment, and nutrients, to route them along collector drains within which recharge can occur, and outfall to infiltration areas and subsequent infiltration through the subsoil, or where infiltration to ground is not suitable, to route them towards new proposed silt traps and settlement ponds (or stilling ponds) prior to controlled diffuse release into the existing drainage network. There will be no direct discharges to the existing hydrological features (agricultural drains or natural watercourses).

During the construction phase, all runoff from works areas (i.e. dirty water) will be slowed down and treated to a high quality prior to being released. A schematic of the proposed site drainage management is shown as below. A detailed drainage plan showing the layout of the proposed drainage design elements is shown in Appendix 4-3 of the EIAR.

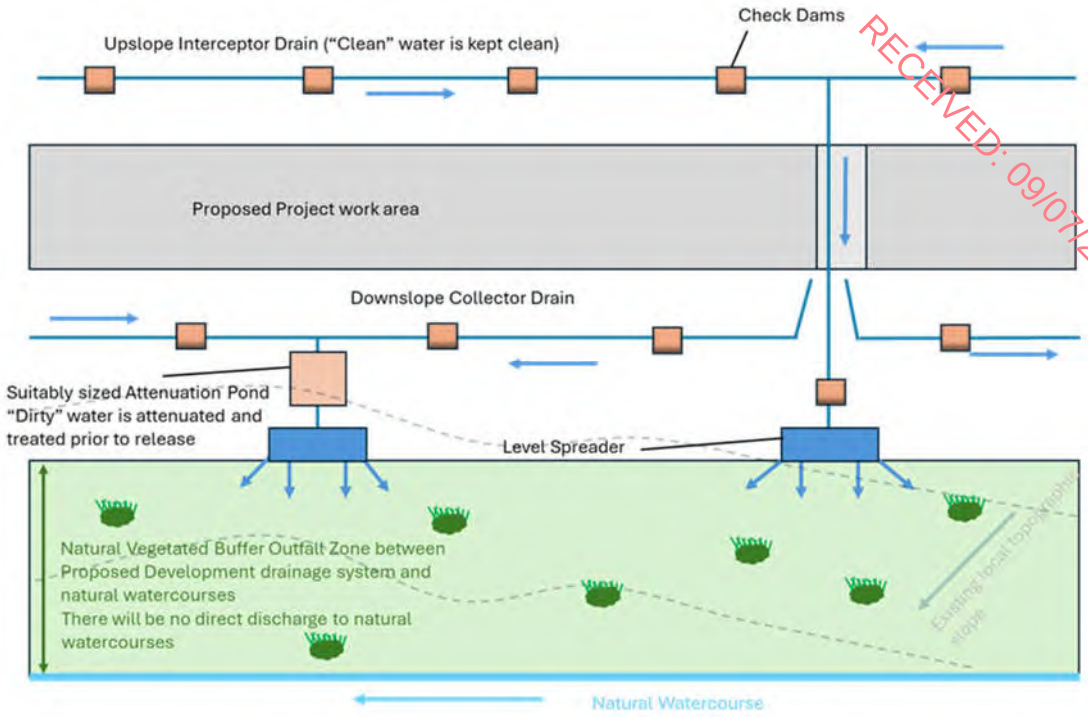


Figure 9-14: Schematic of Proposed Site Drainage Management

9.4 Likely and Significant Effects and Mitigation Measures

The potential effects of the Proposed Development and mitigation measures that will be put in place to eliminate or reduce them are set out below.

9.4.1 Do Nothing Scenario

If the Proposed Development were not to proceed, the existing land-use practices of small-scale agriculture would remain, and the opportunity to develop the Site's potential as a wind energy development would be lost. In this scenario, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions.

9.4.2 Construction Phase – Likely Significant Effects

9.4.2.1 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Drainage Recharge

Construction phase activities that will require earthworks resulting in the removal of vegetation cover and excavation of mineral subsoil (where present), and bedrock in certain areas, are detailed in Chapter 4: Description of the Proposed Development. Excavated soil/subsoil will be backfilled at the proposed borrow pit and any excess will be used for landscaping throughout the Site or accommodated in linear berms alongside the Proposed Wind Farm site access roads and turbine hardstands..

Potential sources of sediment laden water include:

- Drainage and seepage water resulting from infrastructure excavations;
- Stockpiled excavated material providing a point source of exposed sediment;
- Construction of the Grid Connection underground cabling trench resulting in entrainment of sediment from the excavations during construction; and,
- Erosion of sediment from emplaced site drainage channels (although these are limited in scale and channel length).

These activities can result in the generation of suspended solids in drainage water, and as there are no large drainage outlets (other than 2 no. small streams at SW1 and SW2) across the Wind Farm site, there is a risk that sediment laden recharge water could also enter the underlying aquifer.

Along the Proposed Grid Connection underground cabling route, there is 1 no. surface water crossing point across the River Nore. The crossing exists at a location with no existing bridge, therefore the crossings will need to be made via directional drilling under the River Nore or a similar method (refer to Chapter 4, Section 4.8.2.4.1, of the EIAR). The Proposed Grid Connection underground cabling will be emplaced along the road carriageway, therefore no instream works will occur.

Surface water runoff that will occur at Proposed Wind Farm infrastructure will be recharged locally into subsoils or in limited cases, will discharge to existing surface watercourses following attenuation through the treatment train as detailed in Figure 9-14. The potential effects on groundwater quality are assessed separately below at 9.4.2.6, 9.4.2.7 and 9.4.2.8.

Pathways: Drainage and surface water discharge routes – these are largely absent across the Proposed Wind Farm site. This is primarily related to the permeability of the soil/subsoil. Only 2 no. turbines

have the potential to drain to a surface watercourse – T4 which is 380m from Archerstown 15 stream and T8 which is 50m from field drains which lead to the Ballyconra stream. There is a very small flow in both these watercourses, measured at ~0.1-0.25l/s over several site walkovers at both sites respectively. T1 exists 700m south of the Durrow Townspark stream, however T1 will not drain to this stream due to the topography at this location. There is a short watercourse associated with the fault zone, situated ~200m north of T6. This stream discharges to a swallow hole ~180m north of turbine T6. As the topography at T6 slopes east, there is no pathway for a hydraulic connection between the proposed turbine and this stream/swallow hole, either through groundwater flows or surface water.

Receptors: Down-gradient rivers and water dependant ecosystems near the Proposed Wind Farm site which include:

- Rivers – River Nore

Down gradient rivers and dependant ecosystems along the Proposed Grid Connection underground cabling route which include:

- Rivers – River Nore

Pre-Mitigation Potential Impact:

Indirect, negative, slight, temporary, unlikely impact within the Proposed Wind Farm site (receptors listed above).

Indirect, negative, significant, temporary, unlikely impact along the Proposed Grid Connection underground cabling route (receptors listed above).

Proposed Mitigation Measures

Wind Farm site

The key mitigation measures typically employed during the construction phase of Wind Farms is the avoidance of sensitive aquatic areas where possible, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to all mapped drains). Where buffer zones cannot be applied, i.e at watercourse crossing points, further mitigation measures are employed to prevent negative effects.

The large setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be properly installed and operate effectively. The proposed buffer zone will:

- Avoid physical damage (river/stream banks and river/stream beds) to watercourses and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

It is proposed to manage overburden generated through construction activities for the Proposed Development locally within the Site, through backfilling of the proposed borrow pit void in the first instance, and following that within linear berms will be placed along access roads and turbine hardstand areas, where appropriate. The linear berms will be designed and constructed with the minimal amount of surface area exposed. The vegetative top-soil layer will be removed and re-instated or reseeded directly after construction, allowing for re-vegetation which will mitigate against erosion.

Grid Connection underground cabling route

The majority of the underground electrical cabling connection route is >50m from any nearby watercourse. It is proposed to limit any works in any areas located within 50m of any watercourse/waterbody including the stockpiling of excavated soils and subsoils.

There is 1 no. watercourse crossing included as part of the development along the grid connection route, whereby the River Nore will be crossed at a location near E243985, N171860, 250m south of the Tirlán facility. No in-stream works are required at this crossing, however due to the proximity of the streams to the construction work at the crossing location, there is a potential for surface water quality impacts during trench excavation work. Mitigation measures are outlined below.

A constraint/buffer zone will be maintained for all crossing locations where possible. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse.

The large setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be properly installed and operate effectively. The proposed buffer zone will:

- Avoid physical damage to watercourses, and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses; and,
- Avoid the entry of suspended sediment from earthworks into watercourses.

Mitigation by Avoidance:

A key mitigation measure adopted during the design phase is the avoidance of infrastructure close to surface water features across the Proposed Wind Farm site. From Figure 9-2 it can be seen that the Proposed Wind Farm site is significantly distal from any significant surface water course, the nearest being the River Nore located 450m east of the Proposed Wind Farm site.

The Proposed Grid Connection underground cabling route crosses 1 no. watercourse, the River Nore. Additional control measures, which are outlined further on in this section, will be undertaken at this location.

The large setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be properly installed and operate effectively. The proposed buffer zone will:

- Avoid physical damage to watercourses, and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses, by allowing all surface water/recent rainfall to infiltrate to ground at the Proposed Wind Farm site (refer to Appendix 4-3, Drainage Design drawings).

Mitigation by Design:

- Source controls:
  - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with gravel, filter fabrics, and other similar/equivalent or appropriate systems.
  - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls:

- Interceptor drains, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.

- Treatment systems:
  - Silt-buster system or equivalent.

Silt Fences

Silt fencing will be emplaced downgradient of turbines, to prevent any runoff of sediment laden water. Silt fences are effective at removing heavy settleable solids. Inspection and maintenance of these structures will be carried out during construction phase. They will remain in place throughout the entire construction phase.

Double silt fences will also be emplaced where the Proposed Grid Connection is near sensitive areas, as outlined in Section 9.4.2.9 below (*i.e.* HDD crossing under the River Nore).

Silt Bags

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through. The discharge from the silt bags will be directed to the settlement ponds, where the water will be allowed to naturally infiltrate to ground.

Pre-emptive Site Drainage Management

The works programme for the initial construction stage of the Proposed Wind Farm site 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 forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

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 should be suspended if forecasting suggests either 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.

Management of Runoff from Areas of Spoil Placement

It is proposed that excavated subsoil will be primarily used to backfill the borrow pit. Any excess will be used for landscaping throughout the Site or accommodated in linear berms alongside the Proposed Wind Farm site access roads and turbine hardstands..

Proposed surface water quality protection measures regarding the spoil storage areas are as follows:

- During the initial emplacement of spoil at the borrow pit, silt fences, straw bales and biodegradable matting will be used to control surface water runoff from the enclosure.
- Drainage from areas of spoil placement will be directed to settlement ponds as required or will overflow through controlled overflow pipes (not required for borrow pit as runoff will remain in pit).
- Discharge from areas of spoil placement will be intermittent and will depend on preceding rainfall amounts.
- Once the areas of spoil placement have been seeded and vegetation is established the risk to downstream surface water is significantly reduced.

Therefore, at each stage of the spoil storage area development the above mitigation measures will be deployed to ensure protection of downstream water quality.

Timing of Site Construction Works

Construction of the drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and operational for all subsequent construction works.

Monitoring

An inspection and maintenance plan for the on-site drainage system will be prepared in advance of the commencement of any works. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels at infiltration outfall points or within the short drainage channels, that may decrease the effectiveness of the drainage feature, will be removed.

During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken at drainage outfall locations, and specifically following heavy rainfall events (as per the SWMP – Appendix 4-3). The inspections will include ensuring that all

surface water is infiltrating to ground as per the Drainage Design, with no surface water runoff from the Wind Farm site.

Residual Effect: Following the implementation of the mitigation by avoidance measures, which has involved an iterative process of optimising the design and layout of the Proposed Development to minimise the potential for effects due to earthworks, as well as the mitigation by design measures which involves the detailed and site-specific drainage management plan, the residual impact is considered to be - Negative, indirect, imperceptible, short term, unlikely impact on:

Underlying groundwater systems and down-gradient rivers near the Proposed Wind Farm site which include:

- Groundwater – underlying Poor and Regionally Important aquifers
- Rivers – River Nore

Down gradient rivers along the Proposed Grid Connection underground cabling route which include:

- Rivers –River Nore

Significance of Effects: No significant effects on the aforementioned receptors will occur.

9.4.2.2 Potential Effects on Groundwater Flows and Levels due to alteration of recharge (including activation of potential karst)

Wind Farm site.

For the Proposed Wind Farm site, a comprehensive site investigation dataset has been accrued. The collated site investigation dataset for the Site has not identified any significant karst features within the underlying bedrock, following the drilling of 4 no. monitoring wells, 1 no. rotary core borehole and 27 no. trial pits.

The west and northwest of the site is mapped within a Poor Aquifer, which comprises sandstone, siltstone, mudstone and shale with some minor coals in the Moyadd Coal Formation. This bedrock is not susceptible to karstification.

Within the areas of the Site mapped as Limestone, the completed drilling has demonstrated that the bedrock is not significantly water bearing with only small-moderate groundwater strikes. Furthermore, the static groundwater level in the Limestone typically exists at 15-40mbgl, which is considerably below any foundations required for the proposed turbines (typically 3-5m deep). Although mapped as a regionally important karst aquifer, there is no indication of karstification of the bedrock at the Proposed Wind Farm site or along the Proposed Grid connection route.

A reduction in recharge, which would be accompanied by an increase in surface water drainage, would clearly reduce the volume of water infiltrating to the bedrock aquifer and therefore lead to a reduction in groundwater levels. The drainage management design of the Proposed Wind Farm site has been optimised to ensure the volume of rainfall infiltrating through the subsoils to the groundwater aquifer will not change.

Grid Connection

Changes in the permeability of the ground along the Proposed Grid Connection underground cabling route can impact on groundwater recharge to the underlying aquifer. As the cable trench will be shallow (~1.3m) and either within an existing road carriageway or within existing agricultural lands, the trench will be excavated within the soil/subsoil layer. Following the excavation of the trench, the cable will be laid and the soil/subsoil removed will be backfilled within the excavation (in the same order as it was removed). As such, the overall permeability of the ground along the Proposed Grid Connection

underground cabling route will not be altered to a significant degree. Where tarmacadam or other hardstanding is removed, this will be reinstated and as such the permeability will not change as a result of the Proposed Grid Connection underground cabling route.

Pathways:

Groundwater Flow - Groundwater flow paths (typically slow, non-karstic)

Groundwater levels – Rainfall Infiltration (recharge)

Receptors: Downgradient aquifers (Poor Aquifer, Regionally Important Aquifer and Gravel Aquifer) and downgradient connected waterbodies (River Nore).

Pre-Mitigation Potential Effects: Indirect, negative, moderate, medium term, very unlikely impact.

Mitigation by Avoidance - Groundwater Flows:

Wind Farm site

The construction of the turbines, met mast, access roads and other ancillary features of the Proposed Development could impact groundwater flows within the Proposed Wind Farm site, if a particular pathway *e.g.* karst conduit, existed near the development, however based on all the available site investigation data no reasonable pathways have been identified. The identification and avoidance of any potential karst features has been a key aim of the intrusive and extrusive site investigations, through geophysical surveys, drilling and trial pit excavations and is considered to be the most rational method of mitigating against affecting flow paths, by avoiding any potential karst areas.

The Site data outlined, within Section 9.3.6.2 and 9.3.6.3 of this chapter and outlined in more detail within Chapter 8 of this EIAR provides sufficient scientific data to say, with a high degree of certainty, that the construction of the turbine foundations, met mast, site access roads, substation and other relatively near surface constructs, will not interact with or alter the existing groundwater recharge, and underlying groundwater flow, regimes.

Grid Connection

The Proposed Grid Connection underground cabling route will be routed along an existing road carriageway and within agricultural lands. The trench will be excavated to a depth of ~1.3m with the soil/subsoil removed and backfilled in place. As such there will be no significant change in the permeability of the lands occupied by the Proposed Grid Connection underground cabling route.

Mitigation by Design - Groundwater Levels:

As mentioned above, the critical driver of groundwater levels and the potential to affect them is through groundwater recharge. The drainage design of the Proposed Wind Farm site has been designed to mimic the existing hydrological regime within the Site, whereby surface water runoff pathways are generally short and rainfall readily percolates to ground. The drainage design incorporates check dams to reduce velocities, and level spreaders to allow water to infiltrate to ground.

Residual Effects: Due to the siting of the Wind Farm site infrastructure guided by the knowledge accrued through the various phases of site investigations, as well as the design measures incorporated within the drainage management plan, the residual effects are considered to be - No effects on groundwater flows or groundwater levels.

Due to the nature and extent of the Proposed Grid Connection underground cabling route, along an existing road carriageway/agricultural lands, the residual effects are considered to be – No effects on groundwater flows or groundwater levels.

Significance of Effects: No significant effects on groundwater flows and groundwater levels will occur.

9.4.2.3 Potential Effects on Groundwater Levels and Local Groundwater Well Supplies During Excavation Works

Temporary dewatering of turbine foundations during construction has the potential to impact on local groundwater levels. The local groundwater levels which have been monitored over a 12-month period and a full understanding of local prevailing hydrogeological conditions has been gained. Groundwater level effects are not anticipated to be significant due the known local hydrogeological regime, and due to the proposed excavation method as outlined below. Groundwater levels across the Proposed Wind Farm site are well defined through monitoring of numerous groundwater wells and site investigation boreholes.

The known groundwater levels within the Proposed Wind Farm site are summarised in Section 9.3.6.5.2 above. Briefly, they range between 56.45 – 202.2mOD across the Proposed Wind Farm site and surrounding area. Monitored groundwater levels are below the proposed formation levels of all turbines and the formation level of the proposed borrow pit and as such there will be no groundwater dewatering requirements during turbine base construction or extraction of bedrock.

No groundwater level effects are anticipated from the construction of the Proposed Grid Connection underground cabling trench due to the shallow nature of the excavation (i.e. ~1.3m), the excavation of the trench within the road carriageway and the unsaturated nature of the subsoil/bedrock to be excavated.

Pathway: Groundwater recharge and groundwater flowpaths.

Receptor: Groundwater levels in the underlying bedrock aquifers surrounding the Proposed Wind Farm site and the associated groundwater levels in mapped and unmapped wells near the Proposed Wind Farm site which source groundwater from the aquifer as well as groundwater levels along the Proposed Grid Connection underground cabling route.

Pre-Mitigation Potential Effects: Indirect, slight, short term, unlikely impact on groundwater levels and local groundwater well supplies near the Proposed Wind Farm site and the Proposed Grid Connection underground cabling route.

Indirect, slight, short term, very unlikely impact on groundwater levels and local groundwater well supplies along the Proposed Grid Connection underground cabling route.

Impact Assessment – Proposed Wind Farm

Based on the engineering design, bedrock may be exposed where road and hardstand area excavations are proposed. Elsewhere, the proposed turbine base excavations will be within the subsoil strata and do not involve excavation into bedrock. The bedrock underlying the Site has been classified by the GSI as a Poor Aquifer to the west/northwest of the Site and as a Regionally Important Aquifer to the east/southeast. The site data from HES boreholes and site investigation boreholes indicates that within the Regionally Important Aquifer groundwater is not met within the 0-10mgbl and was met first in borehole MW3 as a seepage at 15mbgl *i.e.* low permeability in the bedrock underlying the turbine locations. Within the Poor Aquifer, a very slow water strike was met at 8mbgl at MW1. As outlined above, no groundwater dewatering will be required during the construction phase in any element of the Proposed Wind Farm.

The topographical and hydrogeological setting of turbine locations means no groundwater dewatering will be required. Moreover, direct rainfall and surface water runoff will be the main inflows that will require water volume and water quality management. For the avoidance of doubt, dewatering is defined as a requirement to permanently drawdown the local groundwater table by means of over pumping, e.g.

as would be required for the operation of a bedrock quarry in a valley floor. We consider that this example (the quarry example) is very different in scale and operation from the proposed operation of a temporary shallow excavations (3-5m), where the groundwater aquifer units (water strikes) are known to exist at depth. In order to explain this thoroughly we will outline our reasoning in a series of bullet points as follows:

- Firstly, the turbine locations are located on lands where the ground elevations are between ~80 and 180m OD;
- The elevations of the turbine foundations are above the elevations of groundwater levels recorded in monitoring wells and local domestic/farm wells, and therefore of the known groundwater levels within the Proposed Wind Farm site. The turbine foundations will be excavated to 3-5mbgl and as such will not intercept any aquifer units, but will be excavated within the overlying subsoil and near-surface bedrock;
- The local bedrock comprises a mixture of sandstone, mudstone, siltstone and shale to the west/northwest and medium hard to hard Limestone to the east/southeast. The bedrock has been shown to be generally unfractured and unproductive (not water bearing) during site investigations. This means that groundwater flows at depth, beneath the turbine foundations, will be relatively minor;
- No regional groundwater flow regime, i.e. large volumes of groundwater flow, will be encountered at these elevations (as proven by the Site investigation drilling);
- Therefore, shallow inflows will be fed by recent rainfall, and possibly by limited seepage from localised permeable subsoils;
- As such any shallow groundwater seepage (within the subsoils) will be small in comparison to the expected surface water flows following any heavy rainfall events; and,
- Hence, it is considered that the management of surface water will form the largest proportion of water to be managed and treated, although where permeable subsoils are encountered, rainfall may infiltrate to ground rather than ponding at any excavation.

Any potential dewatering of excavations will take place above the local groundwater level, within excavations with ponded surface water. The water will be pumped a short distance to settlement ponds where it will recharge to ground. There will be no net change in runoff/recharge, other than the displacement of the recharge by a short distance (10's of metres).

In terms of the local well supplies (GWS and domestic wells) included in Section 9.4.2.12 and 9.4.2.13, as well as any potentially unmapped wells, the implementation of the drainage design measures ensures that recharge to the aquifer will not be altered, thus downgradient water levels will not be altered. As such, there are no well supplies down-gradient of the Proposed Wind Farm site that can be affected by temporary dewatering during turbine base construction.

Impact Assessment – Proposed Grid Connection

The Grid Connection underground cabling trench depth will only be approximately ~1.3 m in depth, the excavation will be temporary and transient, and the cable trench will be backfilled with excavated material and/or hardcore material, depending on site conditions. Therefore, there will be no net loss of permeability across the 1.3m depth. As a result, and given the shallow depth, there will be very limited potential for groundwater level effects to occur.

Residual Effect: *Proposed Wind Farm:* Based on the underlying groundwater levels (above the level of excavations), the requirement for groundwater dewatering of groundwater will not exist. There may be an occasional requirement for dewatering of surface water which may pond within the excavation bases. Any pumped water will be directed (by temporary pumping) to a settlement pond to infiltrate to ground slightly downgradient of the excavation, thus recharge rates will not be altered. The residual

effects are considered to be - No effects on groundwater quantity or levels reaching local domestic wells. Groundwater quality leaving the Site is dealt with in Sections 9.4.2.6, 9.4.2.7 and 9.4.2.8.

Proposed Grid Connection: Based on the typical depth of grid excavation trenches, the lack of interaction with groundwater levels, the short-term nature of the works and the spatial extent of the trench, the residual impact is considered to be: Indirect, imperceptible, temporary, very low probability impact on local groundwater levels.

Significance of Effects: No significant effects.

9.4.2.4 Potential Effects Associated with Piled Foundations

While gravity bearing foundations are considered suitable for the turbine base foundations at the Proposed Wind Farm site, the potential effects of piling are considered here, although this is considered a highly unlikely scenario. A piled foundation may be required at Turbine T3, where the geophysics indicates a layer of deep firm silt/clay.

The following potential scenarios arise in respect of proposed piling works:

- Creation of preferential pathways, through a low permeability subsurface layer (an aquitard such as clay), to allow downward flow into the underlying aquifer; and,
- Creation of a blockage to regional groundwater flow within the underlying aquifer due to placement of pile clusters.

These pathways are analogous to pathways described for piling works associated with contaminated land sites, as detailed in Environment Agency (2001)[9].

Pathway: Groundwater flowpaths (upward and/or downward pathways, and regional groundwater flows).

Receptor: Groundwater quality in the underlying GWBs and groundwater hydrochemistry.

Pre-Mitigation Potential Effect: Negative, moderate, direct, short term, likely effect on groundwater quality/hydrochemistry.

Proposed Mitigation Measures:

The proposed mitigation measures designed for the protection of downstream surface water quality and groundwater quality within the Wind Farm site will be implemented at all construction work areas.

- Mitigation measures for sediment control are detailed in Section 9.4.2.1.
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.4.2.6.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.4.2.8.

Proposed mitigation measures relative to piling works will comprise:

- Where driven piles are used, they will have a cross section without re-entrant angles;
- Strict QA/QC procedures for piling works will be followed;
- Piles will be kept vertical during piling works;

[9] *UK Environment Agency's (UKEA) document Model Procedures for the Management of Land Contamination: Contaminated Land Report No.11*

- Good workmanship will be employed during all piling works; and,
- Where required bentonite seals will be used to prevent upward/downward movement of surface water/groundwater.

Impact Assessment:
The ground conditions at Turbine T3 within the Proposed Wind Farm site can be categorised into the following deposits (based on data presented in Chapter 8):

- 0.8m of soft brown, slightly gravelly CLAY logged during trial pitting.
- Firm CLAY from 0.8-3.2mbgl.
- Geophysics interprets bedrock at 10m, while trial pitting at 4 no. locations in same field met bedrock between 0.25-1.75mbgl. Bedrock most likely at 4-5mbgl but may be deeper. Competent firm subsoil from 0.8mbgl.

Proposed piles will penetrate through overburden deposits until the strata have a sufficient load bearing capacity. Where present the glacial tills are likely to act as an aquitard/low permeability layer, through which only very small amounts of water can flow.

For the driven piles the silty gravelly CLAY are likely to 'self-seal' around the piles, meaning that a long term pathway between the upper surface water and the lower bedrock aquifer will not be sustained.

For bored piles, as the temporary steel casing is removed, a steel reinforcement cage is added to the pile column and then concrete is added to the toe of the pile using a tremie pipe. Vermiculite is used to create a plug between the concrete and the displaced water, therefore the concrete seals the entire pile column and pushes the vermiculite plug to the surface as concrete is added. The temporary steel casing is removed carefully as the concreting works are being completed. This concreting process is similar to that used when grouting a water supply production well (IGI (2007), and EPA (2013)). This means that a long term pathway between the upper silty gravelly Clay layer and the lower bedrock aquifer will not be sustained.

Scenario 1: Creating a Pathway for Downward Flow
To ensure downward flow of water and/or pollutants from the piling works does not occur, a bentonite seal will be used in a starter pit for each driven pile, and the mitigation measures outlined above will be implemented. The concrete added to the bored pile will seal the pile annulus. As a result, the potential for either piling work option to create pathways for downward flow of water or pollutants that could affect groundwater quality in the underlying aquifer is imperceptible.

Scenario 2: Creating a Pathway for Upward Flow
No upwelling of groundwater to the surface water recorded in any of the site investigation locations recorded across the Proposed Wind Farm site.

Notwithstanding this, to ensure upward flow of underlying groundwater via potential pathways created by piling works does not occur, a bentonite seal will be used in a starter pit for each driven pile, and the mitigation measures outlined above will be implemented. The concrete added to the bored pile will seal the pile annulus. As a result, the potential for piling works to create pathways for upward flow of groundwater is imperceptible.

Scenario 3: Blocking Regional Groundwater Flow
The scale of the proposed site is important, and it means that the development footprint occurs over a small percentage of the overall site.

If a piling array of 50 no. 300mm piles is applied at a turbine foundation, this combined area of piling footprint amounts to ~92m^2, or 3.53m^2 per turbine foundation. The area of the piles driven into the ground is distributed over a very large area, and that area only amounts to less than 0.01% of the development footprint, or 0.0005% of the proposed site area. Also, none of the proposed piles would penetrate into the underlying bedrock aquifer, as they will find sufficient resistance, either in the over

lying glacial tills/mineral subsoils or upon reaching the top of bedrock. At such wide separation distance, the ability of clusters of piles, with a plan area of ~3.53m^2 per turbine, to alter or affect regional groundwater flow is imperceptible.

Residual Effects: The proposed piling works potentially pose a threat to groundwater quality in the underlying regional groundwater system, and also could potentially create a pathway for upward migration of groundwater to the surface. These potential effects will not arise at the Proposed Wind Farm site due to a combination of the prevailing ground conditions, groundwater conditions, and proposed mitigation measures that will ensure the potential pathways for interaction of shallow water and deeper groundwater are prevented from occurring. In addition, due to the small footprint of proposed pile clusters, and the significant spacing between turbine foundations where pile clusters are proposed, the potential for such pile clusters to block regional groundwater flow is imperceptible at that scale. The proposed piled foundations therefore have no potential to change the WFD status or impact the WFD objectives of the underlying GWB. The residual effect is considered to be Negative, imperceptible, indirect, short term, unlikely effect on groundwater flow, and groundwater quality hydrochemistry.

Significance of Effects: For the reasons given above, no significant effects on regional groundwater and the GWB will occur, and no significant effects on groundwater hydrochemistry will occur from potential piling works.

9.4.2.5 Potential Effects on Surface Water and topographically downgradient Surface Water bodies

Surface water draining from an active construction site can contain elevated levels of suspended sediment, which can impact on downstream surface water bodies. The surface water can also contain cementitious runoff and/or hydrocarbons depending on the nature of the construction activity. Any alteration in the drainage regime within a site can impact on the volume of runoff which leaves the site. These effects can affect the quantity and quality of downstream surface waterbodies (where a flow path exists between the site and the waterbody).

As noted above, there are only two minor surface water pathways which exist between the Proposed Wind Farm site and downgradient watercourses (Archerstown stream and Ballyconra stream). Surface water in the area of T4 will drain southwest towards the Archerstown stream which is situated 380m from T4. Surface water from T8 may drain towards a field drain which leads to the Ballyconra stream. This field drain is 50m from T8. A new watercourse crossing will be emplaced at this location (field drain northwest of turbine T8. Given the lack of flow in this field drain (monitored during site visits between April 2024-April 2025), these works can most likely be completed between the months of May-October with minimal consequence as the field drain will be dry. The remaining rainfall falling at the Site will discharge via groundwater recharge and groundwater flow.

There is 1 no. watercourse crossing along the Proposed Grid Connection underground cabling route. Potential sources of suspended sediment include runoff from spoil excavated from the cabling trench. The mitigation measures outlined in Section 9.4.2.1 will ensure that there are no effects on downgradient surface waterbodies.

Pathway: Surface water recharge, and groundwater flow

Receptor: Downgradient surface waterbodies – Ballyconra stream, Archerstown stream, Lisdowney stream, Durrow townspark stream and River Nore

Pre-Mitigation Potential Effects:

Wind Farm Site - As no significant direct surface water pathways exist between the Proposed Wind Farm and these watercourses (apart from 2 very small streams) - Indirect, negative, slight, short term, unlikely impact.

Grid Connection - Indirect, negative, significant, temporary, unlikely impact along the Proposed Grid Connection underground cabling route.

Mitigation by Avoidance:

The primary mitigating factor in relation to downgradient surface water bodies is the general lack of surface water courses across the Proposed Wind Farm site and the surrounding area. The rainfall falling on the Proposed Wind Farm site recharges to the underlying groundwater aquifer.

The exceptions to this are at turbine T8, where a small seepage face runs into a field drain, before discharging to the Ballyconra stream, as well as at T4, where the Archerstown stream exists ~ 380m southwest of turbine T4. These works will be completed between the months of May-October with minimal consequence as the field drain will be dry.

Along the Proposed Grid Connection underground cabling route, the cabling will be emplaced within existing road carriageways and existing bridges. The utilisation of the existing roadways and bridges avoids any in-stream works.

Mitigation by Design:

Mitigation measures relating to the protection of surface water drainage regimes and surface water quality within the Site have been detailed in Section 9.4.2.1 (earthworks) , Section 9.4.2.5 (Surface water), Section 9.4.2.6 (Hydrocarbons) Section 9.4.2.7 (wastewater), Section 9.4.2.8 (cement-based products) and Sections 9.4.2.9 and 9.4.2.10 (morphological changes).

Similarly, mitigation measures for the protection of groundwater quantity and quality have been detailed in Section 9.4.2.2 (groundwater recharge), Section 9.4.2.3 (groundwater levels), Section 9.4.2.6 (hydrocarbons), Section 9.4.2.7 (wastewater) and Section 9.4.2.8 (cement based products).

We summarise that there will be no significant effects on GWB or SWB WFD status for the following reasons:

- The small footprint (7.6 ha) of the Proposed Development in relation to the scale of the underlying GWBs (Lisdowney GWB has a total area of 54km^2 [54,000,000 ha], whilst the Durrow GWB has a total area of 217km^2 [217,000,000 ha);
- The Proposed Development does not involve any alteration of drainage patterns, therefore, the quantitative status of the receiving surface and groundwaters will remain unaltered;
- There will be no direct discharge from the Proposed Development site to receiving waters; and,
- Mitigation measures for the protection of surface and groundwater water quality will be implemented during the construction phase of the Proposed Development to ensure that there is no deterioration in local or downstream water quality. These mitigation measures will ensure the qualitative status the receiving waterbodies remains unaltered by the Proposed Development.

Wind Farm Site - To ensure the continuation of the existing hydrological regime, whereby the majority of rainfall percolates to ground and does not discharge as surface water runoff (hence the low surface drainage density at the Site), the drainage design has incorporated natural attenuation of flows and allows for collected rainwater to be primarily recharged back into the underlying aquifer rather than leaving as surface water flows. The drainage design also includes mitigation measures to ensure that any

collected surface water is treated prior to discharge/recharge back into the ground and therefore will not contain suspended sediment. The drainage design which was developed for the Proposed Wind Farm site is included in Appendix 4-3 and summarised in Section 9.3.13.

Grid Connection – The mitigation measures outlined in Section 9.4.2.1 will ensure that surface water leaving the site will be of a high quality and control measures such as double silt fencing at watercourse crossings will protect downgradient surface water bodies.

Residual Effect:

Wind Farm - Due to the general lack of surface water drainage from the Site, as well as the proposed drainage management plan which ensures the continuation of the existing hydrological/hydrogeological regime (groundwater recharge, with no runoff), along with the in-line treatment such as check dams, settlement ponds and Terrastop silt fencing outlined in Section 9.4.2.1 - the residual effect is considered to be: No impact on downgradient surface waterbodies.

Grid Connection – With the implementation of the mitigation measures outlined in Section 9.4.2.1, the residual effect is – No residual effect on downgradient surface waterbodies.

Significance of Effects: No significant effects.

9.4.2.6 Potential Release of Hydrocarbons during Construction and Storage

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

The pathways for the rapid transport of any potential spilt chemicals are limited at this site, due to the absence of any surface water drainage routes (rivers, streams *etc*). The primary pathway is through infiltration through the subsoil and bedrock and eventually reaching the underlying groundwater aquifer.

The potential release of hydrocarbons can occur during the works within the Proposed Wind Farm site and during works along the Proposed Grid Connection underground cabling route.

Pathway: Groundwater flowpaths and site drainage network within the Proposed Wind Farm. Groundwater flowpaths and surface water drainage network along the Proposed Grid Connection underground cabling route.

Receptor: *Proposed Wind Farm:* Surface watercourses (Ballyconra and Archerstown streams discharging to Lisdowney stream/River Nore). Groundwater within the underlying bedrock aquifer.

Proposed Grid Connection: Surface watercourses downgradient of the Grid Connection underground cabling route (River Nore) and the underlying groundwater aquifer.

Pre-Mitigation Potential Impact: Due to the nature and depth of subsoils across the Proposed Wind Farm site and the ability of subsoils to attenuate pollutants - Indirect, negative, slight, short term, unlikely effect on local groundwater quality.

Due to the relatively isolated nature of the surface water features at the site, the distance involved to the small drainage features, the nature and depth of subsoils across the Proposed Wind Farm site and the ability of subsoils to attenuate pollutants - Indirect, negative, slight, short term, unlikely effect on local surface water and groundwater quality.

Due to the proximity of surface watercourses to the Proposed Grid Connection underground cabling route - Indirect, negative, slight, short term, possible impact on local surface water quality and groundwater quality.

Proposed Mitigation Measures:

Mitigation measures proposed to avoid release of hydrocarbons at the Proposed Wind Farm site and along the Proposed Grid Connection underground cabling route are as follows:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling will occur at a controlled fuelling station;
- On site re-fuelling of machinery will be carried out using a mobile double skinned refuelling truck.
    - A refuelling truck will be used to refuel construction equipment used on site.
    - The refuelling truck will also carry fuel absorbent material and pads in the event of any accidental spillages.
    - The fuel truck will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site.
    - Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Onsite refuelling will be carried out by trained personnel only;
- Fuels stored on site will be minimised. Fuel storage areas if required will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- Surface water runoff from temporary construction compounds will be collected and drained via silt traps and hydrocarbon interceptors prior to recharge to ground;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within Construction and Environmental Management Plan (Appendix 4-2). Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area.

Residual Effect: *Proposed Wind Farm:* Based on the mitigation measures outlined, such as refuelling off site, the appropriate safe use and handling of hydrocarbons on-site where necessary including fuel bunds and the inclusion of hydrocarbon interceptors, the residual effects within the Wind Farm Site are considered to be - Indirect, negative, imperceptible, short term, very unlikely impact on groundwater and downgradient surface waters.

Proposed Grid Connection: Based on the mitigation measures outlined, such as refuelling off site, the appropriate safe use and handling of hydrocarbons along the Proposed Grid Connection underground cabling route where necessary including fuel bunds, the residual effects along the Proposed Grid Connection underground cabling route are considered to be - Indirect, negative, imperceptible, short term, very unlikely impact on surface water and groundwater.

Significance of Effects: For the reasons outlined above, and with the application of the listed mitigation measures, no significant effects on surface water and groundwater quality will occur.

9.4.2.7 Groundwater and Surface Water Contamination from Wastewater Disposal

Release of effluent from wastewater treatment systems has the potential to impact on groundwater and surface waters if site conditions are not suitable for an on-site percolation unit. There are 2 no. construction compounds proposed for the Proposed Development.

There are no surface water pathways which drain the areas of the construction compounds.

The construction compounds will be used as a base during the construction phase of the Proposed Wind Farm and the Proposed Grid Connection works.

Pathway: *Proposed Wind Farm:* Groundwater flowpaths and site drainage network.

Proposed Grid Connection underground cabling *route:* Groundwater flowpaths and drainage network.

Receptor: Down-gradient well supplies, groundwater quality and surface water quality within the Proposed Wind Farm site and along the Proposed Grid Connection underground cabling route Groundwater - Durrow GWB, River Nore Sand & Gravel Aquifer. Surface water – River Nore

Pre-Mitigation Potential Impact:

- Indirect, negative, significant, temporary, unlikely impact to surface water quality.
- Indirect, negative, moderate, temporary, unlikely impact to local groundwater.

Proposed Mitigation by Avoidance:

- A self-contained port-a-loo system with an integrated wastewater holding tank will be used at the 2 no. temporary construction compounds, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the Site office and other sanitation will be brought to site and removed after use from the Site to be discharged at a suitable off-site treatment location; and,
- No water for sanitation purposes will be sourced on the Site or discharged to the Site.

Residual Effect: Based on the fact that there will be no discharge of wastewater to either the Proposed Wind Farm or along the Proposed Grid Connection underground cabling route and that wastewater will be managed by an appropriately licensed waste contractor, there will be no effect.

Significance of Effects: For the reasons outlined above, no significant effects on surface water or groundwater quality will occur.

9.4.2.8 Release of Cement-Based Products

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative effects on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293/1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of ±0.5 of a pH unit. Entry of cement-based products into surface watercourses represent a risk to freshwater ecology along the Proposed Grid Connection underground cabling route.

At the Proposed Wind Farm site, there are 2 no. potential pathways for surface water effects (Ballyconra stream field drain and Archerstown stream), furthermore the release of cement-based products to the Site drainage system could potentially percolate to ground, given the overall high effective recharge at the Site. Batching of wet concrete on Site and washing out of transport and placement machinery are the activities most likely to generate a risk of cement-based pollution to surface waters and to the underlying groundwater system. Mitigation measures will be put in place to protect water quality.

Pathway: *Proposed Wind Farm:* Site drainage network/ recharge to groundwater.

Proposed Grid Connection: Nearby surface watercourses

Receptor: *Proposed Wind Farm:* Surface water in Ballyconra stream and Archerstown stream. Groundwater within the underlying Lisdowney and Durrow GWB.

Proposed Grid Connection: Groundwater (River Nore Upper Sand & Gravel Aquifer) and Downgradient surface water bodies – River Nore.

Pre-Mitigation Potential Impact: *Proposed Wind Farm:* Indirect, negative, moderate, short term, very unlikely impact to surface water and groundwater within the Wind Farm Site.

Proposed Grid Connection: Indirect, negative, moderate, short term, unlikely impact to surface water or groundwater along/near the Grid Connection underground cabling route.

Proposed Mitigation Measures:

The following mitigation measures are proposed for the Proposed Wind Farm site and the Proposed Grid Connection underground cabling route:

- 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;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined cement washout ponds;
- 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; and,
- Sand blinding, Damp-proof Membrane (DPM) and concrete blinding are to be provided at turbine formation level to create a vertical cut-off barrier and to mitigate the risk of concrete leakage into the ground below the turbine foundations.

Residual Impact: Proven and effective measures to mitigate the risk of releases of cement-based products or cement truck wash water have been proposed above and will break the pathway between the potential source and each receptor. The residual effect during the construction of the Proposed Development will be - Negative, imperceptible, indirect, short term, unlikely effect on surface and groundwater quality.

Significance of the Effect: For the reasons outlined above, no significant effects on surface water quality will occur.

9.4.2.9 Potential Effects from Morphological Changes to Surface Watercourses within the Proposed Wind Farm

As part of the Proposed Development, there is 1 no. watercourse crossing location within the Wind Farm Site over a field drain which leads to the Ballyconra stream. The crossing location is outlined below:

- Wind Farm Site - A new proposed crossing over a field drain which leads to the mapped Ballyconra stream (mapped by EPA as beginning 500m south of T8). This crossing is ~50m north of turbine T8 at E241958, N172960.

Pathway: Site drainage network.

Receptors: Wind Farm Site – Surface Waters (Ballyconra stream)

Pre-Mitigation Potential Effect: Negative, moderate, direct, long-term, likely effect on surface water flows, local stream morphology and surface water quality.

Proposed Mitigation Measures:

The Proposed Development design has been optimised to utilise the existing infrastructure (i.e. existing site roads) where practicable. Only 1 no. new crossing is proposed. Due to the existing hydrological/hydrogeological regimen, characterised by high recharge through the soils/subsoils, there is a very limited site drainage network.

Mitigation measures for the crossings are detailed below:

- The proposed new stream crossing will be clear span crossing and the existing banks will remain undisturbed. No in-stream excavation works are proposed at these locations and therefore there will be no direct impact on the stream at the proposed crossing locations. Abutments will be constructed from precast units combined with in-situ foundations;
- All guidance / mitigation measures required by the OPW and/or the Inland Fisheries Ireland (IFI)[10] is incorporated into the design of the proposed crossings;
- All drainage measures will be installed in advance of the works;
- Plant and equipment will not be permitted to track across the watercourse;
- A foundation base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required;
- Access to the opposite side of the watercourse for excavation and foundation installation will require the installation of a temporary pre-cast concrete or metal bridge across the watercourse to provide temporary access for the excavator. Plant and equipment will not be permitted to track across the watercourse;
- Once the foundation base has been completed, the clear-span structure will be installed with no contact with the watercourse;
- Once the crossing is in position stone backfill will be placed and compacted against the structure up to the required level above the foundations;
- Underground cabling ducting will be contained within the road make-up of the proposed crossing;
- As a further precaution, near stream construction work, will only be carried out during the period permitted by IFI for in-stream works according to the IFI (2016) guidance document "Guidelines on protection of fisheries during construction works in and adjacent to waters", i.e., July 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 (any deviation from this will be done in discussion with the IFI);
- Where works are necessary inside the 50m buffer double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase; and,
- All new river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

The watercourse crossing will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

Confirmatory inspections of the proposed new watercourse crossing location will be carried out by the Project Civil/Structural Engineer and the Project Hydrologist prior to the construction of the crossing.

Residual Effect: Proven and effective measures to protect water quality have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect is considered

[10] *Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*

to be - Negative, imperceptible, direct, long-term, unlikely effect on downstream water quality and aquatic habitats.

Significance of Effects: For the reasons outlined above, no significant effects on stream morphology or stream water quality will occur at crossing locations.

9.4.2.10 Potential Effects from Morphological Changes to Surface Watercourses along the Proposed Grid Connection Cabling Route

The Proposed Grid Connection underground cabling route includes a total of 1 no. new crossing over the River Nore. The new proposed crossing over the River Nore is proposed near E243985, N171860, 250m south of the Tirlán plant.

The proposed crossing method is as follows:

- Horizontal Directional Drilling (HDD) will be completed at the new proposed crossing. HDD is required due to the span, depth and volume of the river, along with the sensitive nature of the River Nore (as a designated site – River Barrow and River Nore SAC). Horizontal drilling will be started ~50m from the river bank and finished ~50m from the opposing bank to allow for a buffer zone to the works;

The HDD method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, for the directional drilling at the proposed crossing. The launch and reception pits will be approximately 0.55m wide, 2.5m long and 1.5m deep. The pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod, and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water is pumped through the centre of the drill rods to the reamer head and is forced in to void and enables the annulus which has been created to support the surrounding subsoil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any adverse impacts arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the Site in the same manner as other subsoil materials associated with the drilling process to a licensed recovery facility.

Backfilling of launch and reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. Sufficient controls and monitoring will be put in place during drilling to prevent frack-out, such as the installation of casing at entry points where reduced cover and bearing pressure exits.

Pathways: Runoff and surface water flowpaths.

Receptors: River Nore and associated water-dependent ecosystem.

Pre-Mitigation Potential Effect: Negative, moderate, indirect, temporary, likely effect on downstream surface water flows and surface water quality.

Prior to the commencement of cable trenching or crossing works the following key temporary drainage measures will be installed:

- A double silt fence perimeter will be placed along the road verge on the down-slope side of any works areas that are located inside the watercourse 50m buffer zone;
- Although no in-stream works are proposed, the drilling works will only be done over a dry period between July and September (as required by IFI for in-stream works) to avoid the salmon spawning season and to have more favourable (dryer) ground conditions;
- The crossing works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance;
- There will be no storage of material / equipment or overnight parking of machinery inside the hydrological buffer zone;
- Before any ground works are undertaken, double silt fencing will be placed between the works area and the River Nore;
- 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 contained in an adequately sized skip before been 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 settlement pond area at least 50m from the watercourse;
- The discharge of water onto vegetated ground will be via a silt bag which will filter any remaining sediment from the pumped water. The entire infiltration area will be enclosed by a perimeter of double silt fencing;
- Any sediment laden water from the works area will not be discharged directly to a watercourse or drain;
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted;
- 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 soonest 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 batching or storage of cement allowed at the watercourse crossing;
- There will be no refuelling allowed within 100m of the watercourse crossing; and,
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing.

Residual Effect: Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect will be a negative, imperceptible, direct, short term, likely effect on surface water flows and surface water quality.

Significance of Effects: For the reasons outlined above, no significant effects on surface water flows and surface water quality will occur.

9.4.2.11 Potential Effects Hydrologically Connected Designated Sites

Hydrologically connected designated sites near the Proposed Wind Farm and the Proposed Grid Connection underground cabling route are:

- River Barrow and River Nore SAC;
- River Nore SPA
- River Nore/Abbeyleix Woods Complex pNHA

The Lisgibney Bog pNHA/SAC, Cullahill Mountain pNHA/SAC, and Spahill and Clomantagh Hill pNHA/SAC are not hydrologically connected to the Proposed Wind Farm Site or Grid Connection route as they are all hydraulically upgradient of the Site.

The River Barrow and River Nore SAC, the River Nore SPA, River Nore/Abbeyleix Woods Complex pNHa are hydrologically connected with the Site (Proposed Wind Farm and Proposed Grid Connection). The surface water connections from the Site could transfer poor quality surface water that may affect the conservation objectives of these designated sites.

Pathway: Surface water flowpaths.

Receptor: Down-gradient water quality with the River Barrow and River Nore SAC, the River Nore SPA, and the River Nore/Abbeyleix Woods Complex pNHA.

Pre-Mitigation Potential Effect: Indirect, negative, slight, short term, likely effect on the River Barrow and River Nore SAC/SPA. Indirect, negative, imperceptible, short-term, likely effect on the River Nore SPA and the River Nore/Abbeyleix Woods Complex pNHA.

Mitigation by Design:

Proposed Wind Farm site

There will be no net change in runoff from the Wind Farm site due to the drainage design. All water will recharge to ground. Any "dirty" surface water generated on site will be collected within a downstream collector drain, be attenuated with the collector drain and allowed to infiltrate to ground along the collector drain and within an end of drain infiltration area.

Proposed Grid Connection

The mitigation measures outlined in Section 9.4.2.1 relating to earthworks along the Grid Connection underground cabling route will ensure that surface water quality within the River Nore will be protected during all phases of the proposed works.

Mitigation measures relating to the protection of surface water drainage regimes and surface water quality within the Proposed Wind Farm site and along the Proposed Grid Connection route have been detailed in Section 9.4.2.1 (earthworks), 9.4.2.5 (surface water), 9.4.2.6 (hydrocarbons), 9.4.2.7 (wastewater), 9.4.2.8 (cement-based products), 9.4.2.9 and 9.4.2.10 (morphological changes).

Similarly, mitigation measures for the protection of groundwater quantity and quality have been detailed in 9.4.2.2 (recharge alteration), 9.4.2.3 (groundwater levels), Section 9.4.2.6 (hydrocarbons), 9.4.2.8 (cement-based products), and Section 9.4.2.7 (wastewater).

We conclude that there will be no significant effect on downstream designated sites for the following reasons:

- The length and scale (volume of water) of the hydrological flowpaths between the Proposed Wind Farm site and the downstream designated sites. The River Barrow and River Nore SAC is situated ~500m east of the Wind Farm site, however it is located ~6.2km downstream (by channel length) from the Ballyconra stream (near T8) and 8.1km downstream of the upper reaches of the Archerstown stream (380m from T4);

- The only works which are located in the immediate vicinity of a designated site is the new proposed crossing over the River Nore along the Proposed Grid Connection underground cabling route. There will be no instream works at this location and the crossing will be achieved by directional drilling;

- The potential for effects on other designated sites is limited given the increasing volumes of water and associated dilution effect in downstream watercourses (River Nore downstream of the Proposed Wind Farm and Proposed Grid Connection underground cabling route); and,

- Nevertheless, mitigation measures for the protection of surface and groundwater water quality will be implemented during the construction phase of the Proposed Development to ensure that there is no deterioration in local or downstream water quality.

For these reasons, and with the implementation of these mitigation measures the protection of downstream designated sites will be ensured.

Residual Effect: Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the Site will be equivalent to baseline conditions and will therefore have no impact on downstream surface water quality and/or the status or ecology of the protected species and habitats within the designated sites. The residual effect is considered to be Negative, imperceptible, indirect, short term, unlikely effect on downstream designated sites.

Significance of the Effect: For the reasons outlined above, no significant effects will occur.

9.4.2.12 Potential Effects on Public Water Supplies/Group Water Schemes

Proposed Grid Connection

Due to the shallow nature of the Proposed Grid Connection underground cabling route, which is essentially a shallow trench excavated to allow for cable ducting, there are no reasonable potential effects on nearby public water supplies. As such, the potential effects from the construction stage activities within the Proposed Wind Farm site (including the Proposed Grid Connection 38kV substation) are considered primarily in this section, although an assessment is given of the works along the grid connection route which occur near the Seskin GWS.

Proposed Wind Farm site

The public water supplies near the Site are outlined in Section 9.3.6.5 and include the following GWS and public water abstraction points, in order of proximity to the Proposed Wind Farm site:

- Seskin GWS – 0.15km east of the Site (east of grid connection along N77)
- Durrow PWS – 0.8km north of the Site
- Ballyconra PWS – 0.9km south of the Site
- Ballyragget Infiltration Gallery – 1.05km south of grid connection route
- Fermoyle PWS – 2.2km
- Cullahill GWS – 3.4kmwest of the Site

The quality and quantity of water being abstracted from these locations is critically important to these schemes. There is a risk of poor quality or contaminated water entering the groundwater system below the Proposed Wind Farm site and/or Grid Connection route and flowing towards the existing GWS/PWS water sources.

The following terms (definitions) are used within this section, relating to the mapping of groundwater source protection areas:

- Source Protection Area (SPA) - The catchment area around a groundwater source which contributes water to that source (Zone of Contribution), divided into two areas;
  - The Inner Protection Area (SI). The SI is designed to protect the source against the effects of human activities that may have an immediate effect on the source, in particular in relation to microbiological pollution. It is defined by a 100-day time of travel (TOT) from any point below the water table to the source.
  - The Outer Protection Area (SO)The SO covers the remainder of the zone of contribution of the groundwater source.
- Zone of Contribution (ZOC) - The area surrounding a pumped well that encompasses all areas or features that supply groundwater recharge to the well. It is defined as the area required to support an abstraction from long-term groundwater recharge.

Seskin GWS

The Source Protection Area (SPA) to the Seskin GWS has been delineated and forms a quasi-lobe shaped area which extends west of the Seskin GWS source(s), with an area of 6.8Ha, of which 3.0Ha overlaps with the Site.

The Seskin GWS is supplied by 2 no. sumps and 1 no. borehole. The Seskin GWS is situated between the N77 and the River Nore, approximately 3.9km south of Durrow and ~ 1.1km from the nearest proposed turbine (T5). The 2 no. gravel sumps are shallow sources, drawing water from the gravel aquifer. The borehole is deeper, although the full depth is unknown, This borehole may be gaining water from the underlying bedrock also, but more likely it is also primarily a production well installed in the mapped gravel aquifer. Groundwater levels (pumping water levels) at the site range between 64-71.6mOD.

Turbine T5 is situated within this mapped SPA along with ~0.45km of new roads and 1 no. temporary construction compound. Borehole MW2 was drilled within the Source Protection Area, ~110m from turbine T5. Groundwater levels at MW2 range between 118.7 – 129.8mOD. As such, the Seskin GWS source is hydraulically downgradient of T5 and the surrounding area. Borehole MW2 is drilled through firm brown sandy clay to 2.6m, weathered Limestone from 2.6-3.5m and hard, competent Limestone from 3.5-51m. There were no groundwater strikes recorded and no water bearing gravels. As such, the Limestone around MW2 (and T5) is low permeability limestone with limited potential for connectivity with the gravels which the Seskin GWS relies on as a water source. Nonetheless, mitigation measures have been put in place [Sections 9.4.2.1 (earthworks), 9.4.2.2 (groundwater levels), 9.4.2.3 (groundwater recharge), 9.4.2.6 (hydrocarbons), 9.4.2.7 (wastewater) and 9.4.2.8 (cement based products)] to ensure the protection of groundwater quality and quantity which will ensure there are no negative effects on groundwater quality or quantity at the Seskin GWS.

Durrow PWS

The Durrow PWS is situated 0.8km north of the Site. Groundwater at the site flows east/southeast towards the River Nore. As such, the Durrow PWS is not hydraulically connected to the Site and there is no pathway for effects.

Ballyconra PWS

The Ballyconra PWS is no longer a public supply, however the wells are used as water supply boreholes for the Tirlán facility at Ballyragget. The Ballyconra PWS zone of contribution (ZoC) has been mapped, and encompasses an area of 410Ha which includes ~113Ha of the southern section of the Proposed Wind Farm site. Within this area there are 3 no. proposed turbines (T6, T7 and T8), as well as ~2.5km of new and upgraded access roads.

Groundwater levels at the Ballyconra PWS boreholes has been monitored and ranges between 65.31 – 72.45mOD, while groundwater levels monitored northwest of the PWS, measure between 76-97.5mOD at MW4 (130m from T7) and 80.4 – 85.8mOD at Tirlán GW3 (situated 600m south of turbine T7). The measured groundwater levels and flow direction across the Site demonstrates that groundwater at turbines T6 – T8 will drain in the direction of the Ballyconra PWS. The bedrock underlying the turbines (T6-T8) is competent and groundwater velocities are expected to be slow, given the information from monitoring well drilling at MW2, MW3 and MW4. Mitigation measures have been put in place (Sections 9.4.2.1 (earthworks), 9.4.2.2 (recharge), 9.4.2.3 (groundwater levels), 9.4.2.5 (hydrocarbons), 9.4.2.6 (wastewater) and 9.4.2.7 cement based products)) to ensure the protection of groundwater quality and quantity which will ensure there are no negative effects on groundwater quality or quantity at the Ballyconra PWS.

Ballyragget Infiltration gallery

The Ballyragget Infiltration Gallery is a groundwater source situated 1.05km south of the Grid Connection and 2.1km southeast of the Wind Farm Site. This abstraction pumps water from an infiltration gallery

situated along the western bank of the River Nore. Due to the known groundwater levels and flow directions recorded at the Wind Farm site, there will be no hydrological or hydrogeological connection between the Proposed Wind Farm site and the Ballyragget Infiltration gallery. The groundwater flowing through the site, from ~200mOD towards the north of the site to ~65 mOD at the River Nore, discharges in an easterly direction. The groundwater from the site will discharge to River Nore between 1.5-2km north of the Ballyragget Infiltration gallery. As such, groundwater from the site will not reach the infiltration gallery as it will already have discharged to the River Nore.

Fermoyle GWS

The Fermoyle PWS is supplied from 2 no. bored wells in the townland of Fermoyle, Co. Laois, which is located approximately 2km northeast of Durrow. As with the Durrow PWS, the Fermoyle GWS is situated north and hydraulically upgradient of the Site. As such, there will be no potential effects on water quality or quantity at this GWS.

Cullahill GWS

The Cullahill GWS is supplied by 8 no. springs located ~3.4km northwest of the Proposed Site. Groundwater at the site flows east/southeast towards the River Nore, while the Cullahill GWS is situated on the opposite side of the Cullahill mountains within separate hydrological/hydrogeological basin. As such, the Cullahill GWS is not hydraulically connected to the Site and there is no pathway for effects.

Receptor: Groundwater quality and/or quantity at the GWS/PWS production wells and PWS infiltration gallery.

Pathway: Surface waters infiltrating to the underlying groundwater aquifer. Groundwater Flowpaths from the Proposed Development towards the GWS/PWS sources.

Pre-Mitigation potential Impact: Indirect, negative, imperceptible, short-term, unlikely impact on groundwater quality and quantity at the Seskin GWS and Ballyconra PWS. No potential effects at the Durrow PWS, Cullahill GWS, Fermoyle GWS and Ballyragget Infiltration gallery.

Impact Assessment & Proposed Mitigation Measures:

Proposed Wind Farm site

There are sections of the Seskin GWS and Ballyconra PWS SPA's situated within the Site. The area of the Wind Farm site which includes the Seskin GWS SPA includes turbine T5 and a section of proposed access track (600m). The access track consists of the emplacement of new access track. Surface water mitigation measures will be put in place as outlined in Section 9.4.2.1 which will ensure that any surface water in this area during the construction process will be attenuated and will be of a high quality before being allowed to recharge to ground within a short distance (10's of metres). The quantity and quality of recharge to the groundwater system will be maintained. The ground conditions underlying the turbine consist of competent Limestone and the turbine base foundation will not intercept the groundwater table (at significant depth of 27.8-38.9mbgl at MW2 near T5).

The area of the Wind Farm site which includes the Ballyconra PWS includes the proposed turbines T6,T7 and T8, along with ~1.98km of access tracks.. Surface water mitigation measures will be put in place as outlined in Section 9.4.2.1 which will ensure that any surface water in this area during the construction process of the roadway will be attenuated and will be of a high quality before being allowed to recharge to ground within a short distance (10's of metres) or discharge to the nearby field drain in the case of Turbine T8 . The quantity and quality of recharge to the groundwater system will be maintained, while surface water quantity and quality will also remain unaltered. There was no evidence of karstification during the drilling of either MW3 or MW4. Furthermore, the Ballyconra PWS wells are abstracting water from the gravel aquifer, rather than bedrock. These gravels were not encountered during the drilling of the monitoring wells. The primary risk to the GWS SPA is therefore

considered to be surface waters arising during the construction phase, before recharging to ground. During the construction phase, mitigation measures outlined in Section 9.4.2.1 such as interceptor drains, silt fences, swales and settlement ponds will ensure that the recharge to the underlying groundwater aquifer remains at a high standard.

Proposed Grid Connection

In terms of the Proposed Grid Connection underground cabling route, there is no area located within a mapped SPA. The Ballyragget infiltration gallery is situated 1.05km south of the grid connection route and as noted above, any groundwater movement under the grid connection route will be east towards the River Nore, not south. As such there will be no effects on GWS/PWS wells or the infiltration gallery as a result of the proposed Grid Connection.

Residual Impact:

Seskin GWS – Based on the small volume of works within the Seskin GWS Source Protection Area, the fact that the Seskin GWS is situated within a differing aquifer unit (gravels) to the Site (Limestone bedrock), the mitigation measures which will be implemented to ensure surface water quality, and thus groundwater recharge is maintained to a high quality, as well as the Site investigation indicating competent Limestone underlying turbine T5 thus eliminating any subsurface connection to the GWS well, the residual effects are considered to be - Indirect, negative, imperceptible, short term, unlikely impact on groundwater quality and quantity in the Seskin GWS sumps/well.

Ballyconra PWS - Based on the ground conditions within the area of the site which intersects with the SPA of the Ballyconra PWS (*i.e.* area of Site is on Limestone, while Ballyconra wells and situated in the River Nore Gravels), the mitigation measures which will be implemented to ensure surface water quality, and thus groundwater recharge is maintained to a high quality, the residual effects are considered to be - Indirect, negative, imperceptible, short term, unlikely impact on groundwater quality and quantity in the Ballyconra PWS wells.

Residual Effect: Based on the separation distances and the Site being situated outside of the remaining mapped Source Protection Area, the detailed site investigation data detailing competent (not karstified) Limestone underlying the turbines at the Proposed Wind Farm site, the proposed mitigation measures in relation to suspended sediment, hydrocarbons and cement based products (outlined in Sections 9.4.2.1 - 9.4.2.8), as well as the information gathered on the hydrogeological regimen including groundwater flow directions and groundwater levels, the residual effect on the remaining GWS/PWS wells, namely Durrow PWS, Cullahill GWS, Fermoyle GWS, as well as the Ballyragget Infiltration Gallery PWS, is considered to be – Indirect, negative, imperceptible, short term, very unlikely impact on groundwater quality and quantity in these sources.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigations measures, no significant effects on the GWS/PWS wells and the infiltration gallery mapped in the area surrounding the Proposed Development will occur.

9.4.2.13 Potential Effects on Domestic Water Supplies

Due to the prevalence of local GWS wells within the area and their associated connection numbers, the number of domestic wells present in the area surrounding the Site is relatively low.

Potential effects on domestic groundwater wells are similar to those in relation to GWS wells and include a reduction in groundwater quality in the aquifer underlying the Site through poor quality water recharging to ground. Due to the knowledge of competent Limestone underlying the Proposed Wind Farm site to the east/southeast and hard sandstone/siltstone/mudstone/shale to the west/northwest at the turbine and major infrastructure locations and the known level of groundwater strikes, and the shallow and transient nature of the excavated trench along the Proposed Grid Connection underground cabling route there is no potential to affect groundwater pathways during the construction phase.

Receptors: Local unmapped downgradient groundwater wells (east and southeast of the Proposed Development due to groundwater flow direction). This assessment assumes there is (or could be a further) a groundwater well/water source (including spring/sump) at all local properties.

Pre-mitigation Potential Effects: Indirect, negative, moderate, long term, unlikely impact on groundwater quality and quantity in unmapped local domestic wells.

Mitigation Measures:

Surface water mitigation measures will be put in place as outlined in Section 9.4.2.1 which will ensure that any surface water arising at the Site during the construction process of the Proposed Development will be attenuated and will be of a high quality before being allowed to recharge to ground within a short distance (10's of metres). The quantity and quality of recharge to the groundwater system will be maintained. Measures to protect the water environment from cement based products and hydrocarbons (as outlined in Sections 9.4.2.8 and 9.4.2.6) will ensure that the water recharging to ground is of a high quality.

The Limestone bedrock underlying the proposed turbine locations to the east and southeast of the Site is competent Limestone without any signs of karstification, while the ground to the west/northwest exists on hard, competent siliciclastics[11]. The primary risk to unmapped domestic wells is therefore considered to be surface waters arising during the construction phase, before recharging to ground. During the construction phase, mitigation measures outlined in Section 9.4.2.1 such as interceptor drains, silt fences, swales and settlement ponds along with mitigation measures to protect against effects from hydrocarbons and cement based products will ensure that the recharge to the underlying groundwater aquifer remains at a high standard.

Residual Effect: Based on the separation distances involved, the detailed site investigation data detailing competent Limestone (not karstified) and siliciclastics underlying the turbines at the Proposed Wind Farm site, the proposed mitigation measures in relation to suspended sediment, hydrocarbons and cement based products, as well as the information gathered on the hydrogeological regimen including groundwater flow directions and groundwater levels, the residual effect on unmapped domestic wells is considered to be – Indirect, negative, imperceptible, medium term, very unlikely impact on groundwater quality and quantity.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigations measures, no significant effects on unmapped domestic wells mapped in the area surrounding the Proposed Development will occur.

9.4.2.14 Potential Effects on Water Framework Directive Status

Construction phase activities will require earthworks resulting in removal of vegetation cover and excavation of soil and subsoils.

The main risk will be from surface water runoff from bare soil and areas of spoil placement during construction works, however as outlined several times in the above text, surface water pathways are very short, and any surface water will readily infiltrate to ground.

Hydrocarbons and cement-based compounds will also be used during the construction phase.

These activities can result in the release of suspended solids and pollutants in runoff water and could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which in turn could affect the water quality and fish stocks of downstream water bodies such as the River Nore.

[11] *Siliciclastic rocks are clastic noncarbonate sedimentary rocks that are composed primarily of silicate minerals, such as quartz.*

These Surface Water Bodies (SWB's) are relatively distal in relation to the Wind Farm Site (6.2-8km downstream by channel length), although works along the Grid Connection route are closer. Overall, there is the possibility of contaminants having the potential to cause a deterioration in the overall status of the Lisdowney_010 and Nore_120 to Nore_140 waterbodies. Further downstream the status of the Nore_150 and Nore_160 river waterbodies are unlikely to be impacted even in an unmitigated scenario due to the distal location of the SWB from the Proposed Development and the large volume of water within the river. However, they are included into the WFD Impact Assessment for precautionary measures.

In terms of groundwater bodies, accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a major pollution risk to groundwater. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Chemicals such as cement-based compounds also pose a threat to the groundwater environment. Runoff from concrete works can impact on groundwater quality. These sources of contamination have the potential to impact on groundwater quality in the underlying groundwater Lisdowney GWB and Durrow GWB in the area of the Proposed Development.

Receptors: Surface water bodies listed in Table 9-18. Groundwater bodies listed in Table 9-19.

Pre-mitigation Potential Effects:

A summary of potential status change to WFD SWBs arising from surface water quality effects from earthworks during the construction phase of the Proposed Development in the unmitigated scenario are outlined in Table 9-18.

Table 9-18: Potential Surface Water Body effects during the Proposed Development

SWB	Risk (3rd Cycle)	Current Status	Potential Status Change
Nore_120	At risk	Moderate	Poor
Nore_140	Not at risk	Good	Moderate
Nore_110	Not at risk	Good	Moderate
Lisdowney_010	At risk	Moderate	Poor
Nore_130	Not at risk	Good	Moderate
Nore_150	Not at risk	Good	Good
Nore_160	Not at risk	Good	Good

Table 9-19: Potential Groundwater body status effects during the Proposed Development

GWB	(Risk 3rd Cycle)	Pressure	Current Status	Potential Status Change
Durrow	At risk	Agriculture	Poor	Poor (further reduction)
Lisdowney	Not at risk	-	Good	Moderate

Mitigation Measures

The mitigation measures outlined in Section 9.4.2.1 including avoidance of surface watercourses, along with source controls (interceptor drains, sandbags, silt fences), amongst others, will ensure that any surface water generated at the Wind Farm Site, will be of a high quality in terms of suspended sediments, while it is noted that runoff from the Wind Farm Site will not occur as surface water will infiltrate to ground.

In terms of cement-based materials, the mitigation measures outlined above in Section 9.4.2.8 relating to cement products will be implemented and will break the pathway between the source and receptor.

Mitigation measures in relation to the use of hydrocarbons including off-site refuelling, hydrocarbon interceptors and an emergency plan to deal with accidental spillages are outlined in Section 9.4.2.6.

Residual Effect:

Proposed Wind Farm site: Based on the mitigation measures outlined in relation to sediment control (Section 9.4.2.1), cement based products (Section 9.4.2.8) and hydrocarbons (Section 9.4.2.6, the residual effects within the Proposed Wind Farm site on the WFD status of the SWB's and GWB are considered to be - Indirect, negative, imperceptible, short term, very unlikely impact.

Grid Connection underground cabling route: Based on the mitigation measures outlined in relation to sediment control (Section 9.4.2.1), cement based products (Section 9.4.2.8) and hydrocarbons (Section 9.4.2.6, the residual effects along the Proposed Grid Connection underground cabling route on the WFD status of the SWB's and GWB are considered to be - Indirect, negative, imperceptible, short term, very unlikely impact.

Significance of Effects: For the reasons outlined above, and with the application of the listed mitigation measures, no significant effects on the WFD status of the Surface water bodies and Groundwater bodies listed in Table 9-18 and Table 9-19 will occur. There will be no deterioration in the status of any WFD waterbody and the Project will not impact the ability of any waterbody to achieve its WFD objectives.

9.4.2.15 Potential Effects of the Proposed Turbine Delivery Route

Minor earthworks are required along the turbine delivery route at both Location 1 (Durrow Townsparks, Co. Laois) and Location 2 (Ballynaslee, Co. Kilkenny). Crushed stone will be emplaced at Location 1 to raise the level of the laneway to accommodate the delivery. At Location 2, crushed stone will be emplaced across an area of 820 m^2 within the grass verge on the southern side of the junction between the L58333 local road and the N77 road.

Pathway: Surface water drainage to nearby watercourses

Receptors: Downgradient surface watercourses (Erkina River and River Nore)

Pre-Mitigation Potential Effect: No potential for effects, the locations are sufficiently distal to surface watercourses that the emplacement of small amounts of crushed stone does not pose a risk of negative effects on these watercourses.

Residual Effects: No significant effects

9.4.3 Operational Phase – Likely Significant Effects

9.4.3.1 Progressive Replacement of Natural Ground Surface with Lower Permeability Surfaces

Proposed Wind Farm

Progressive replacement of the vegetated surface with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network, if the drainage design included surface water runoff leaving the Site. However, at this site, the drainage design has been optimised to allow for all rainfall which may fall on impermeable surfaces (such as at turbine hardstands) to recharge to ground as would normally occur at the Site.

Proposed Grid Connection

Along the Proposed Grid Connection underground cabling route, a trench will be excavated for the emplacement of the grid connection cabling. Once installed, this trench will be backfilled and the road surface or soil/subsoil reinstated. As such, there will be no change in the permeability along this route.

Pathway: Proposed Wind Farm site drainage network and recharge to underlying groundwater in the Durrow GWB and Lisdowney GWB.

Proposed Grid Connection underground cabling route – excavate and reinstate.

Receptor: Underlying groundwater aquifers.

Pre-Mitigation Potential Impact: Indirect, negative, slight, permanent, unlikely effect on groundwater quality and quantity within the Durrow GWB and the Lisdowney GWB.

Impact Assessment/Mitigation Measures

As summarised in Section 9.3.13 and outlined in detail in Appendix 4-3, the drainage design for the Proposed Wind Farm includes for the release of any surface water captured within the interceptor drains to recharge back to ground, with a very nominal spatial diversion of the water (10's of metres). In doing so, all rainfall which falls on the Site will still infiltrate to ground. There will be no net increase in runoff from the Proposed Wind Farm site or along the Proposed Grid Connection underground cabling route.

Proposed Mitigation by Design:

Proposed Wind Farm site

The operational phase drainage system of the Proposed Wind Farm site will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Interceptor drains will be installed up-gradient of proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be slowly re-distributed over the ground surface and infiltrate through the soil and subsoils;
- Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the Proposed Wind Farm site, likely to have entrained suspended sediment, and channel it to infiltration areas for sediment settling; and,

- Check dams will be used along sections of access road drains to attenuate flows and intercept silts at source. Check dams will be constructed from 4/40mm non-friable crushed rock.

Proposed Grid Connection
The trench associated with the Proposed Grid Connection underground cabling route will be backfilled and reinstated following the laying of the cable. As such, the permeability of the ground will remain unchanged.

Residual Impact:

Proposed Wind Farm site

Due to the retention of the groundwater recharge regime, with no increase in surface water drainage from the Proposed Wind Farm site, as well as the relative short displacement of any surface water before natural infiltration occurs and the mitigation measures to ensure the quality of the surface water, the residual effect is considered to be - indirect, negative, imperceptible, permanent, very unlikely effect on groundwater quality and quantity within the Durrow GWB and Lisdowney GWB.

Proposed Grid Connection underground cabling route

Due to the temporary and transient nature of the works along the grid route and the reinstatement of the ground following completion of the cable laying, the residual effect is considered to be – no effect on groundwater quality and quantity.

Significance of Effects: No significant effects on surface water and groundwater quality or quantity are anticipated during the operational phase of the Proposed Development.

9.4.3.2 Potential Hydrological and Hydrogeological Effects on Designated Sites

The potential water environment effects on designated sites from the Proposed Development are principally related to the construction process, through potential sources such as sediment generation, cement-based materials and hydrocarbon spillages and potential pathways created during the excavation and movement of soils/subsoils and in some cases bedrock.

During the operational phase of the Proposed Development, these potential sources and pathways no longer exist. Any potential effects then on designated sites are related to the operational maintenance of the wind farm infrastructure.

Pathway: Rainfall infiltration through soils/subsoils and groundwater flow towards designated sites

Receptor(s): River Barrow and River Nore SAC, River Nore SPA, River Nore/Abbeyleix Wood Complex pNHA

Pre-Mitigation Potential Impact: Indirect, negative, moderate, short term, unlikely impact to designated sites.

Mitigation Measures:

Mitigation measures to protect designated sites during the operational phase of the Proposed Development include:

- Regular maintenance of the on-site drainage system. The maintenance schedule will be reduced once natural vegetation is re-established, which will provide consistent filtration through the soil/subsoil;

- The use of fuel storage bunds for any hydrocarbons (fuel/oils) and the ongoing maintenance of the bund structures; and,
- Any maintenance works which may involve soil movement (such as the removal of sediment from the settlement ponds) will take place during the dry months of the year (May - September).

Residual Effect: Based on the considerable reduction in the potential sources of effects during the operational phase, as well as the ongoing mitigation measures the residual effect is considered to be – No effect.

Significance of Effects: None.

9.4.3.3 Potential Effects on Water Framework Directive Status

During the operational phase of the Proposed Development, the progressive replacement of the soil or vegetated surfaces with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff at the Proposed Wind Farm site (this will not occur along the Proposed Grid Connection underground cabling route as the trench will be backfilled and the road reinstated, and permeability will be unchanged). This could potentially increase runoff from the Proposed Wind Farm site, however as noted all surface water will infiltrate to ground within the Proposed Wind Farm site. An increase in surface water runoff leaving the Site would have an effect on the groundwater recharge to the underlying groundwater body, however due to the drainage design proposed at the Proposed Wind Farm site, this will not occur.

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads and hardstand areas. These works are of a very minor scale and are very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.

Receptors

- Surface water bodies listed in Table 9-20
- Groundwater bodies listed in Table 9-21

Pre-mitigation Potential Effects:

Table 9-20: Potential Surface Water Body effects during the Proposed Development

SWB	Risk (3rd Cycle)	Current Status	Potential Status Change
Nore_120	At risk	Moderate	Poor
Nore_140	Not at risk	Good	Moderate
Nore_110	Not at risk	Good	Moderate
Lisdowney_010	At risk	Moderate	Poor
Nore_130	Not at risk	Good	Moderate
Nore_150	Not at risk	Good	Good
Nore_160	Not at risk	Good	Good

Table 9-21: Potential Groundwater body status effects during the Proposed Development

GWB	(Risk 3rd Cycle)	Pressure	Current Status	Potential Status Change
Durrow	At risk	Agriculture	Poor	Poor (further reduction)
Lisdowney	Not at risk	-	Good	Moderate

Mitigation Measures

The operational phase drainage system of the Proposed Wind Farm site will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- 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. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/road-side drains will be used to collect runoff from access roads and turbine hardstanding areas of the Wind Farm site, likely to have entrained suspended sediment, and channel it to infiltration areas for sediment settling and recharge to ground;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock; and,
- Infiltration areas, emplaced downstream of road swale sections and at end of the downstream collector drains, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall and allow the rainfall to recharge to ground effectively.

The mitigation measures to protect against poor quality runoff during the operational phase of the Proposed Development are the same as those outlined in Section 9.4.2.1 above.

Mitigation measures for oils and fuels during the operational phase of the Proposed Development are the same as those outlined in 9.4.2.6 above.

Residual Effect:

Proposed Wind Farm: Based on the mitigation measures outlined in relation to drainage/sediment controls (Section 9.4.2.1), wastewater (Section 9.4.2.7), cement based products (Section 9.4.2.8) and hydrocarbons (Section 9.4.2.6), the residual effects within the Wind Farm Site on the WFD status of the SWB's and GWB are considered to be - Indirect, negative, imperceptible, short term, very unlikely impact.

Proposed Grid Connection: Based on the mitigation measures outlined in relation to earthworks (Section 9.4.2.1), cement based products (Section 9.4.2.8) and hydrocarbons (Section 9.4.2.6), the residual effects along the Proposed Grid Connection underground cabling route on the WFD status of the SWB's and GWB are considered to be - Indirect, negative, imperceptible, short term, very unlikely impact.

Significance of Effects: There will be no deterioration in the status of any WFD waterbody and the Project will not impact the ability of any waterbody to achieve its WFD objectives. For the reasons outlined above, and with the application of the listed mitigation measures, no significant effects on the

WFD status of the Surface water bodies and Groundwater bodies listed in Table 9-20 and Table 9-21 will occur.

9.4.4 Decommissioning Phase – Likely Significant Effects

Proposed Wind Farm

In the event of decommissioning of the Proposed Wind Farm site, similar activities to the construction phase are carried out.

Potential effects will be similar to the construction phase but to a lesser degree. There may be increased trafficking and an increased risk of disturbance to underlying soils at the Proposed Wind Farm site, during the decommissioning phase. Any such potential effects will be less than during the construction stage as the drainage system will be fully mature and will provide additional filtration of runoff. Any diesel or fuel oils stored on site will be bunded. In the event of decommissioning of the Proposed Wind Farm, the proposed access tracks may be used in the decommissioning process.

Following decommissioning of the Proposed Wind Farm site; the turbine foundation areas will be rehabilitated, i.e. left in place, covered over with local soils/subsoils and allowed to re-vegetate naturally, if required. The internal site access tracks will be left in place. It is considered that leaving these areas in-situ will cause less environmental damage than removing and recycling them.

The removal of this infrastructure (hardstanding areas, foundations *etc.*) would result in disturbance to the local environment in terms of disturbance to underlying soils and an increase in erosion, sedimentation, dust, noise, traffic and an increased possibility of contamination of the local water table. As such, these areas will be left in place and there will be no effects from a decommissioning process.

The electrical cabling connecting the site infrastructure to the on-site substation will be removed, while the ducting itself will remain in-situ rather than excavating and removing it, as this is considered to have less of a potential environmental impact, in terms of soil exposure, and thus on the possibility of the generation of suspended sediment which could enter nearby watercourses.

The residual effect on the water environment as a result of the decommissioning phase is considered to be: Negative, indirect, imperceptible, long-term, unlikely effect on groundwater quality and groundwater quantity in the Durrow GWB and Lisdowney GWB. Negative, indirect, imperceptible, long-term, unlikely effect on Surface water quality and quantity in the Nore_120 to Nore_140 waterbodies.

Proposed Grid Connection

The onsite substation will remain in place as it will be under the ownership/ control of the ESBN/ EirGrid. The Proposed Grid Connection underground cabling will also remain in place. As such there will be no effects associated with the Proposed Grid Connection during the decommissioning stage of the Proposed Development.

The potential for effects during the decommissioning phase of the Proposed Grid Connection underground cabling route is considered to be - No effect.

An outline decommissioning plan is contained in the CEMP in Appendix 4-2 of this EIAR for the decommissioning of the Proposed Development, the detail of which will be agreed with the local authority prior to any decommissioning.

9.4.5 Cumulative Assessment

9.4.5.1 Assessment of Cumulative Effects

This section presents an assessment of the potential cumulative effects associated with the Proposed Project and other developments (existing and/or proposed) on the hydrological and hydrogeological environment.

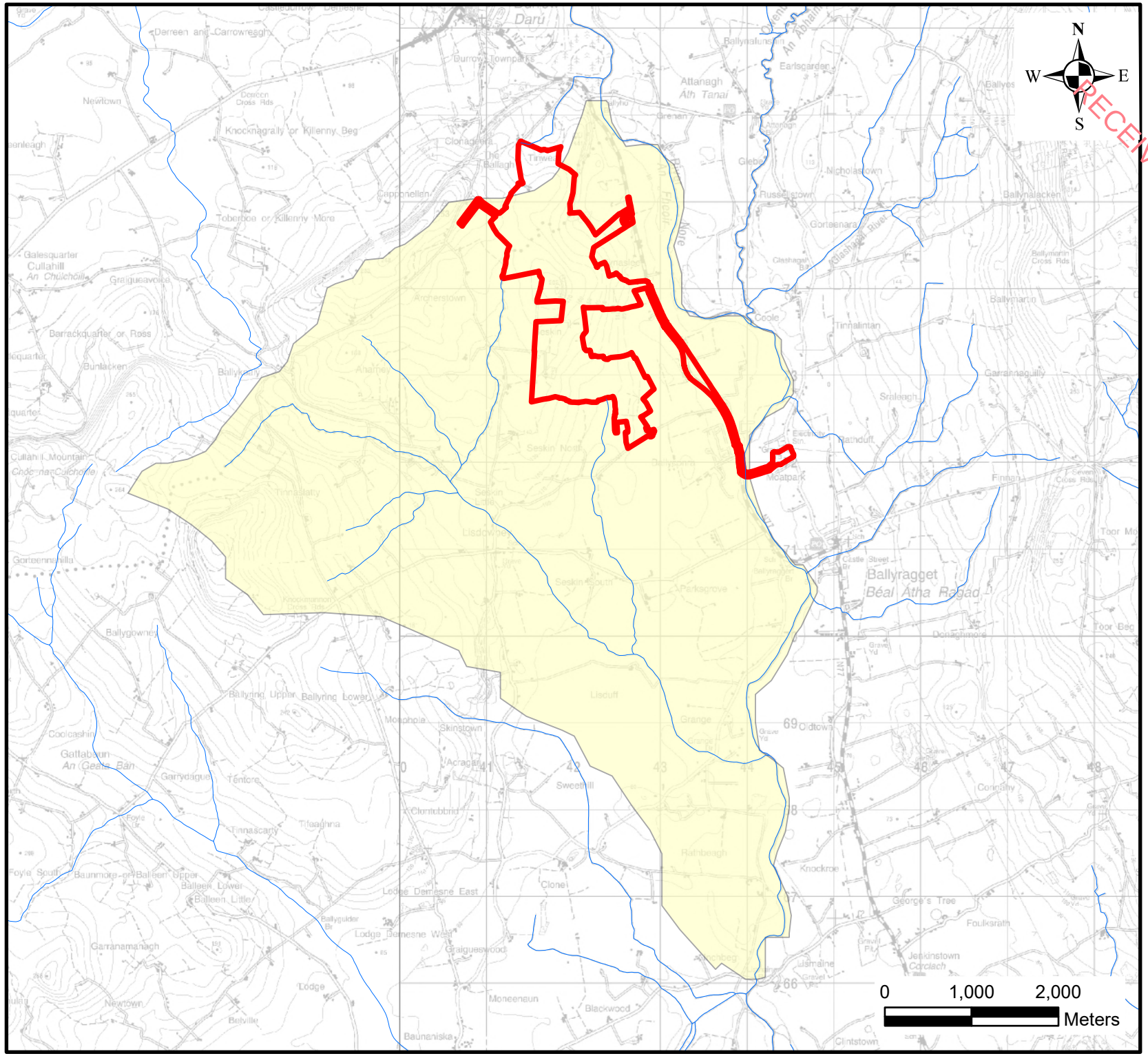
The main likelihood of cumulative effects is assessed to be associated with the hydrogeological environment, and to a lesser extent the surface water environment (as there is a lack of surface watercourses at the Proposed Development site).

The primary potential for cumulative effects will occur during the construction phase of the Proposed Project as this is when earthworks and excavations will be undertaken at the Site. The potential for cumulative effects during the operational phase of the Proposed Project will be significantly reduced as there will be no exposed excavations, there will be no sources of sediment to reach watercourses, there will be no use of cementitious materials and fuels/oil will be kept to a minimum at the Site. During the decommissioning phase, the potential cumulative effects are similar to the construction phase, but to a lesser degree with less ground disturbance.

A cumulative hydrological and hydrogeological study area has been delineated as shown below in Figure 9-15.

The hydrological cumulative study area is delineated as follows:

- The northwestern boundary is delineated by the high ground of the Cullahill mountains which from a ridgeline which also makes up the northwestern boundary of the Lisdowney_010 river sub-basin.
- The remaining land area within the cumulative boundary to the south contains the river sub-basins of the Lisdowney_010, the Nore_120 (west of the River Nore), the Nore_130 (west of the River Nore), and the Nore_140;
- The eastern boundary of the cumulative area is delineated by the River Nore;
- A further assessment has been completed within a 200m zone of the Proposed Grid Connection. Due to the shallow nature of the underground cabling connection trench, a 200m buffer zones is an appropriate scale when considering potential cumulative effects on the water environment.



Legend

- EIAR Site Boundary
- Cumulative Hydrological Study Area
- Watercourses

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Client: Seskin Renewable Energy Ltd	
Job: Seskin Renewable Energy Development, Co. Kilkenny/Co. Laois	
Title: Cumulative Hydrological Study Area	
Figure No: 9-15	
Drawing No: P1653-1-0625-A4-916-00A	
Sheet Size: A4	Project No: P1653-1
Scale: 1:60,000	Drawn By: GA
Date: 01/07/2025	Checked By: MG

9.4.5.2 Cumulative Effects with Agriculture

The delineated cumulative study area is a largely agricultural area.

Agriculture is the largest pressure on water quality in Ireland. Agricultural practices such as the movement of soil and the addition of fertilizers and pesticides can lead to nutrient losses and the entrainment of suspended solids in local surface watercourses. This can have a negative effect on local and downstream surface water quality.

In an unmitigated scenario the Proposed Project would have the potential to interact with these agricultural activities and contribute to a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

However, the mitigation measures detailed above in Section 9.4.2, 9.4.3 and 9.4.4 for the construction, operation and decommissioning phases of the Proposed Project will ensure the protection of downstream surface water quality.

For these reasons it is considered that there will not be a significant cumulative effect associated with agricultural activities.

9.4.5.3 Cumulative Effects with Other Renewable Energy Developments

There are no other proposed wind farm developments within the hydrological cumulative study area.

There is 1 no. existing wind farm, the Lisdowney Wind Farm, which exists towards the southern border of the Hydrological Cumulative study area. As construction is complete at this wind farm, there will be no significant cumulative effects.

There is 1 no. solar farm (PL:23/60330), with permission granted, located~1km south of the Proposed Wind Farm site. This application is for planning permission for this solar farm with an associated above ground grid connection. Having reviewed this planning application and the elements proposed, there is no potential for hydrological cumulative effects as a result of this proposed solar farm development with the Seskin Renewable Energy Development.

9.4.5.4 Cumulative Effects with Other Grid Connections

A study was completed to identify any grid connection routes associated with other wind farm developments which overlap with the Proposed Grid Connection underground cabling route. From this study, the following overlaps were recorded:

- ~130m overlap with the grid connection underground cabling route associated with the proposed Briskalagh Wind Farm. The overlap occurs along the N77. Both grid connections are proposed to cross the Nore via HDD at different locations;

The greatest potential for cumulative effects to occur would be if the construction phase of the underground grid connection routes overlapped with each other. In an unmitigated scenario, there may be some cumulative effects on the downstream receiving watercourses. However, practicalities will make it highly unlikely that the construction phase of the overlapping sections of the grid connections would occur at the same time as this would result in road closures (two trenches being excavated). Therefore, the overlapping sections of the grid connections cannot be built at the same time.

Furthermore, the EIARs for the above wind farm development detail potential hydrological and hydrogeological issues relating to the construction of the grid connection underground cabling routes. The EIARs propose a suite of best practice mitigation measures designed to ensure that the

construction of the grid connection underground cabling routes do not in any way have a negative effect on downstream surface water quality and quantity. Similarly, the mitigation and best practice measures proposed in this EIAR chapter will ensure that the construction of the Proposed Grid Connection does not have the potential to result in significant effects on the hydrological/hydrogeological environment.

Therefore, with the implementation of the proposed mitigation measures (both for the Proposed Project and for the other grid connections) there will be no cumulative effects associated with the construction, operational or decommissioning phases of the Proposed Project and other grid connections within the cumulative study area.

9.4.5.5 Cumulative Effects with Other Developments

A detailed cumulative assessment has been carried out for all planning applications (granted and awaiting decisions) within the cumulative assessment area for the Proposed Wind Farm site and the Proposed Grid Connection described above.

The planning applications identified within the study area for new dwellings or renovations of existing dwellings, associated wastewater treatment systems as well as for the erection of farm buildings. The planning applications have been reviewed based on their type, scale and proximity to the Proposed Wind Farm site. Based on the scale of the works, their proximity to the Proposed Wind Farm site and the temporal period of likely works, no cumulative effects will occur as a result of the Proposed Project (construction, operation and decommissioning phases).

A desk study of planning applications within 200m of the Proposed Grid Connection was undertaken. The majority of these applications relate to the construction or renovation/extension of domestic dwellings, which will not generate potential cumulative effects due to their scale. However, in the vicinity of Ballyragget substation there are applications for the construction battery energy storage systems. A hydrological and hydrogeological assessment report and drainage strategy was submitted along with the Environmental Report for the Power Reserve Project at Ballyragget. This report detailed mitigation measures for the protection of the hydrological and hydrogeological environment through all phases of the development.

The works along the Proposed Grid Connection are minor and transient, similar to roadworks being completed across the country and have no potential for significant cumulative effects on the hydrological or hydrogeological environment.

Construction Phase

A detailed cumulative assessment has been carried out for all planning applications (granted and awaiting decisions) within a combined river sub-basin zone within the vicinity of the Site defined within Appendix 2-3.

A dataset of 3,910 no. planning applications within the defined potential cumulative boundary (defined by boundaries of downgradient water catchments) has been completed. Of the 3,910 no. applications, 406 no. applications are for agricultural buildings, typically slatted sheds and milking parlors. There are 163 no. commercial units within the dataset and 2,288 no. residential dwellings. There are 22 no. wind farms listed within 25km of the Site, however apart from the Lisdowney Wind Farm considered in Section 9.3.5.3 above, no other wind farm is located within the delineated hydrological cumulative area.

Based on the scale of the works, their proximity to the Proposed Development and the temporal period of likely works, no cumulative effects will occur as a result of the Proposed Development.

Operational Phase

During the operational phase of the proposed development, the main sources of potential environmental effects will not exist. There will be no exposed excavations and spoil management will not be in operation. There will be no sources of sediment to reach watercourses. There will be no use of cementitious materials. Fuels/oil will be kept to a minimum at the site. Any oils for turbine maintenance will be stored within bunded areas.

The underground electrical connection cabling route will be reinstated at the end of the construction phase and will remain in-situ during the operational phase. No maintenance of the electrical cabling is envisaged, however any minor maintenance will be completed from inspection points along the route.

During the operational phase of the project, there will be no cumulative effects with other planned projects (as listed in Section 2.9 of Chapter 2) within the sub-basin catchment zone).

Decommissioning

During the decommissioning phase, the potential cumulative effects are similar to the construction phase, but to a lesser degree with less ground disturbance. The substation and grid connection will remain in-situ and will not be decommissioned. There will be increased trafficking and an increased risk of disturbance to underlying soils at the Wind Farm Site, during the decommissioning phase. Any potential effects would be likely to be less than during the construction stage as the drainage system will be fully mature and would provide additional filtration of runoff. Any diesel or fuel oils stored on site will be bunded. During the decommissioning phase of the Proposed Development, the proposed access tracks may be used in the decommissioning process.

During the decommissioning phase, there will be no cumulative effects within the sub-basin zone.

The hydrological impact assessment undertaken above in this chapter outlines that significant effects will not occur during the construction, operational and decommissioning works.

No significant cumulative effects on the hydrology and hydrogeology environment will occur as a result of the Proposed Development within the Wind Farm Site and the associated Grid Connection underground cabling route.

APPENDIX 9-1

FLOOD RISK ASSESSMENT REPORT

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SESKIN RENEWABLES WIND FARM,
CO. KILKENNY AND CO. LAOIS

FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

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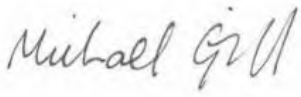
Author(s):	**Michael Gill Adam Keegan Nitesh Dalal**
Signed:	 **Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services**

Disclaimer:
This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site specific and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO to undertake a Flood Risk Assessment (FRA) for the Proposed Seskin Renewables Wind Farm and associated Grid Connection Route, Co. Kilkenny and Co. Laois. The core of the Proposed Wind Farm site is located approximately 2.5 kilometres south of the town of Durrow, Co. Laois, 43.2 kilometres northwest of the town of Ballyragget, Co Kilkenny and 5.9 kilometres east of the village of Cullahill, Co. Laois. The Proposed Wind Farm will connect into the proposed onsite 38kV substation, which is located in the east of the Proposed Wind Farm site. This substation will be connected to the existing 110kV Ballyragget Substation via a c. 3.4km long underground cabling route. The existing Ballyragget 110kV Substation is located approximately 1.8km southeast of the Proposed Wind Farm site. A site location map is attached as **Figure A**.

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009).

This FRA is written to accompany Chapter 9 of the Environmental Impact Assessment Report (EIAR) for the Proposed Wind Farm Site and the Proposed Grid Connection Route. The Proposed Project is described in full in Chapter 4 of the EIAR. For the purposes of this FRA, and to be consistent with the EIAR, the various components are described and assessed using the following references: 'Proposed Development, 'Proposed Wind Farm', 'Proposed Grid Connection Route' and the 'Site' (as defined in Chapter 1, Section 1.1.1, of the EIAR).

This Stage 1 FRA report has been completed to identify the flood risk at the Proposed Seskin Renewables Wind Farm. Please note that this Stage 1 FRA will be upgraded to a Stage II or Stage III FRA upon receipt of the final layout and final details of the Proposed Wind Farm Site. Flood risk identification is an important part of the flood risk assessment process and identifies any areas of the Proposed Wind Farm Site (if any) which may be at risk of flooding.

1.2 STATEMENT OF QUALIFICATIONS

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience includes soils, subsoils and geology. We routinely complete impact assessments for land soils and geology, hydrology and hydrogeology for a large variety of project types.

This Flood Risk Assessment Report was prepared by Adam Keegan, Michael Gill and Nitesh Dalal.

Adam Keegan PGeo (B.Sc., M.Sc.) is a hydrogeologist with 7 years environmental consultancy experience in Ireland. Adam has worked on numerous Environmental Impact Assessments, Flood Risk Assessment Reports for infrastructure projects, such as wind farms, strategic housing developments and quarries. Adam has experience in intrusive site investigation works within mapped karst environments and experience in trial and production well drilling within areas mapped as Regionally Karstified Aquifers. Adam has worked on several wind farm EIAR projects, including Seven Hills WF, Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Coole WF.

Michael Gill PGeo (BA, BAI, MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments, Flood Risk Assessments for infrastructure projects including private residential and commercial developments which are occasionally sited within areas of known karstification, particularly in the East Galway/Clare area. In addition, he has substantial experience in intrusive site investigation and site suitability assessments, karst and epikarst hydrology/hydrogeology within proposed wind farm sites, water resource assessments for commercial and public water supplies including trial and production well drilling within a karst environment, surface water drainage design and SUDs design, and surface water/groundwater interactions. In addition, Michael has worked for Seven Hills WF, Oweninny WF, Cloncreen WF, Derrinlough WF and Yellow River WF, and over 120 other wind farm-related projects.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India. Nitesh holds a M.Sc. in Environmental Science from University College Dublin (2024), a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the site setting and details of the Proposed Wind Farm Site and the Proposed Grid Connection Route;
- Section 3 outlines the hydrological and geological characteristics of the Surface water Catchment and existing drainage;
- Section 4 describes the site-specific flood risk assessment (FRA) undertaken for the Proposed Wind Farm Site and the Proposed Grid Connection Route which was carried out in accordance with the above-mentioned guideline;
- Section 5 presents Planning policy and responses to that policy outlined in this FRA; and,
- Section 6 presents the FRA report conclusions.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the site along with a description of the Proposed Wind Farm Site and Proposed Grid Connection Route.

2.2 SITE LOCATION AND TOPOGRAPHY

The core of the Proposed Wind Farm Site is located approximately 2.5 kilometres south of the town of Durrow, Co. Laois, 3.2 kilometres northwest of the town of Ballyragget, Co Kilkenny and 5.9 kilometres east of the village of Cullahill, Co. Laois. The N77 National Secondary Road runs in a north-south orientation, east of the Site. It is proposed to access the Proposed Development via an existing agricultural access off the L58333 Local Road, part of the old N77, on the eastern side of the Site.

The land within the Site is mainly improved agricultural grassland, primarily used for grazing.

The Proposed Wind Farm will connect into the proposed onsite 38kV substation, which is located in the east of the Proposed Wind Farm site. This substation will be connected to the existing 110kV Ballyragget Substation via a c. 3.4km long underground cabling route. The existing Ballyragget 110kV Substation is located approximately 1.8km southeast of the Proposed Wind Farm site. The proposed onsite 38kV Substation, , adjacent temporary construction compound and the first c. 0.3km of the underground cabling route to Ballyragget Substation are elements of the Proposed Grid Connection which overlap with the Proposed Wind Farm site.

The approximate centre of the Site is located at E 642016, N 673936. The northwestern and central sections of the Site are situated within an elevated area of ground (~150-200mOD) within a broader area that slopes to the east and south to elevations of ~80-90mOD. The Grid Connection underground cabling route is situated along the N77 road, along the eastern margin of the site at elevations of ~80mOD.

A site location map is shown as **Figure A**.

2.3 PROPOSED DEVELOPMENT DETAILS

The Proposed Wind Farm site comprises 8 no. wind turbines with associated infrastructure including hardstands, access roads and substation, as well as 2 no. temporary construction compounds located in the townlands of Seskin, Ballynaslee and Ballyconra, Co. Kilkenny and the townlands of Tinwear and Archerstown, Co. Laois. The Proposed Grid Connection route is located in the townland of Ballynaslee, Ballyconra and Moatpark, Co. Kilkenny.

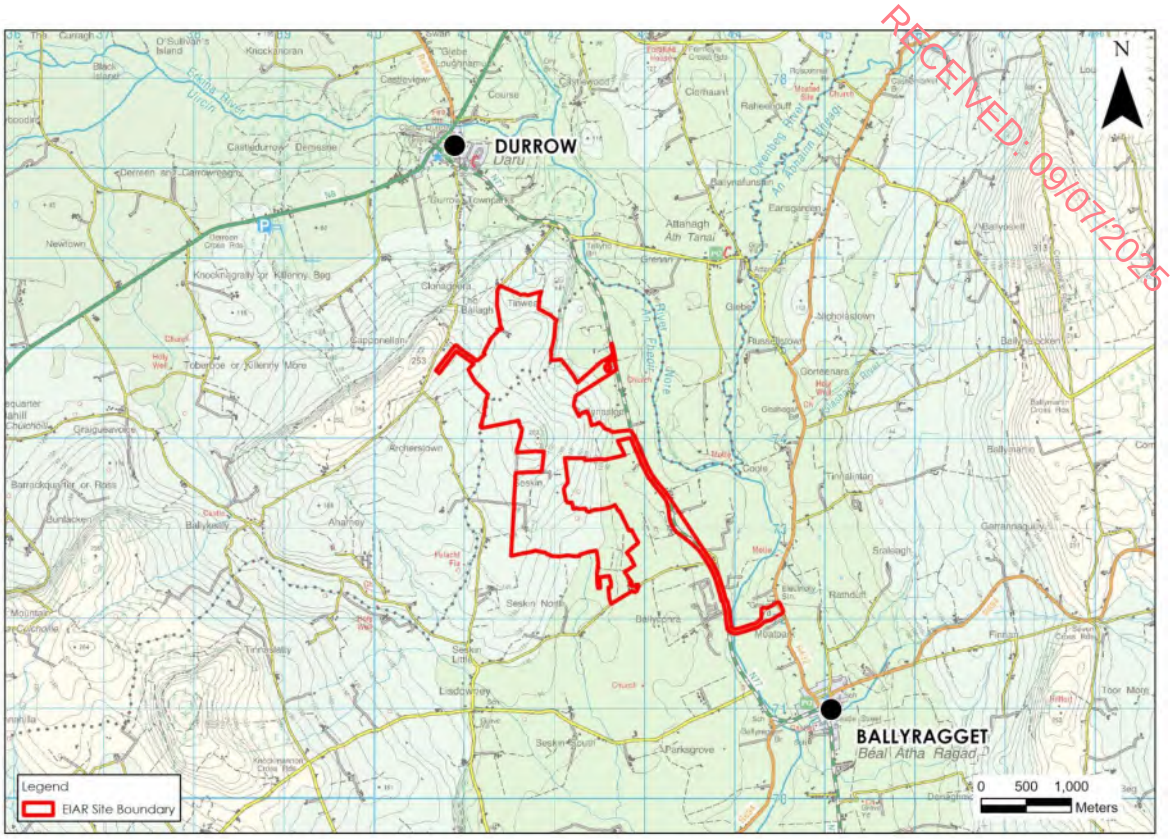

Figure A: Site Location Map

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics of the Proposed Development Site, the Proposed Grid Connection Route and the surrounding region.

3.2 HYDROLOGY

3.2.1 Regional and Local Hydrology

The Proposed Wind Farm Site and the Proposed Grid Connection Route are located in the regional River Nore surface water catchment within Hydrometric Area 15 of the Southeastern River Basin District (SERBD).

The Proposed Wind Farm Site and the Proposed Grid Connection Route are located in the regional River Nore surface water catchment within Hydrometric Area 15 of the Southeastern River Basin District (SERBD).

On a more local scale the majority of the Proposed Wind Farm Site is located within the Nore_SC_070 sub-catchment while small area in the north of the Proposed Wind Farm Site is located within the Nore_SC_050 sub-catchment. Within the Nore_SC_050 sub-catchment, the Proposed Wind Farm Site is located within the Nore_110 river sub-basin while within the Nore_SC_070 sub-catchment, the Proposed Wind Farm Site is located within the Nore_120 river sub-basin, the Lisdowney_010 river sub-basin and the Nore_140 river sub-basin.

Within the Nore_110 river sub-basin, the Durrow Townspark stream flows northeast discharging to the River Nore (Nore_110 section of the River Nore). The River Nore then flows south and drains out into Nore_120 section of the River Nore.

Within the Lisdowney_010 river sub-basin, the Archerstown stream flows south, discharging to the Lisdowney stream which drains out into the River Nore (Nore_140). Within the Nore_140 river sub-basin, the Ballyconra stream flow south, discharging to the Lisdowney stream and ultimately discharges to the River Nore.

The Proposed Grid Connection route exists within the Nore_120 river sub-basin and varies in distance between 0-850m from the River Nore (Nore_120 section of the river). The Proposed Grid Connection crosses the Nore_120 river section at the proposed watercourse crossing.

On a broad scale the majority of the Proposed Grid Connection Route is located within the Nore_SC_070 sub-catchment while a small area is located within the Nore_SC_060 sub-catchment, where the grid route crosses to the eastern side of the River Nore. Within the Nore_SC_070 sub-catchment, the Proposed Grid Connection Route is mapped within the Nore_120 river sub-basin while within the Nore_SC_060 sub-catchment the Proposed Grid Connection Route is also mapped within the Nore_120 river sub-basin.

A local hydrology map is attached as **Figure B**.

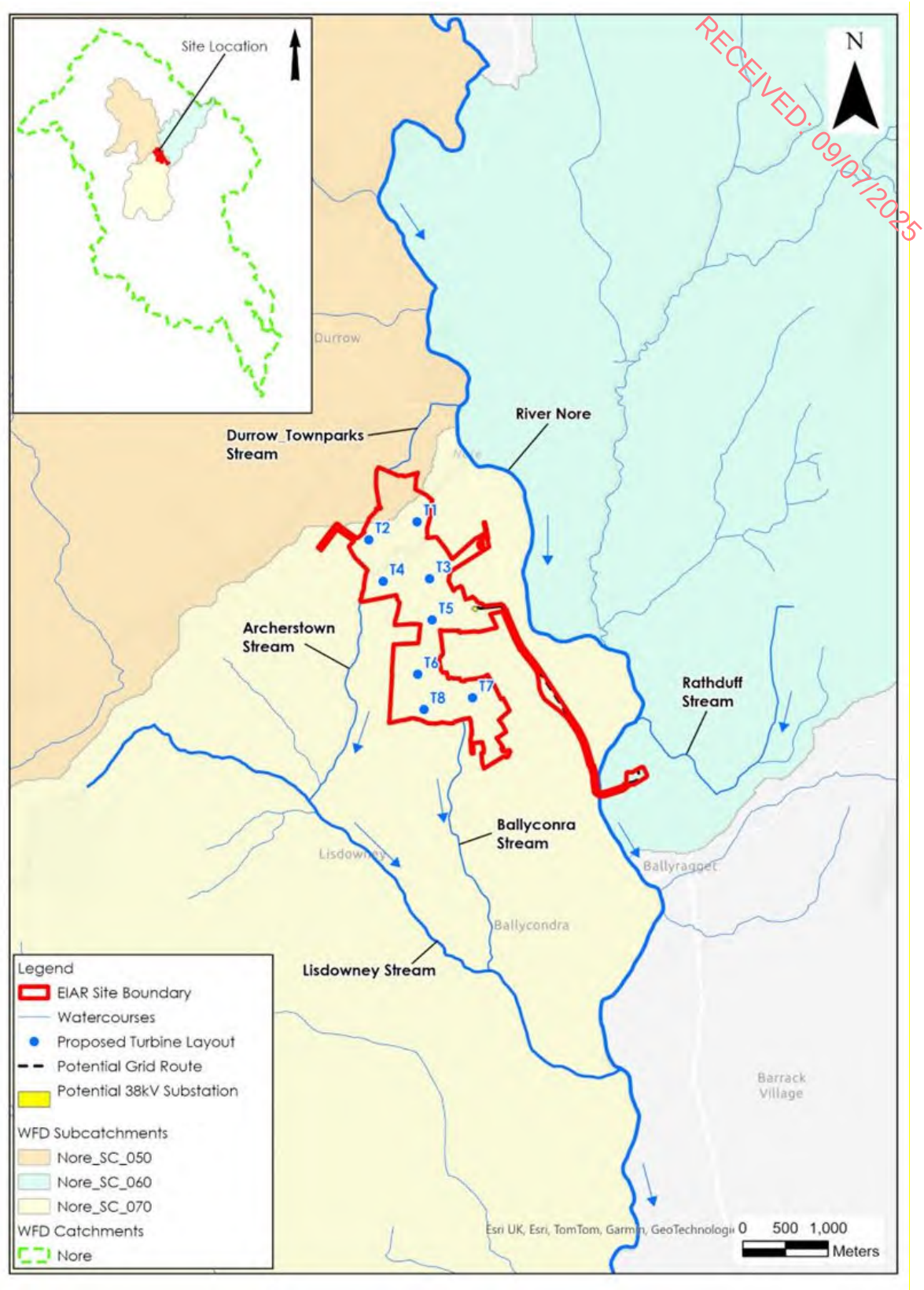

Figure B: Local Hydrology Map

3.2.2 Rainfall and Evaporation

The SAAR (Standard Average Annual Rainfall) recorded at Durrow, the closest rainfall station to the proposed development site with long term SAAR data, is 879mm (www.met.ie). Durrow rainfall station is located ~1.5km north of the Proposed Wind Farm site.

The average potential evapotranspiration (PE) at Kilkenny (~18km south-southwest of the Proposed Wind Farm Site) is taken to be 458.8mm (www.met.ie). The actual evapotranspiration (AE) is calculated to be 435.9mm (95% PE).

Met Éireann also provide a grid of average annual rainfall for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the annual rainfall at the Proposed Wind Farm Site is estimated at 879 mm/year.

The effective rainfall (ER)[1] represents the water available for runoff and groundwater recharge. The ER for the Proposed Wind Farm Site is calculated as follows:

Effective rainfall (ER) = AAR – AE

= 879mm/year – 435.9mm/year

ER = 443.1mm/year

The recharge coefficient estimates from the GSI (www.gsi.ie), range between 22.5-85%, based on the expected or observed outcrop/subcrop near the surface. Based on the GSI mapping, a groundwater recharge cap of 100 mm/year is applied to the majority of the site's aquifers in the western, northeastern and central areas. Therefore, surface runoff rates for these areas of the Wind Farm Site are estimated to be 343.1mm/year. A groundwater recharge cap is not applied to the aquifers in the central and southeastern areas of the Site. Therefore, surface runoff rates in these areas of the site are expected to be near 0 mm/year, which broadly aligns with the lack of surface water drainage features across this portion of the site. The only area where surface water drainage features is seen is at the faulted boundary between the sandstone/siltstone/shale formations and the Carboniferous Limestone rocks.

Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM's). Projections for the period 2041-2060 (mid-century) are available from Met Eireann. The data indicates a projected decrease in summer rainfall from 0 to 13% under the medium-low emission range scenario and an increase in the frequency of heavy precipitation events of 20%. In total, the projected annual reduction in rainfall near the Wind Farm Site is 8% under the medium-low emission scenario and 4% under the high emissions scenario. As stated above the local average long term rainfall data for the Wind Farm Site is estimated to be 879mm/yr. Under the medium-low emissions scenario this may reduce to~809mm/yr, while under the high emissions scenario this figure may change to ~844mm/yr.

In addition to average rainfall data, extreme value rainfall depths are available from Met Eireann. **Table A** below presents return period rainfall depths for the area of the Wind Farm site site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year).

[1] *ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.*

Table A. Seskin – Return Period Rainfall Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.9	6.9	12.2	17.5
15 mins	6.5	11.3	20.1	28.6
30 mins	8.2	13.8	23.5	32.7
1 hours	10.4	16.9	27.6	37.4
6 hours	19.4	28.3	41.6	52.8
12 hours	24.7	34.5	48.7	60.3
24 hours	31.4	42.2	57.1	68.9
2 days	38.4	50.5	66.9	79.6

3.3 GEOLOGY

The published soil maps (**www.gsi.ie**) for the local area shows that the majority of the Proposed Wind Farm Site is overlain by Shallow well drained mineral (Mainly acidic) (AminSW), Deep well drained mineral (Mainly acidic) (AminDW) and Shallow well drained mineral (Mainly basic) (BminSW) with small areas of Mineral poorly drained (Mainly acidic) (AminPD). The majority of the Proposed Grid Connection route is overlain by Shallow well drained mineral (Mainly basic) (BminSW) with small areas of Alluvial (mineral) (AlluvMIN) and Made ground (Made).

The published subsoil maps (**www.gsi.ie**) for the local area shows that the majority of the Proposed Wind Farm Site was underlain by Till derived from Namurian sandstones and shales (TNSSs) and Bedrock outcrop or subcrop (Rck) with small areas of Kartsified bedrock outcrop or subcrop (KaRck) and Gravels derived from Limestones (GLs). The majority of the Proposed Grid Connection Route was underlain by Gravels derived from Limestones (GLs) with small area underlain by Alluvium (A).

A local subsoil map is shown as **Figure C.**

Based on the GSI Bedrock Geology 110k mapping (www.gsi.ie), the Proposed Wind Farm site is underlain by a total of 5 no. bedrock geological formations. The east of the Proposed Wind Farm site is mapped to be underlain by the Clogrenan Formation. This formation comprises of cherty, muddy calcarenitic limestones. The southeastern corner of the Proposed Wind Farm site is mapped to be underlain by the Ballyadams Formation, which consists of crinoidal wackestone/packstone limestone. The western section of the Proposed Wind Farm site is mapped to be underlain predominantly by the Bregaun Flagstone Formation, which consists of thick, flaggy sandstone and siltstone. A small area in the northwest of the Proposed Wind Farm is underlain by the Moyadd Coal Formation, which consists of shale, siltstone and minor sandstone. Finally a small area towards the centre of the Proposed Wind Farm site is underlain by the Killeshin Siltstone Formation which comprises of muddy siltstone.

There are 2 faults mapped at the Proposed Wind Farm site that run from north to south and from north to southwest. The GSI map the limestone bedrock of the Ballyadams Formation to be dipping 26° to the northeast, while the flagstone/sandstone bedrock of the Breguan Formation is mapped as dipping 50° to the east/southeast. This GSI map the occurrence of several areas of bedrock outcrop in the Proposed Wind Farm site.

A local bedrock geology map is shown as **Figure D.**

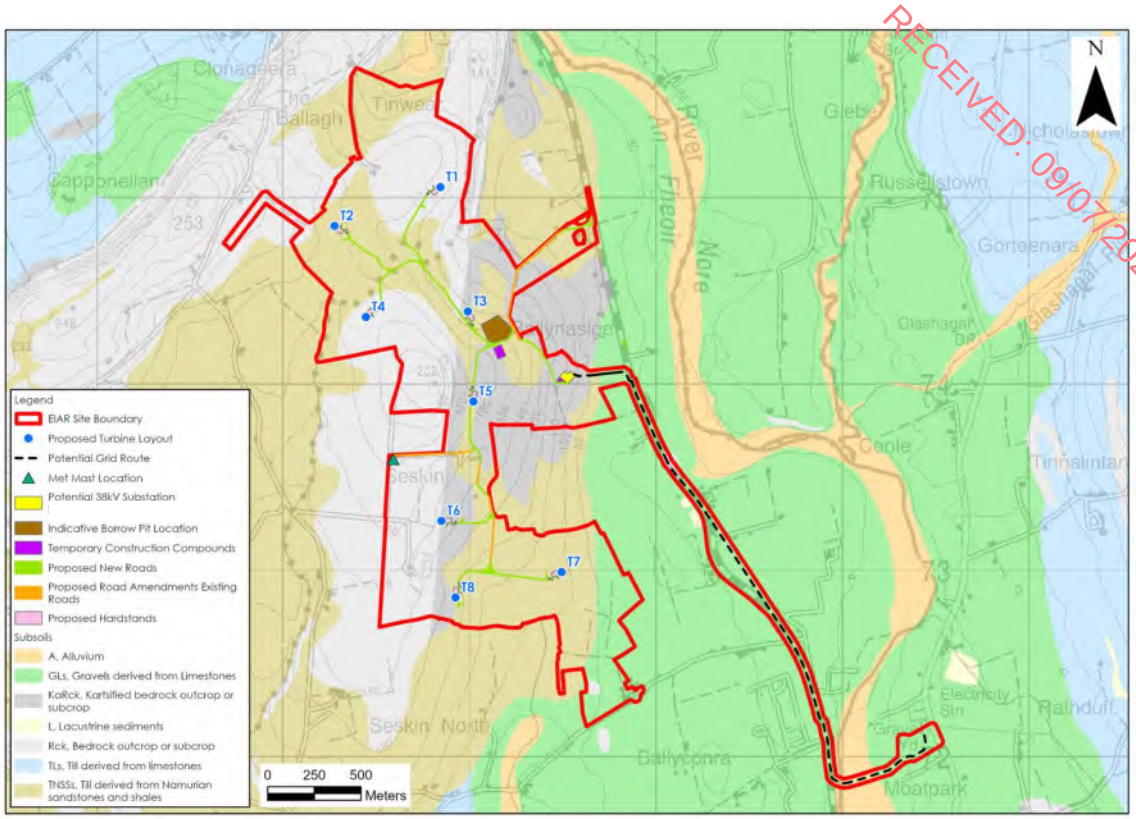

Figure C: Local Subsoil Map (www.gsi.ie)

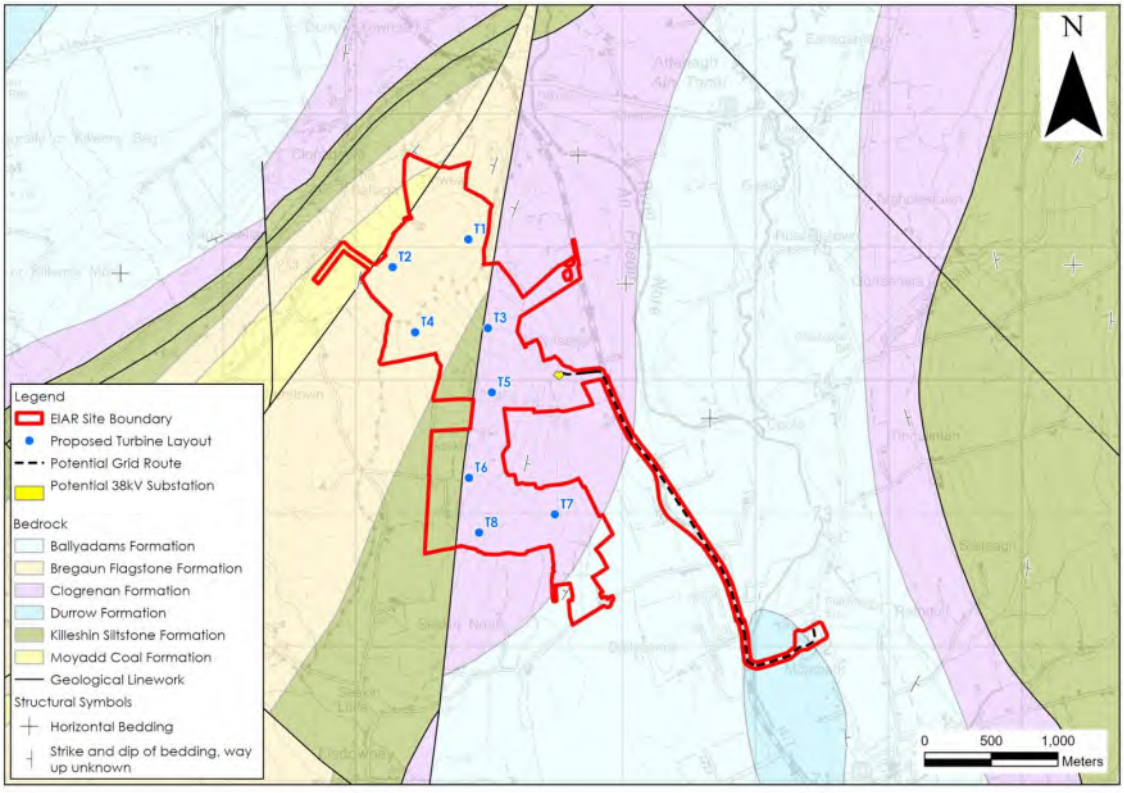

Figure D: Local Bedrock Geology Map (www.gsi.ie)

3.4 SITE DRAINAGE

3.4.1 Existing Site Drainage

The lack of surface water drainage features across the site, demonstrates a significant bias towards groundwater recharge through the soil and subsoil, rather than surface water runoff. There are only 2 no. watercourses which drain the area, the Archerstown stream and the Ballyconra stream, both of which are small 5th order streams with very low flow, neither of which are mapped within the Proposed Wind Farm Site. During several site visits there was no flow observed in these channels, while during times of heavy rainfall (November -December 2024), the flow was observed at between 1-2 l/s.

As groundwater recharge dominates across the site, the primary pathway for rainfall is via infiltration to the underlying groundwater aquifer.

A flow diagram for the existing drainage system is shown as **Figure E** below.

3.4.2 Proposed Site Drainage

Runoff control and drainage management are key elements in terms of mitigation against effects on the underlying groundwater aquifer and surface water courses. Two distinct methods will be employed to manage drainage water within the Proposed Development. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage and recharge patterns. The second method involves collecting any drainage/runoff waters from works areas within the Wind Farm site that might carry silt or sediment, and nutrients, to route them along collector drains within which recharge can occur, and outfall to infiltration areas and subsequent infiltration through the subsoil, or where infiltration to ground is not suitable, to route them towards new proposed silt traps and settlement ponds (or stilling ponds) prior to controlled diffuse release into the existing drainage network. There will be no direct discharges to the existing hydrological features (agricultural drains or natural watercourses).

During the construction phase, all runoff from works areas (i.e. dirty water) will be slowed down and treated to a high quality prior to being released. A schematic of the proposed site drainage management is shown as below.

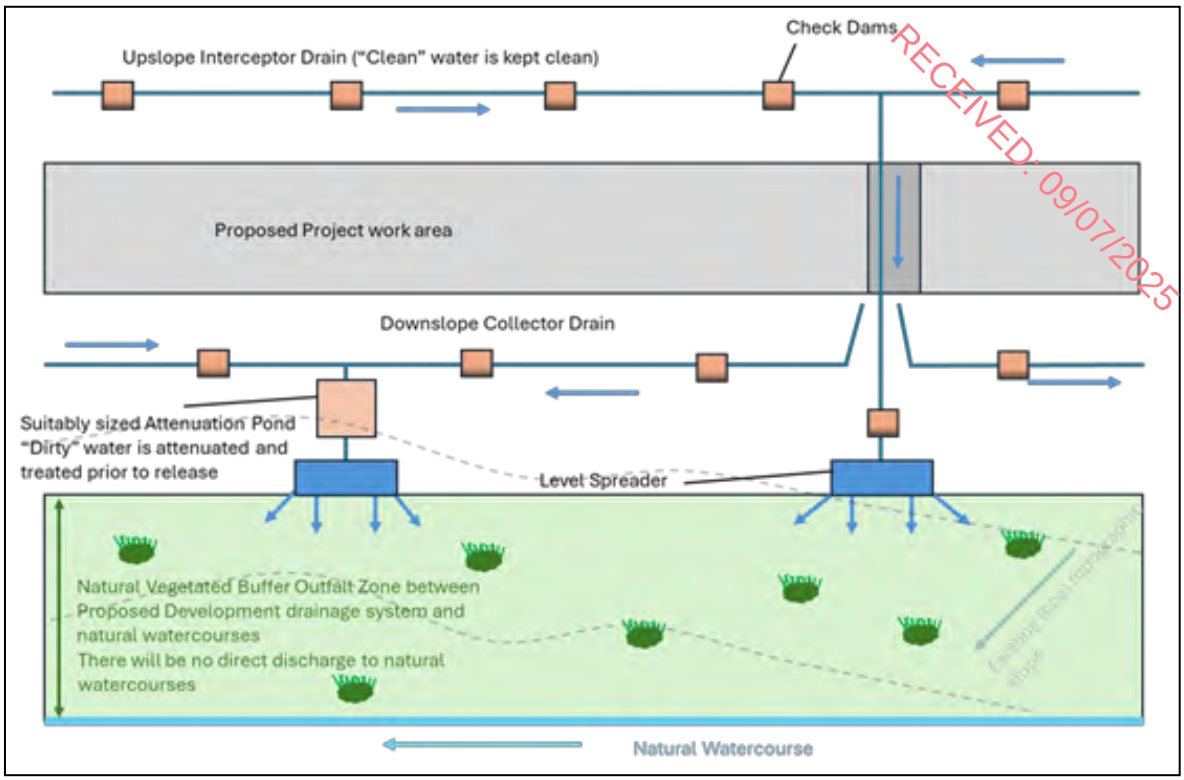

Plate A: Schematic of proposed site drainage management

3.5 DESIGNATED SITES & HABITATS

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

The closest designated site to the Proposed Wind Farm Site is the River Barrow and River Nore SAC (Site Code: 002162), which is situated 100m from the Proposed Grid Route along N77. The proposed Grid Connection runs adjacent to the River Barrow and River Nore SAC along the N77 national road. Rivers and streams that drain the Proposed Wind Farm site or the Proposed Grid Connection Route ultimately drain towards the River Barrow and River Nore SAC.

The River Nore/Abbeyleix Woods Complex pNHA (Site Code: 002076) and the River Nore SPA (Site Code: 004233) which are situated 100m east of the Proposed Grid Connection Route along N77.

Lisbigney Bog SAC/pNHA (Site Code: 000869) is located ~4.2km northeast of the Proposed Wind Farm Site. There is no surface water connection between the Proposed Wind Farm Site and Lisbigney Bog.

Cullahill Mountain SAC/pNHA (Site Code: 000831) is located ~5.8km to the west of the Proposed Wind Farm Site and there is no hydrological connection between this designated site and the Proposed Wind Farm Site.

The Spahill and Clomantagh Hill SAC/pNHA (Site Code: 000849) is located ~8.2km southwest of the Proposed Wind Farm site. There is no surface water connection between the Proposed Wind Farm Site and this SAC/pNHA.

Waterford Harbour pNHA (Site Code: 000787) is located downstream of the Proposed Project site within Waterford Harbour.

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following flood risk assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

4.2 FLOOD RISK ASSESSMENT PROCEDURE

This section of the report details the site-specific flood risk assessment carried out for the proposed windfarm Site and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the development. As per the relevant guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development; and,
- *Detailed flood risk assessment – quantitative appraisal of potential risk to a proposed development*.

As per the Guidelines, there are essentially two major causes of flooding:

Coastal flooding which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:

- High tide level;
- Storm surges caused by low barometric pressure exacerbated by high winds (the highest surges can develop from hurricanes); and,
- Wave action, which is dependent on wind speed and direction, local topography and exposure.

Due to its inland location, coastal flooding is not applicable to the Site.

Inland flooding which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:

- Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall and eventually enters a piped or natural drainage system.

- River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent low-lying areas (the floodplain). This can occur rapidly in short steep rivers or after some time and some distance from where the rain fell in rivers with a gentler gradient.

- Flooding from artificial drainage systems results when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity and the system becomes blocked, and / or cannot discharge due to a high water level in the receiving watercourse. This mostly occurs as a rapid response to intense rainfall. Together with overland flow, it is often known as pluvial flooding. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during recent summers.

- Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from interactions of site-specific factors such as tidal variations. While water level may rise slowly, it may be in place for extended periods of time. Hence, such flooding may often result in significant damage to property rather than be a potential risk to life.

- Estuarial flooding may occur due to a combination of tidal and fluvial flows, i.e. interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will prevent water flowing out to sea tending to increase water levels inland, which may flood over river banks.

The Flood Risk Management Guidelines provide direction on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management and the core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for inland and coastal flooding.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined within the guidelines:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and,

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Once a flood zone has been identified for a site, the guidelines set out the different types of development appropriate to each identified zone (pg 25, Table 3.1 of the Guidelines). Exceptions to the restriction of development due to potential flood risks are provided for through the application of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated by the applicant.

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes:

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. Plan making Justification Tests are made at Plan/Policy development stage such as County Development Plans, or Local Area Plans.

- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land. For example, application of Development Management Justification Test would be required at a site specific level, such as for this FRA assessment, if a Justification Test is required.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted. There are identifiable map texts along the River Nore that are mapped as 'liable to flood' in close proximity to the Proposed Grid Connection route. These areas labelled as 'liable to flood' do not encroach upon the Proposed Grid Connection Route.

4.3.2 Soils Maps - Fluvial Maps

A review of the soil types in the vicinity of the Proposed Wind Farm site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers, deposits of transported silts/clays referred to as alluvium build up within the flood plain and hence the presence of these soils is a good indicator of potentially flood prone areas.

Based on the EPA/GSI soil map for the local area, no fluvial or lacustrine deposits are mapped within the Proposed Wind Farm site. The closest Alluvium soil is mapped adjacent to the northern boundary of the Proposed Wind Farm Site. The Alluvium soil is also mapped in the area along the Nore river. The presence of these soils indicates areas where flooding may have occurred in the past.

4.3.3 OPW Past Flood Event Mapping

To identify those areas as being at risk of flooding, OPW's Past Flood Event mapping (www.floodinfo.ie) were consulted.

No recurring or historic flood incidents are recorded within the Proposed Wind Farm Site. There are some recurring floods in the lowlands that surround the Proposed Wind Farm Site, the closest of which is located ~0.85km to the northwest, within the flood zone of the River Nore (ID: 2657). The Laois Western Area Engineer – Minutes[2] dated 28/09/2005 states that the River Nore overflows its banks upstream of Tally Ho Bridge after heavy rainfall every year. More recurring floods are seen upstream and downstream of this point. There is a recurring flood zone located ~1.15km north of the Site in the townland of Durrow (ID:2676), The Laois Western Area Engineer – Minutes dated 28/09/2005 states that the Low lying land floods after heavy rainfall every year. The flooding has been exacerbated by recent development. The road is liable to flood and 1 no. property is affected. Water gushes into property from the road. There

[2] Meeting with Tom'OCarroll Area Engineer for Borris-in-Ossory 29/09/05

is also a recurring flood zone located ~2.2km downstream of the Proposed Wind Farm Site in the townland of Ballyragget within the flood zone of the River Nore (ID: 2813).

There are two historical flooding events mapped in townlands of Durrow Townparks located ~1.8 km north of the Proposed Wind Farm site dated 22/11/2017 (Flood ID: 13585) and 01/12/2015 (Flood ID: 13313). There is another historical flooding event mapped ~2.2km downstream of the Proposed Wind Farm Site in the townland of Ballyragget dated 06/11/2000 (Flood ID: 4803).

Historic and recurring flood events in the vicinity and downstream of the Site are shown on **Figure E** below.

No areas within the Proposed Wind Farm Site are mapped as an OPW Drainage District (i.e. an area where drainage schemes to improve land for agricultural purpose) or as Benefiting Lands (i.e. land identified by the OPW as potentially benefitting from the implementation of Arterial (Major) Drainage Schemes and an indicator of land subject to flooding and poor drainage).

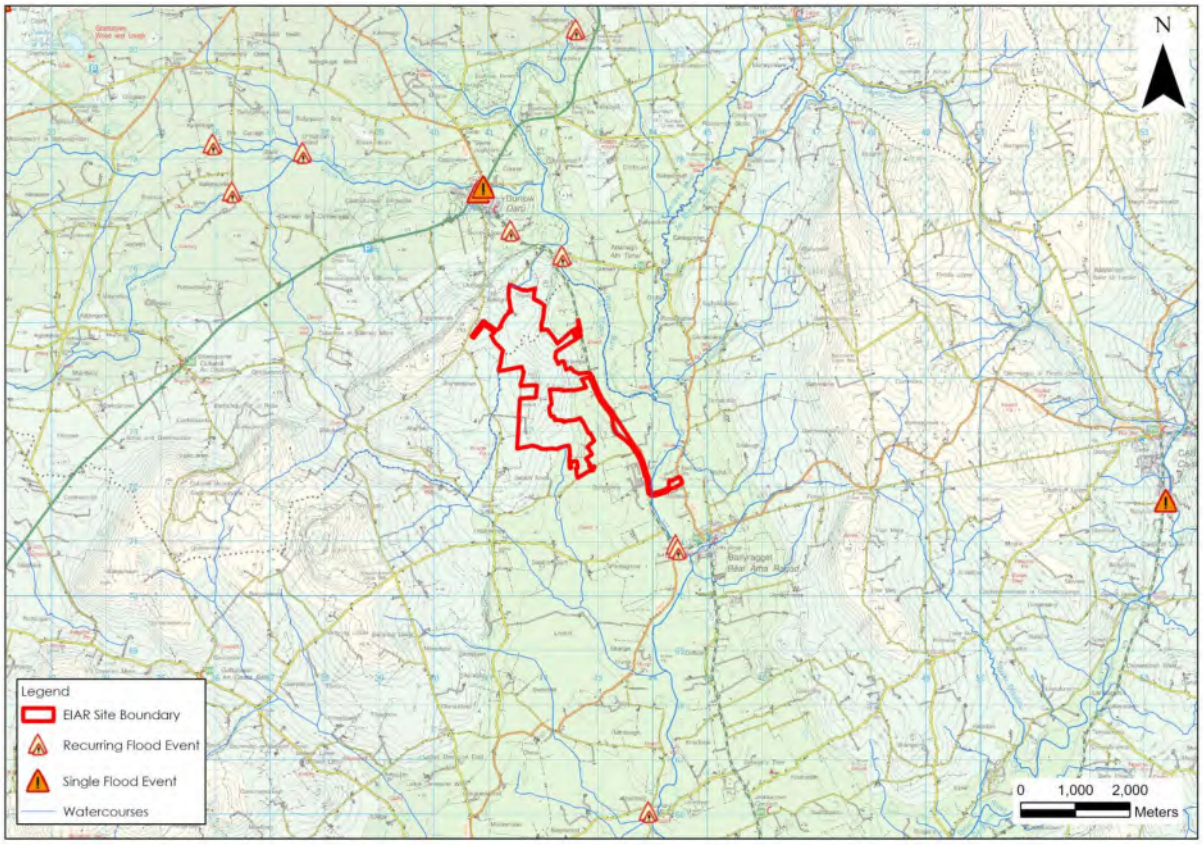

Figure E: OPW Past Flood Event Map

4.3.4 GSI Winter (2015/2016) Surface Water Flood Mapping

The GSI Winter (2015/2016) Surface Water Flooding Map[3] shows areas of fluvial and pluvial flood extents during the Winter 2015/2016 flood event, which was the largest recorded flood event in many areas.

The GSI Winter (2015/2016) Surface Water Flooding Maps do not show any areas within the Proposed Wind Farm Site as susceptible to flooding. The closest GSI Winter Surface Water

[3] GSI *Historical flood mapping principally developed using Sentinel-1 Satellite Imagery from the European Space Agency Copernicus Programme as well as any available historic records (from winter 2015/2016 or otherwise)*

Flooding is along the River Nore in the east of the Proposed Wind Farm Site. (Refer **Figure F** below). There is a very small area of historic groundwater flooding located along the western edge of the N77, however this is not noted on any past flood event mapping (refer to **Figure E**).

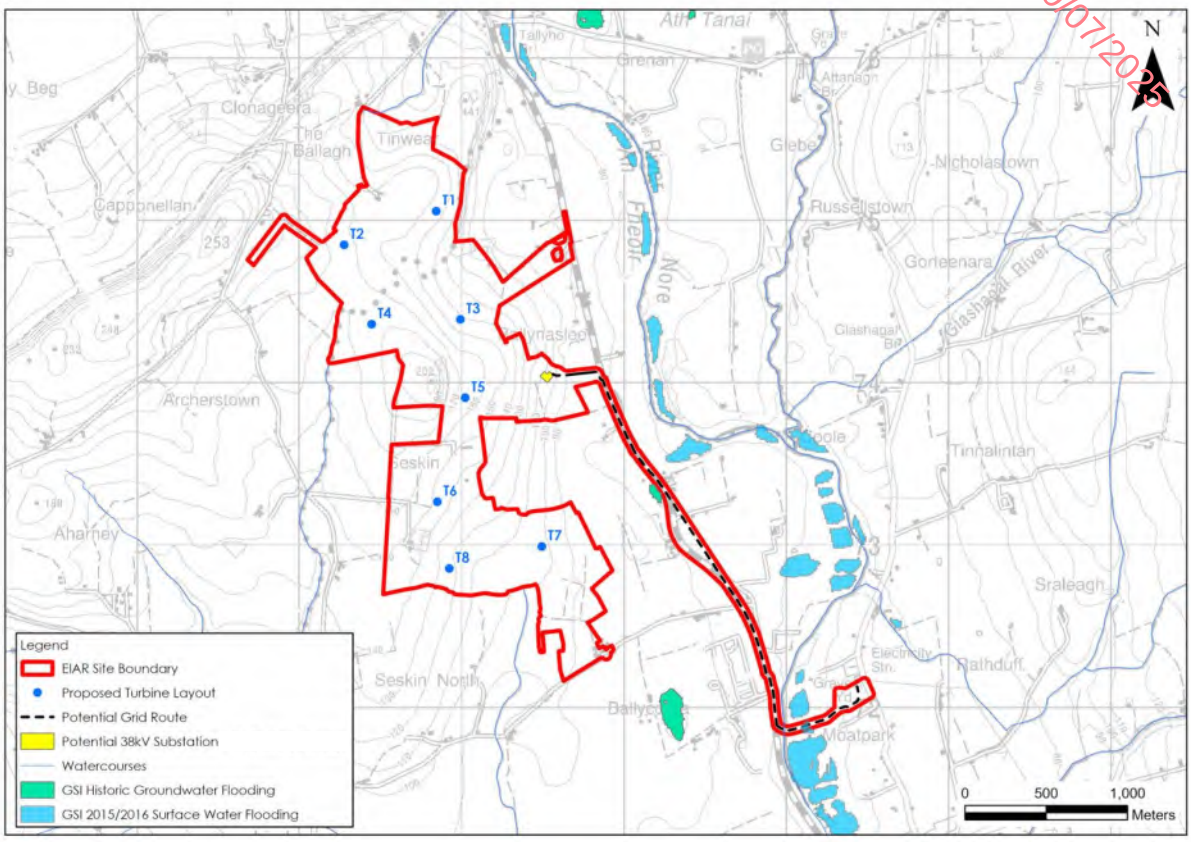

Figure F: GSI Winter 2015/2016 Surface Water Flood and Ground Water Flood Mapping

4.3.5 CFRAM Mapping – Fluvial and Pluvial Flooding

Catchment Flood Risk Assessment and Management (CFRAM)[4] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the previous PFRA maps.

CFRAM mapping has not been completed for the area of the Proposed Wind Farm Site. The closest CFRAM mapping to the Proposed Wind Farm Site has been completed to the east along the River Nore, which runs adjacent to and downstream of the Proposed Wind Farm Site. There is no CFRAM area mapped in the majority of the Proposed Grid Connection route expect for the area crossing the Nore River, where CFRAM fluvial flood zone is mapped.

4.3.6 National Indicative Fluvial Flood Mapping

National Indicative Fluvial Mapping (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme.

[4] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

The Present-Day Scenario has been generated using methodologies based on historic flood data and does not consider the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.3.9** below).

For the Present-Day Scenario, no medium (1 in 100) and low probability (1 in 1,000) fluvial flood zones have been mapped as encroaching upon the Proposed Wind Farm Site. The Proposed Wind Farm Site is mapped entirely within Fluvial Flood Zone C. The closest NIFM Fluvial flood zone is mapped ~1.2km east of the Proposed Wind Farm Site along the River Nore (EPA Code: 15N01).

A map showing the National Indicative Fluvial Mapping for the present-day scenario is included as **Figure G** below.

Based on the combined CFRAM and NIFM fluvial flood zones, the Proposed Wind Farm Site and the majority of the Proposed Grid Connection route are located in Fluvial Flood Zone C, where the probability of fluvial flooding is low (less than 0.1%) with a small area of the Proposed Grid Connection Route mapped in Flood Zone A and B, where it crosses the River Nore.

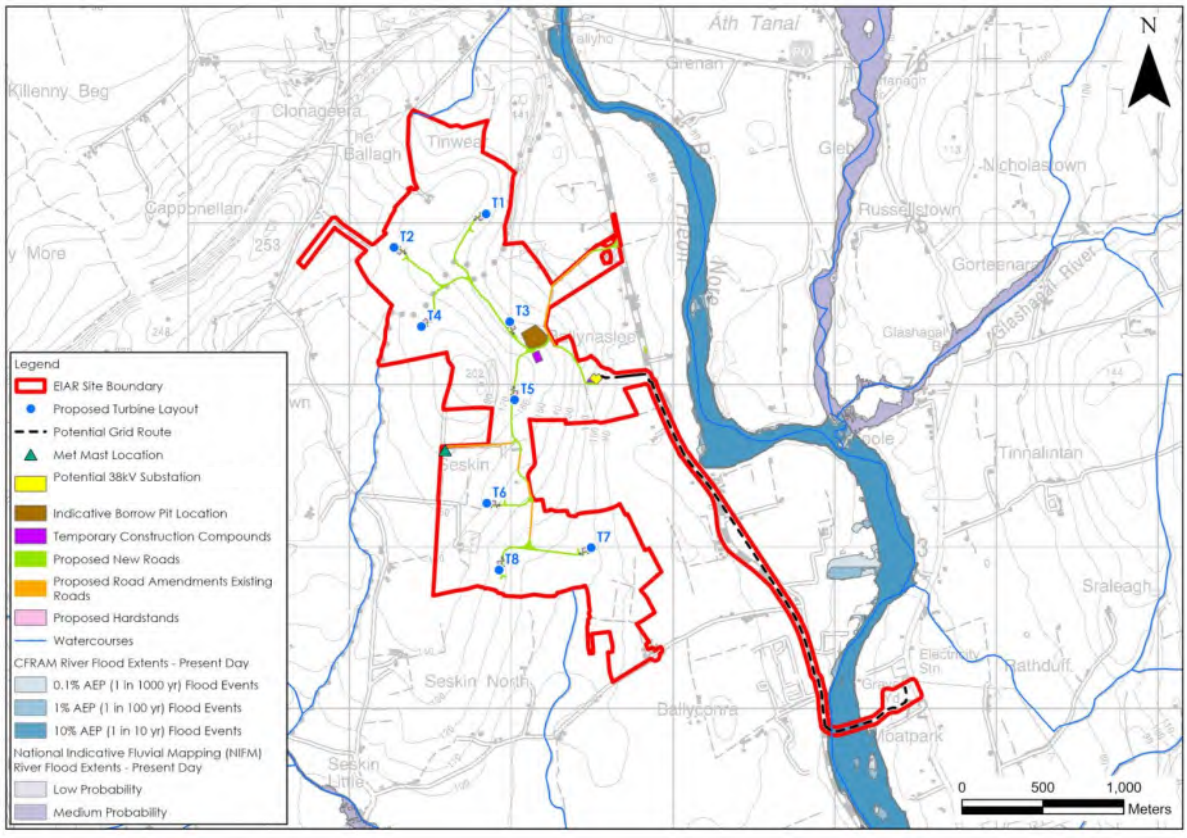

Figure G: OPW National Indicative Flood Mapping

4.3.7 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the Proposed Wind Farm Site or along the Proposed Grid Connection Route.

The closest historic and modelled groundwater flood extents are located ~1km northeast of the Proposed Wind Farm Site in the townlands of Grenan.

4.3.8 Coastal Flooding

The Site is located at elevations of ~150-200mOD and is ~70km from the coast. Therefore, the Proposed Development is not at risk of coastal (tidal) flooding.

4.3.9 Climate Change

Fluvial flood modelling has also been completed to consider future climate scenarios where the potential effects of climate change can increase rainfall.

The National Indicative Fluvial Flood Mapping Mid-Range Future Scenario models flood extents based on a 20% increase in rainfall. Similarly, the National Indicative Fluvial Flood Mapping High-End Future Scenario models flood extends based on a 30% increase in rainfall. Both of these modelled flood extents show similar flood zones to the Present Day Scenario discussed above in **Section 4.3.6.** Therefore, flood zones at the Proposed Wind Farm Site are unlikely to be significantly impacted by future climate change.

The CFRAM flood mapping has also been completed for the Mid-Range and High-End Future Scenarios. Both of these modelled flood extents show similar flood zones to the Present Day Scenario discussed above in **Section 4.3.5**. Therefore, flood zones at the Proposed Wind Farm Site are unlikely to be significantly impacted by future climate change.

4.3.10 Summary – Flood Risk Identification

Based on the information gained through the flood identification process it is apparent that the Proposed Wind Farm Site and the Proposed Grid Connection Route is located in Fluvial Flood Zone C except for the small area of the Proposed Grid Connection Route along the River Nore, where the Grid Connection crosses the river, which is mapped as Flood Zone A and B.

4.4 INITIAL FLOOD RISK ASSESSMENT

4.4.1 Site Survey and Drainage

Detailed walkover surveys of the Site and the surrounding areas was undertaken by HES between November 2024 and April 2025.

The Proposed Wind Farm site is drained by several first or second order streams which emerge from within the development landholding. These streams include the Ballyconra Stream, and Archerstown Stream, which ultimately discharge to the Lisdowney Stream

Three rounds of surface water flow monitoring were carried out at the main streams draining the wind farm site and the results are shown in **Table B** below. The measured flows are typical of seasonal flows for first/second order.

Table B: Surface Water Flow Monitoring

Location/Date	01/11/2024	09/04/2025
	Flow (l/sec)	Flow (l/sec)
SW1	1	Dry
SW2	1.5	0.5
SW4	1	Dry

4.4.2 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the Proposed Wind Farm Site and the Proposed Grid Connection Route can be described using the Source – Pathway – Receptor Model ("S-P-R"). The primary potential source of flooding in this area, and the one with most consequence for the Proposed Wind Farm Site and the Proposed Grid Connection Route, is fluvial. The primary potential pathways, in the most likely order of significance, would be overbank flooding of the River Nore and its tributaries during significant rainfall events. The potential receptors in the area are infrastructure and land as outlined below.

4.4.3 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process, flooding is unlikely to be problematic at the Proposed Wind Farm Site or downstream. The potential sources of flood risk for the Proposed Wind Farm Site are outlined and assessed in **Table C**.

Table C. S-P-R Assessment of Flood Sources for the Proposed Wind Farm Site.

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the rivers and streams that are close to some of the wind farm infrastructures and the rivers and streams that flow throughout the Proposed Wind Farm Site	Land & infrastructure	The Proposed Wind Farm Site and the majority of the Proposed Grid Connection Route is located in Fluvial Flood Zone C with some areas of the Proposed Grid Connection Route mapped in Fluvial Flood Zones.
Pluvial	Ponding of rainwater on Proposed Wind Farm Site	Land & infrastructure	There is very little risk of pluvial flooding within the Proposed Wind Farm Site as drainage moves relatively freely due to the site recharge rates and the sloping topography of the Proposed Wind Farm site. CFRAM have no pluvial flood areas mapped at the Proposed Wind Farm Site.
Surface water	Surface ponding/ Overflow	Land & infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land & infrastructure	Based on local hydrogeological regime and GSI mapping, there is no risk of groundwater flooding at the Proposed Wind Farm Site.
Coastal/tidal	Overbank flooding	Land, People, property	The Proposed Wind Farm Site is located ~70km inland from the sea. So no coastal flooding will be possible.

4.5 REQUIREMENT FOR A JUSTIFICATION TEST

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test[5] is shown in **Table D** below.

It may be considered that the Proposed Wind Farm Site can be categorised as "Highly Vulnerable Development". However, as stated above, the Proposed Wind Farm Site and the majority of the Proposed Grid Connection Route is located in Flood Zone C (Low Risk) except for a small area on the Proposed Grid Connection Route which is located in Flood Zone A and B, where the Grid Connection route crosses the River Nore.

Based on the above, a Justification Test will be required if any infrastructure associated with the Proposed Wind Farm Site or the Proposed Grid Connection Route is to be located within the mapped flood zones. If required, this Justification Test will be presented in subsequent iterations of this FRA.

Table D: Matric of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	**Justification test**	**Justification test**	**Appropriate**
Less vulnerable development	Justification test	Appropriate	Appropriate
Water Compatible development	Appropriate	Appropriate	Appropriate

Note: *Taken from Table 3.2 (DoEHLG, 2009)*
Bold: *Applies to this project.*

Box 5.1 (Table E: Format of Justification Test for Development Management) of "The Planning System and Flood Risk Management Guidelines" (PSFRM Guidelines) outlines the criteria required to complete the "Justification Test".

Table E: Format of Justification Test for Development Management

Box 5.1 Justification Test for Development Management (to be submitted by the applicant)
When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied: 1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines. 2. The proposal has been subject to an appropriate flood risk assessment that demonstrates: i. The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk; ii. The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible; iii. The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and

[5] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

iv. The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: *this table has been adapted from Box 5.1 of "The Planning System and Flood Risk Management Guidelines", (2009).*

Referring to Point 1 and Points 2 (i) to (iv) inclusive:

The Proposed Wind Farm Site and majority of the Proposed Grid Connection Route is not located in mapped fluvial flood zones except for small area of the Proposed Grid Connection Route along the Nore River.

No displacement of floodwaters will result from the emplacement of the Proposed Grid Connection Route. This will be achieved by directional drilling and there will be no in-stream works or alteration of the existing hydromorphological regime.

During the construction phase, works at these locations may be postponed in the event of flooding.

1. The Proposed Wind Farm Site and the Proposed Grid Connection Route has been the subject of a flood risk assessment (this report) and the following has been determined:

   i. Due to the relatively small footprint of the Proposed Development (~7ha) and given that the only portion of the Proposed Grid Connection Route that is located within modelled flood zones is at an a proposed horizontal directional drilling watercourse crossing location (river Nore), the Proposed Development is predicted to have no impact on flood water levels downstream. No increase in downstream flood risk will occur.
   ii. All proposed turbines and all other site infrastructure are located outside of the flood zones. These measures will mitigate against any potential disruption to the natural hydrology of the Proposed Wind Farm site. No increase in flood risk to people, property, the economy or the environment during extreme flood events as a result of the Proposed Development is predicted due to the appropriate design measures which will result in unmeasurable/imperceptible upstream and downstream effects;
   iii. The Proposed Grid Connection Route crossing of the River Nore is located within the modelled flood zone, but this will not have an effect on flood levels. This crossing will be achieved by horizontal directional drilling. Therefore, there will be no displacement of flood waters;
   iv. The Proposed Development is compatible with the wider planning objectives of the area, including the provision of wind energy developments at appropriate locations and the proper planning and sustainable development of the area.

5. FLOOD IMPACT PREVENTION AND DRAINAGE MANAGEMENT

5.1 RELEVANT LOCAL AUTHORITY GUIDANCE AND POLICIES

The following policies are defined in the Kilkenny City and County Council Development Plan (2021-2027) (**Table F**) and Laois County Council Development Plan (2021-2027) (**Table G**) in respect of flooding, and we have outlined in the column to the right how these policies are provided for within the Proposed Wind Farm Site design:

Table F: Kilkenny Development Management Requirements on flooding and reference to relevant sections of this FRA report

Section	Development Management Requirements	Response
10.2.6.2	Where flood risk may be an issue for any proposed development, a detailed flood risk assessment should be carried out appropriate to the scale and nature of the development and the risks arising. In particular, any area within or adjoining flood zone A or B, or flood risk area, shall be the subject of a site-specific Flood Risk Assessment appropriate to the type and scale of the development being proposed. This shall be undertaken in accordance with the Planning System and Flood Risk Management – Guidelines and the Strategic Flood Risk Assessment accompanying this Plan.	As outlined in this FRA
10.2.6.2	If a Site specific FRA demonstrates an unmanageable level of flood risk and/or impacts to 3rd party lands, development cannot proceed.	Not applicable as there is no such risk anticipated
10.2.6.2	Proposals for mitigation and management of flood risk will only be considered where avoidance is not possible and where development can be clearly justified with the Guidelines' Justification Test.	As outlined in this FRA and **Section 4.5 above**.

Table G: Laois CDP Policy on flooding and reference to relevant sections of this FRA report

CDP Policy Number:	Policy	Response
FRM 1	Ensure that flood risk management is incorporated into the preparation of all local area plans through the Preparation in accordance with the requirements of the Planning System and Flood Risk Management – Guidelines for Planning Authorities (DoEHLG 2009)	As outlined in this FRA
FRM 2	Ensure that all development proposals comply with the requirements of the Planning System and Flood Risk Management - Guidelines for Planning Authorities' (DEHLG 2009) and to ensure that the Justification Test for Development Management is applied to required development proposals and in accordance with methodology set out in the guidelines and new development does not increase flood risk elsewhere, including that which may arise from surface water runoff.	As outlined in this FRA
FRM 3	Support the implementation of recommendations in the CFRAM Programme to ensure that flood risk management policies and infrastructure are progressively implemented.	As outlined in this FRA, the Proposed Wind Farm Site is not located in the CFRAM
FRM 4	Support the implementation of recommendations in the Flood Risk Management Plans (FRMP's), including	As outlined in this FRA

	planned investment measures for managing and reducing flood risk	
FRM 5	Consult with the OPW in relation to proposed developments in the vicinity of drainage channels and rivers for which the OPW are responsible, and to retain a strip on either side of such channels where required, to facilitate maintenance access thereto.	As outlined in this FRA and **Section 4.3.3** no area of the Proposed Wind Farm Site is mapped as OPW drainage district
FRM 6	Assist the OPW in developing catchment – based Flood Risk Management Plans for rivers in County Laois and have regard to their provisions/recommendations.	As outlined in this FRA and **Section 4.3.3**, no area of the Proposed Wind Farm Site is mapped as OPW drainage district
FRM 7	Protect and enhance the County's floodplains and wetlands as 'green infrastructure' which provides space for storage and conveyance of floodwater, enabling flood risk to be more effectively managed and reducing the need to provide flood defenses in the future, subject to normal planning and environmental criteria	As outlined in this FRA the Proposed Wind Farm Site is not located in any flood plains and there is no flood risk.
FRM 8	Protect the integrity of any formal (OPW or Laois County Council) flood risk management infrastructure, thereby ensuring that any new development does not negatively impact any existing defense infrastructure or compromise any proposed new infrastructure	As outlined in this FRA the Proposed Wind Farm Site is not located in vicinity of the flood risk management structure.
FRM 9	Ensure that where flood risk management works take place that the natural and cultural heritage, rivers, streams and watercourses are protected and enhanced	Will be ensured
FRM 10	Ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the OPW Climate Change Sectoral Adaptation Plan Flood Risk Management applicable at the time	As outlined in this FRA and **Section 4.3.9**
FRM 11	Consult, where necessary, with Inland Fisheries Ireland, the National Parks and Wildlife Service and other relevant agencies in the provision of flood alleviation measures in the County	Not applicable
FRM 12	Prioritise plans for flood defence works in the towns as indicated in the Strategic Flood Risk Assessment in order to mitigate against potential flood risk	As outlined in this FRA
FRM 13	Ensure new development does not increase flood risk elsewhere, including that which may arise from surface water runoff.	As outlined in this FRA
FRM 14	Protect water sinks because of their flood management function, as well as their biodiversity and amenity value and encourage the restoration or creation of water sinks as flood defence mechanisms, where appropriate.	Not applicable

5.2 PROPOSED DRAINAGE

The site drainage system was designed integrally with the wind farm layout as a measure to ensure that the proposal will not change the existing flow regime across the site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from wind farm related sediment runoff.

Runoff control and drainage management are key elements in terms of mitigation against effects on the underlying groundwater aquifer and surface water courses. Two distinct methods will be employed to manage drainage water within the Proposed Development. The

first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage and recharge patterns. The second method involves collecting any drainage/runoff waters from works areas within the Wind Farm site that might carry silt or sediment, and nutrients, to route them along collector drains within which recharge can occur, and outfall to infiltration areas and subsequent infiltration through the subsoil, or where infiltration to ground is not suitable, to route them towards new proposed silt traps and settlement ponds (or stilling ponds) prior to controlled diffuse release into the existing drainage network. There will be no direct discharges to the existing hydrological features (agricultural drains or natural watercourses).

The resultant diversion of clean water runoff will ensure that the treatment system will only need to deal with construction related runoff. The treatment system consists of a series of settlement ponds that are located at each works site and at intervals along the access roads. The outflow from the settlement ponds will be allowed to disperse across vegetation and will become diluted through contact with the clean water runoff in the buffer areas before entering the downstream watercourses.

5.3 PROPOSED ON-SITE RUNOFF ATTENUATION

The creation of impermeable areas within a development site has the effect of increasing rates of runoff into the downstream drainage system and this may increase flood risk and flood severity downstream. This applies particularly to urban areas that drain to closed pipe systems which do not have the capacity to cater for increased hydraulic loads. The proposed Seskin Renewables Wind Farm development is located within a large rural catchment with an open drainage system. The footprint of the impermeable areas and the associated increase in runoff rate is very small in the context of the catchment size and therefore represents a negligible increase in downstream flood risk. Notwithstanding the low increase in flood risk due to the development, the drainage system has been designed to prevent any increase in discharge rates above that which already exist in the undeveloped site.

Due to the high recharge rate in existence at the site, and the dominance of groundwater recharge over surface water runoff, the effect of impermeable surfaces is expected to be limited, with pathways for surface water runoff being only several metres over the relatively impermeable surfaces, before this runoff can effectively infiltrate to ground through the drainage process described in **Plate A**.

5.4 FLOOD IMPACT SCREENING FOR DESIGNATED SITES

Table H provides a flood impact screening for local designated sites.

Table H: Flood Impact Screening for Local Designated Sites

Name	Site Code	Flood Risk Screening
River Barrow and River Nore SAC	002162	No increased flood risk, small development footprint and attenuation proposals outlined above.
River Nore SPA	004233	No increased flood risk, small development footprint and attenuation proposals outlined above.
River Nore/Abbeyleix Woods Complex pNHA	002076	No increased flood risk, small development footprint and attenuation proposals outlined above.
Lisbigney Bog SAC/pNHA	000869	No increased flood risk, small development footprint and attenuation proposals outlined above.
Cullahill Mountain SAC/pNHA	000831	No increased flood risk, small development footprint and attenuation proposals outlined above.
River Shannon and Fergus Estuary SAC	004077	No increased flood risk, small development footprint and attenuation proposals outlined above.

6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the proposed Seskin Renewables Wind Farm. From this study:
    - No instances of historical flooding within the Site were identified in historic OS maps;
    - No instances of recurring or historic flooding were identified on OPW maps within the Site;
    - No instances of recurring flood incidents were identified on OPW maps immediately downstream of Site;
    - The proposed development site is not identified within the OPW/CFRAM Flood Zones; and,
    - The Proposed Wind Farm is not located within any National Indicative Fluvial Flood Zones. There is a small section of the Proposed Grid Connection Route located within mapped Flood Zones A & B, where the Proposed Grid Connection cross the River Nore. This has been addressed and justified within Section 4.5 and in Section 5 above.
- During the walkover surveys and flow monitoring at the site there was no evidence of out of bank flow from within the various stream/river channels. No widespread or even localized flooding was observed during these site visits;
- The Proposed Wind Farm can be categorised as "Highly Vulnerable Development", however, the proposed infrastructure is located outside of areas mapped as Flood Zones and therefore the Proposed Development is appropriate from a flood risk perspective;
- The overall risk of flooding posed at the Site is estimated to be very low. A low risk would typically relate to the probability of being impacted by a 1000-year flood (*i.e.* the entire area of the Proposed Development footprint is located in fluvial Flood Zone C). The flooding risk at the Site has an estimated AEP of <0.1%.
- In addition, the risk of the Proposed Development contributing to downstream flooding is also very low, as the long-term plan for the site is to retain and slow down drainage water rates prior to release . Robust drainage measures on the site will include swales, silt traps, check dams, settlement ponds and buffered outfalls. Please refer to the Chapter 9 of the EIAR for further details.

* *

7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
Natural Environment Research Council	1975	Flood Studies Report (& maps).
Cunnane & Lynn	1975	Flood Estimated Following the Flood Studies Report
Cawley, A.	1990	*The Hydrological Analysis of a Karst Aquifer System*. B.E., National University of Ireland.
CIRIA	2004	Development and Flood Risk – Guidance for the Construction Industry.
OPW	Not Dated	Construction, Replacement or Alteration of Bridges and Culverts. A Guide to Applying for Consent under Section 50 of the Arterial Act, 1945.
Institute of Hydrology	1994	Flood Estimation in Small Catchments.
Fitzgerald & Forrestal	1996	Month and Annual Averages of Rainfall for Ireland 1961 – 1990.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
Kilkenny County Council	2021	Kilkenny City and County Council Development Plan (2021-2027)
Laois County Council	2022	Laois County Council Development Plan (2021-2027)

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APPENDIX 9-2

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Customer	*Adam Keegan* *Hydro-Environmental Services* *22 Lower Main Street* *Dungarvan* *Co Waterford*	Lab Report Ref. No.	7820/2504072/01
		Date of Receipt	10/04/2025
		Sampled On	*09/04/2025*
		Date Testing Commenced	10/04/2025
		Received or Collected	By Fitz Pick up: Larry Commin
		Condition on Receipt	Acceptable
Customer PO	*P1653*	Date of Report	24/04/2025
Customer Ref	*Seskin DW1*	*Sample Type*	*Ground Water*
Ref 2			
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Bicarbonate (CaCO3)	102	Colorimetry	121.2	mg/L CaCO3	
**Calcium (Ground Water)	184	ICPMS	27.4	mg/L	INAB
Chloride (Ground Water)	100	Colorimetry	30	mg/L	INAB
**Iron (Ground Water)	177	ICPMS	8	ug/L	INAB
**Magnesium (Ground Water)	184	ICPMS	14.8	mg/L	INAB
**Manganese (Ground Water)	177	ICPMS	17	ug/L	INAB
Nitrate (Ground Water)	103	Colorimetry	1	mg/L as N	INAB
**Nitrite (Ground Water)	118	Colorimetry	<0.01	mg/L as N	INAB
pH (Ground Water)	110	Electrometry	8.33	pH Units	INAB
**Phosphate (Ortho) Ground Water	117	Colorimetry	0.01	mg/L as P	INAB
**Potassium (Ground Water)	184	ICPMS	3	mg/L	INAB
**Sodium (Ground water)	184	ICPMS	19	mg/L	INAB
Solids (Total Suspended)	106	Gravimetry	<5	mg/L	
Sulphate (Ground Water)	119	Colorimetry	14	mg/L as SO4	INAB

Signed: A Harmon **Date: 24/04/2025**

Aoife Harmon - Laboratory Supervisor

Acc. : Accredited Parameters by ISO/IEC 17025:2017

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All organic results are analysed as received and all results are corrected for dry weight at 104 C
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Customer	*Adam Keegan* *Hydro-Environmental Services* *22 Lower Main Street* *Dungarvan* *Co Waterford*	Lab Report Ref. No.	7820/2504072/02
		Date of Receipt	10/04/2025
		Sampled On	*09/04/2025*
		Date Testing Commenced	10/04/2025
		Received or Collected	By Fitz Pick up: Larry Commin
		Condition on Receipt	Acceptable
Customer PO	*P1653*	Date of Report	24/04/2025
Customer Ref	*Seskin MW4*	*Sample Type*	*Ground Water*
Ref 2			
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Bicarbonate (CaCO3)	102	Colorimetry	276.5	mg/L CaCO3	
**Calcium (Ground Water)	184	ICPMS	122.8	mg/L	INAB
Chloride (Ground Water)	100	Colorimetry	15	mg/L	INAB
**Iron (Ground Water)	177	ICPMS	1421	ug/L	INAB
**Magnesium (Ground Water)	184	ICPMS	7.5	mg/L	INAB
**Manganese (Ground Water)	177	ICPMS	183	ug/L	INAB
Nitrate (Ground Water)	103	Colorimetry	10	mg/L as N	INAB
Nitrite (Ground Water)	118	Colorimetry	<0.01	mg/L as N	INAB
pH (Ground Water)	110	Electrometry	7.25	pH Units	INAB
**Phosphate (Ortho) Ground Water	117	Colorimetry	0.01	mg/L as P	INAB
**Potassium (Ground Water)	184	ICPMS	1.6	mg/L	INAB
**Sodium (Ground water)	184	ICPMS	6.1	mg/L	INAB
Solids (Total Suspended)	106	Gravimetry	123	mg/L	
Sulphate (Ground Water)	119	Colorimetry	9	mg/L as SO4	INAB

Signed: A Harmon **Date: 24/04/2025**

Aoife Harmon - Laboratory Supervisor

Acc. : Accredited Parameters by ISO/IEC 17025:2017

For bacterial analysis a result of 0 means none detected in volume examined
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Dungarvan
Co. Waterford.
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Certificate Code: AR-24-M3-020457-01
Page Number: Page 1 of 1
PO reference:

Certificate of Analysis

Sample number	966-2024-00023381	Received on	21/08/2024
		Analysis started on	21/08/2024
Your sample reference	Seskin FZ		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	16/08/2024
Time Sampled	12:30		

Test Code / Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Hardness as CalciumCarbonate (Calc) - Trace [M303N]								
Hardness as Calcium Carbonate		04/09/24 15:50	EW188	2.5		103	mg/l	
pH (Robotic Method) [M3051]								
pH		21/08/24 16:50 [7D]	EW152R	4		7.6		
Conductivity at 20°C (Robotic Method) [M3052]								
Conductivity at 20°C		21/08/24 16:50	EW152R	5		260	µS/cm	C6
Alkalinity as CaCO3 [M30D3]								
Alkalinity as CAC03		21/08/24 13:45	EW175	30		113	mg/l	
Alkalinity Bicarbonate as HCO3 [M30F7]								
Alkalinity Bicarbonate as HCO3		04/09/24 15:50	EW175	30		138	m/l	
Calcium - Trace [M3241]								
Calcium		26/08/24 15:01		1.08		41.1	mg/l	C6

[4] Accreditiation Information

C6: ISO/IEC 17025:2017 INAB 138-T

Signed: 04/09/2024

Aoife De Barra - Organics & Instrumentation Team Lead

NOTES

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2. SPEC = Allowable limit or parametric value.
3. LOQ = Limit of Quantification or lowest value that can be reported.
4. ACCRED = Indicates accreditation for the test, a blank field indicates not accredited.
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6. The sampling date was not communicated; this may impact the validity of the results unless provided.
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Email: ASTsupport@etuki.eurofins.com

Client: Hydro-Environmental Services
22
Lower Main Street
Dungarvan
Co. Waterford.
Waterford
IRELAND

Certificate Code: AR-24-M3-020457-01
Page Number: Page 1 of 1
PO reference:

Certificate of Analysis

Sample number	966-2024-00023381	Received on	21/08/2024
		Analysis started on	21/08/2024
Your sample reference	Seskin FZ		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	16/08/2024
Time Sampled	12:30		

Test Code / Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Hardness as CalciumCarbonate (Calc) - Trace [M303N]								
Hardness as Calcium Carbonate		04/09/24 15:50	EW188	2.5		103	mg/l	
pH (Robotic Method) [M3051]								
pH		21/08/24 16:50 [7D]	EW152R	4		7.6		
Conductivity at 20°C (Robotic Method) [M3052]								
Conductivity at 20°C		21/08/24 16:50	EW152R	5		260	µS/cm	C6
Alkalinity as CaCO3 [M30D3]								
Alkalinity as CAC03		21/08/24 13:45	EW175	30		113	mg/l	
Alkalinity Bicarbonate as HCO3 [M30F7]								
Alkalinity Bicarbonate as HCO3		04/09/24 15:50	EW175	30		138	m/l	
Calcium - Trace [M3241]								
Calcium		26/08/24 15:01		1.08		41.1	mg/l	C6

[4] Accreditiation Information

C6: ISO/IEC 17025:2017 INAB 138-T

Signed: 04/09/2024

Aoife De Barra - Organics & Instrumentation Team Lead

NOTES

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CERTIFICATE OF ANALYSIS

ALS Life Sciences Ltd.,
Carrigeen Business Park Clonmel Co. Tipperary E91 PF63 Ireland
Telephone: +353 (0) 52 617 8100
www.alsglobal.ie

Hydro Environmental Services
Hydro Environmental Services
22 Lower Main Street
Dungarvan, Co. Waterford
Ireland

Certificate Number: CLN023699-1 Final
Date Reported: 17/04/2025
Date Analysis Started: 10/04/2025

Lab Ref.	Sample Details	Method Number	Test	Result	Units	Flag
CLN74806	Prod: Rcvd Dt: 10/04/2025 Start Testing: 10/04/2025 Description: Seskin SW1 Spt: Water Sample Type: Ground Waters	P280	BOD 5 day Total with ATU	6	mg/L O_2	
		P202	Suspended Solids	<5	mg/L	
		P281	Chloride	10.5	mg/L Cl	
		P285	Total Nitrogen	1.6	mg/L N	
		P281	Total Oxidised Nitrogen (TON)	0.43	mg/L N	
		P281	Ammonia	<0.02	mg/L NH_3-N	
		P281	Nitrate	<5.0	mg/L NO_3	
		P281	Nitrite	<0.05	mg/L NO_2	
		P207	Total Phosphorus	0.13	mg/L P	
		P293	Orthophosphate	<0.02	mg/L P	
CLN74807	Prod: Rcvd Dt: 10/04/2025 Start Testing: 10/04/2025 Description: Seskin SW2 Spt: Water Sample Type: Ground Waters	P280	BOD 5 day Total with ATU	<2	mg/L O_2	
		P202	Suspended Solids	10	mg/L	
		P281	Chloride	29.8	mg/L Cl	
		P285	Total Nitrogen	3.2	mg/L N	
		P281	Total Oxidised Nitrogen (TON)	2.26	mg/L N	
		P281	Ammonia	0.02	mg/L NH_3-N	
		P281	Nitrate	10.2	mg/L NO_3	
		P281	Nitrite	<0.05	mg/L NO_2	
		P207	Total Phosphorus	0.15	mg/L P	
		P293	Orthophosphate	0.06	mg/L P	

Certificate approved and electronically signed on 17/04/25 15:05
By Ciara Gildea, Senior Environmental Chemistry Analyst

For and on Behalf of ALS Life Sciences Ltd

Disclaimers:

The testing results in this certificate relate only to the samples described above.
Unless otherwise stated, all results are expressed on an as received basis.
Statement of conformity made against the result does not take into account the uncertainty of measurement associated to the method.
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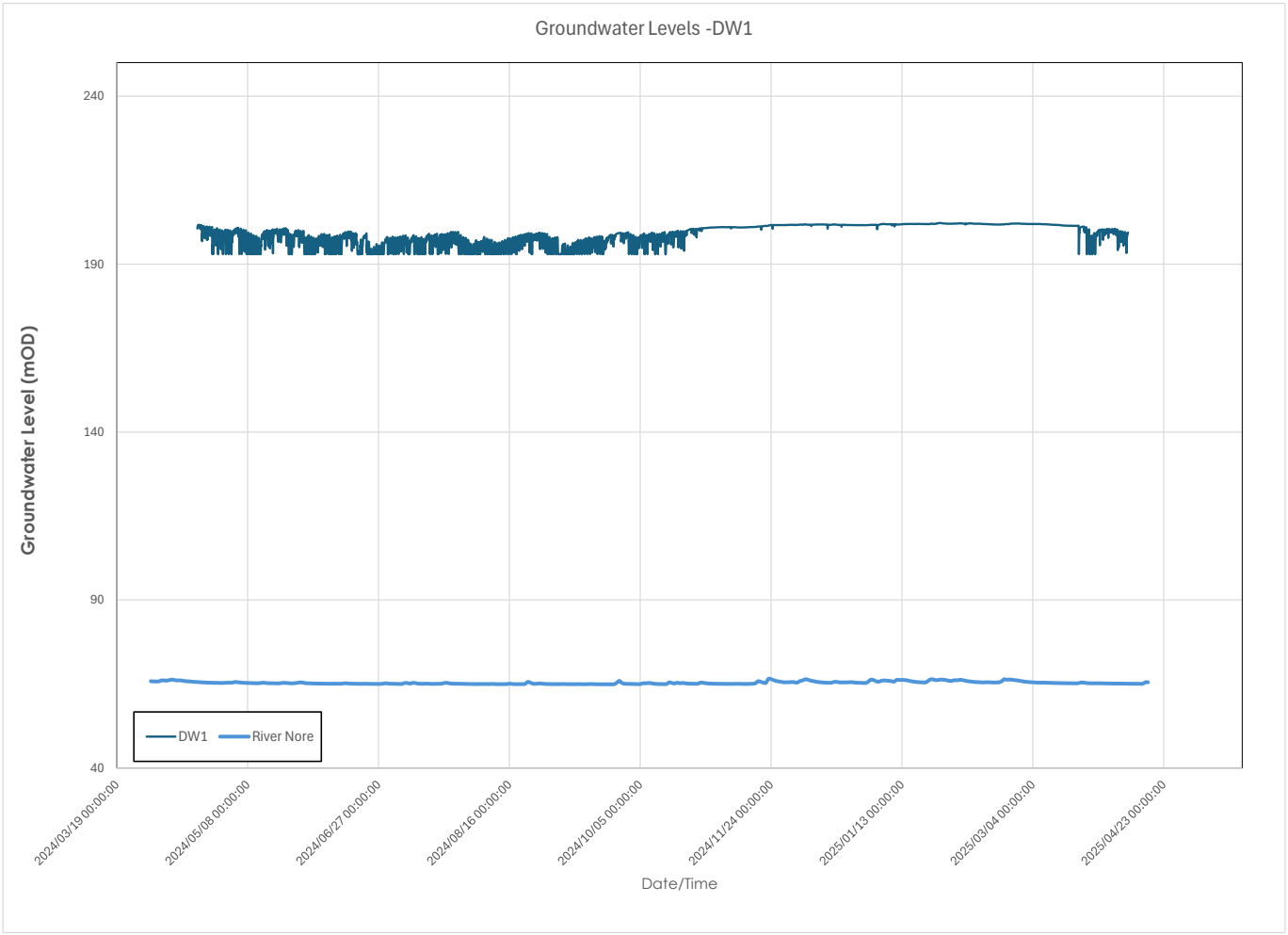
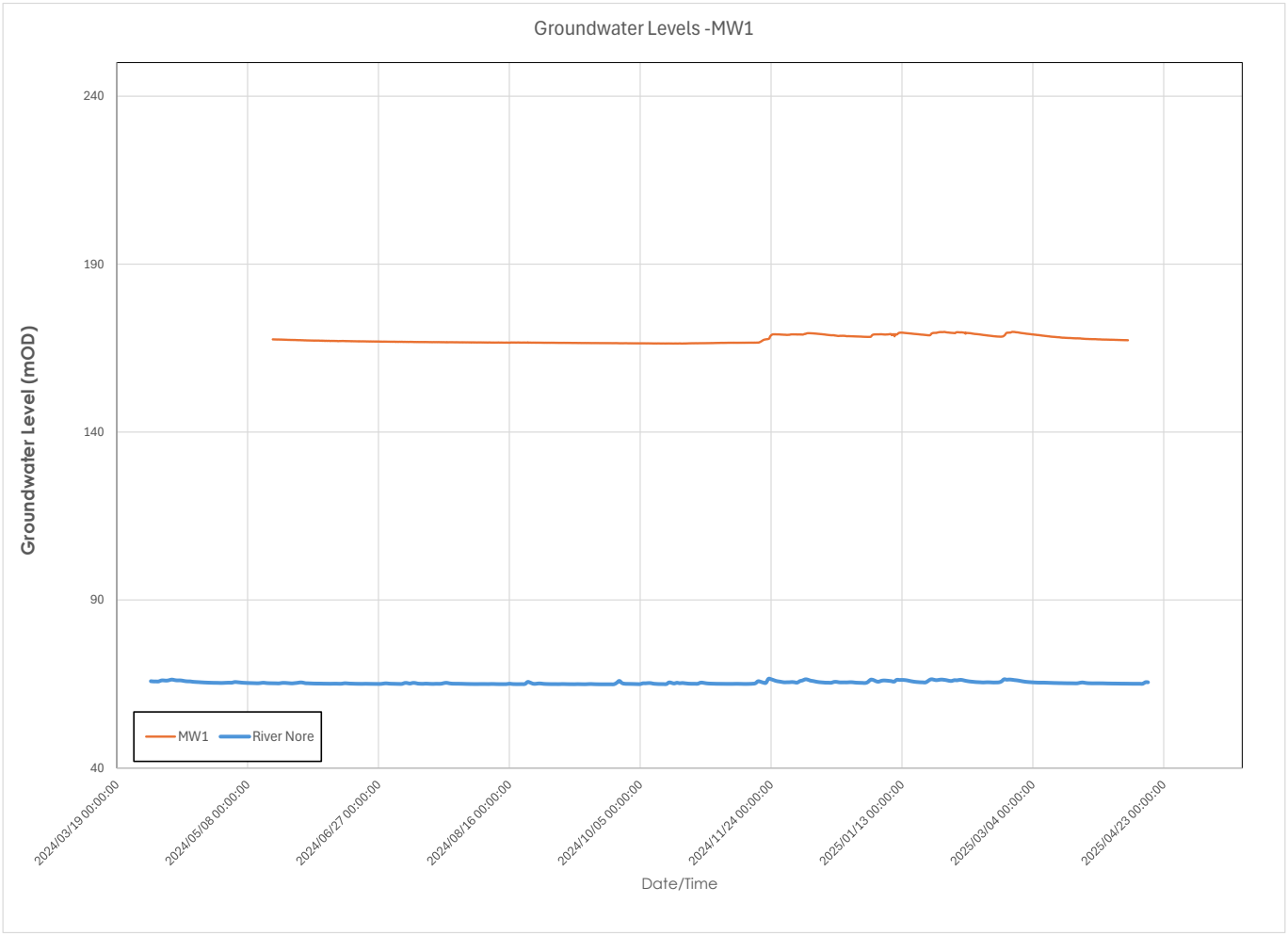
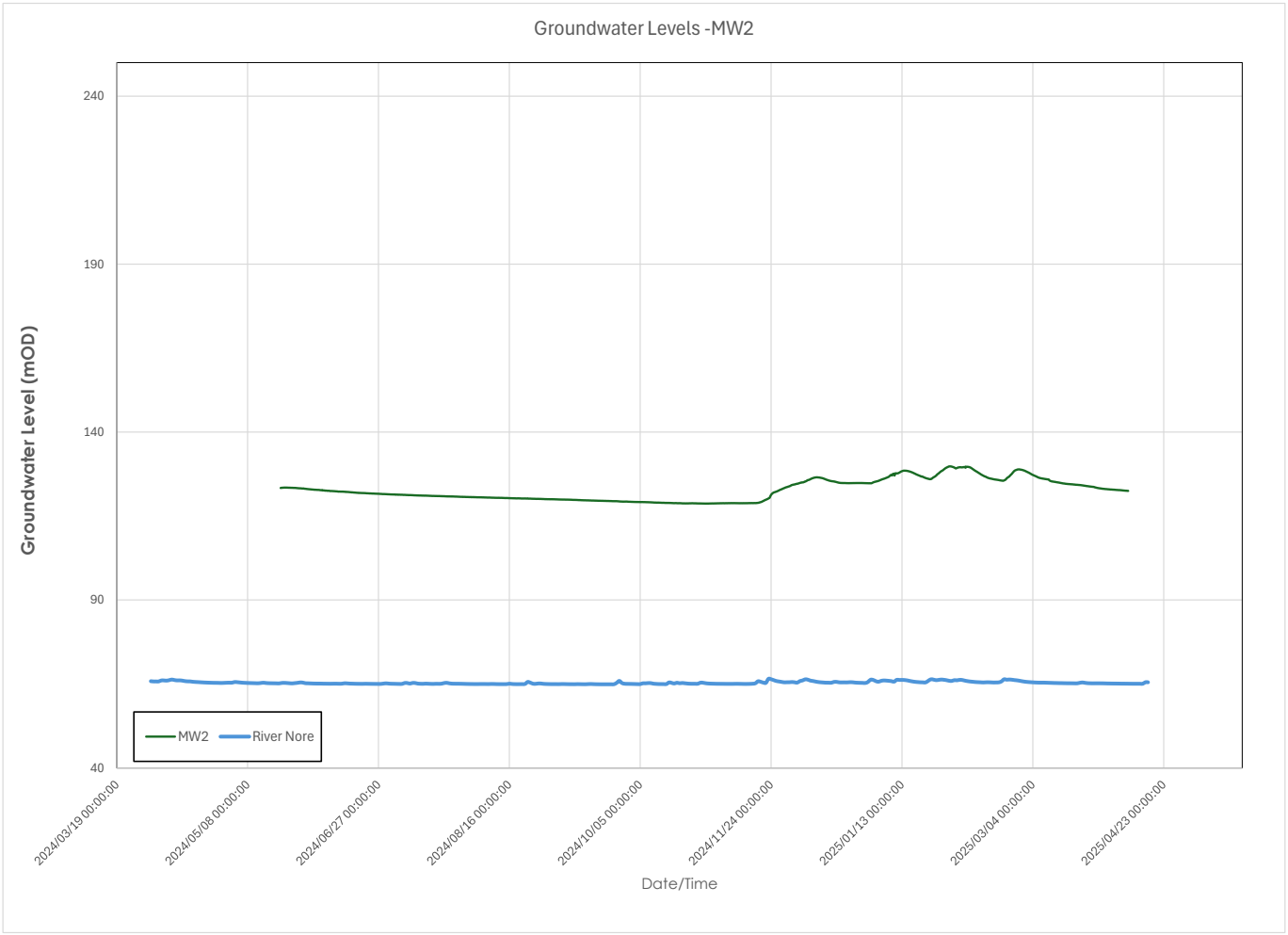
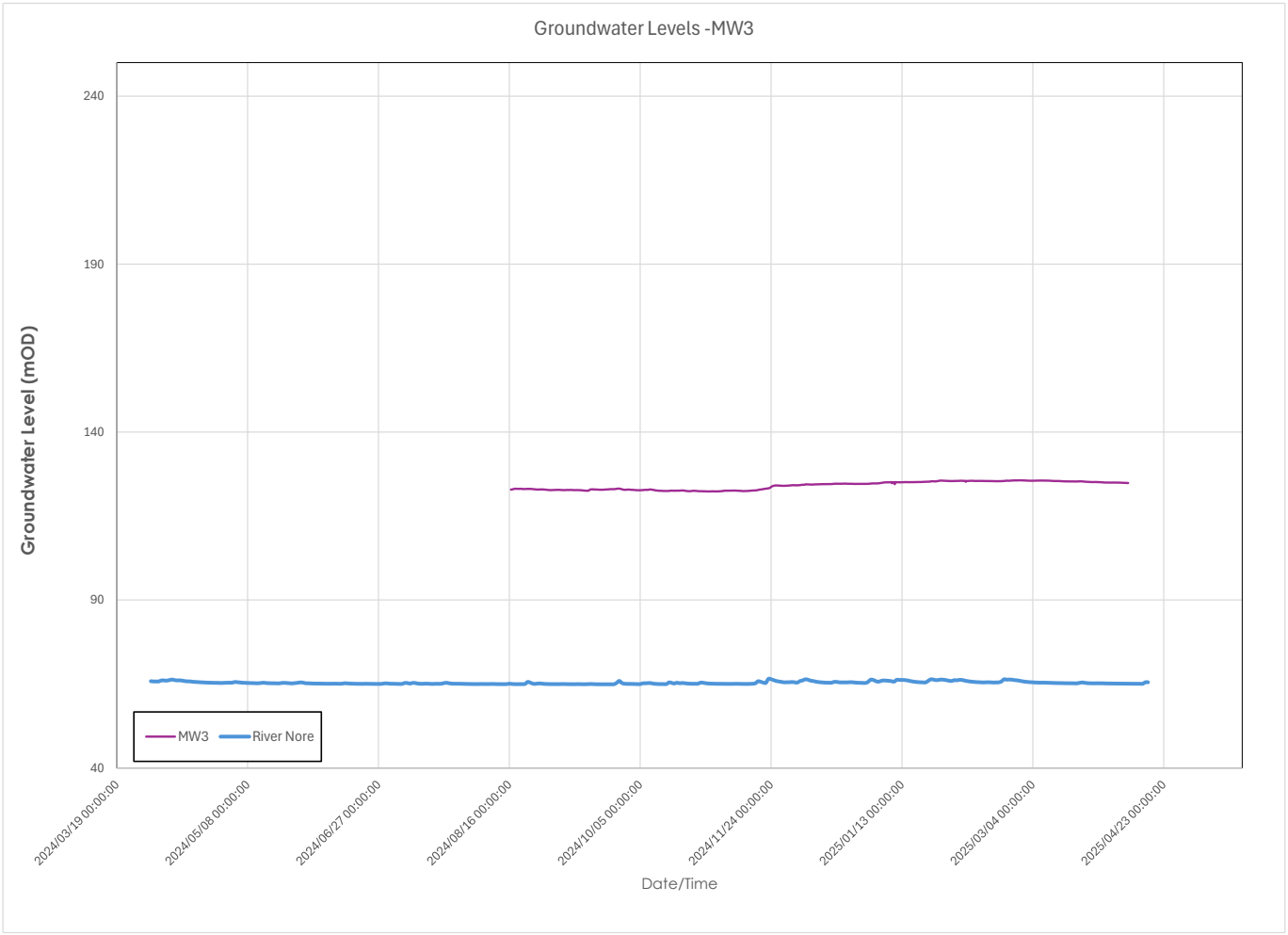
APPENDIX 9-3

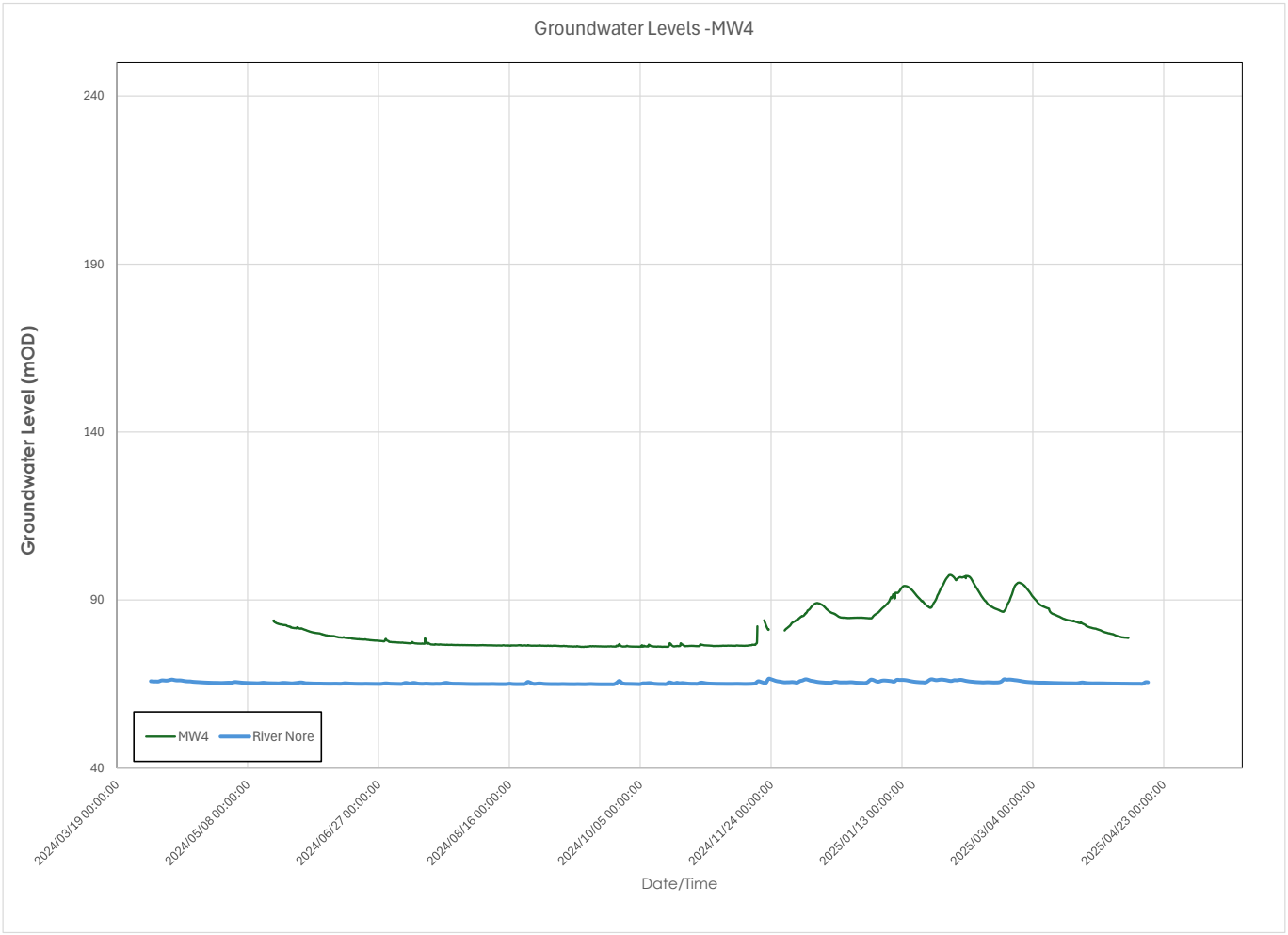
GROUNDWATER LEVEL PLOTS

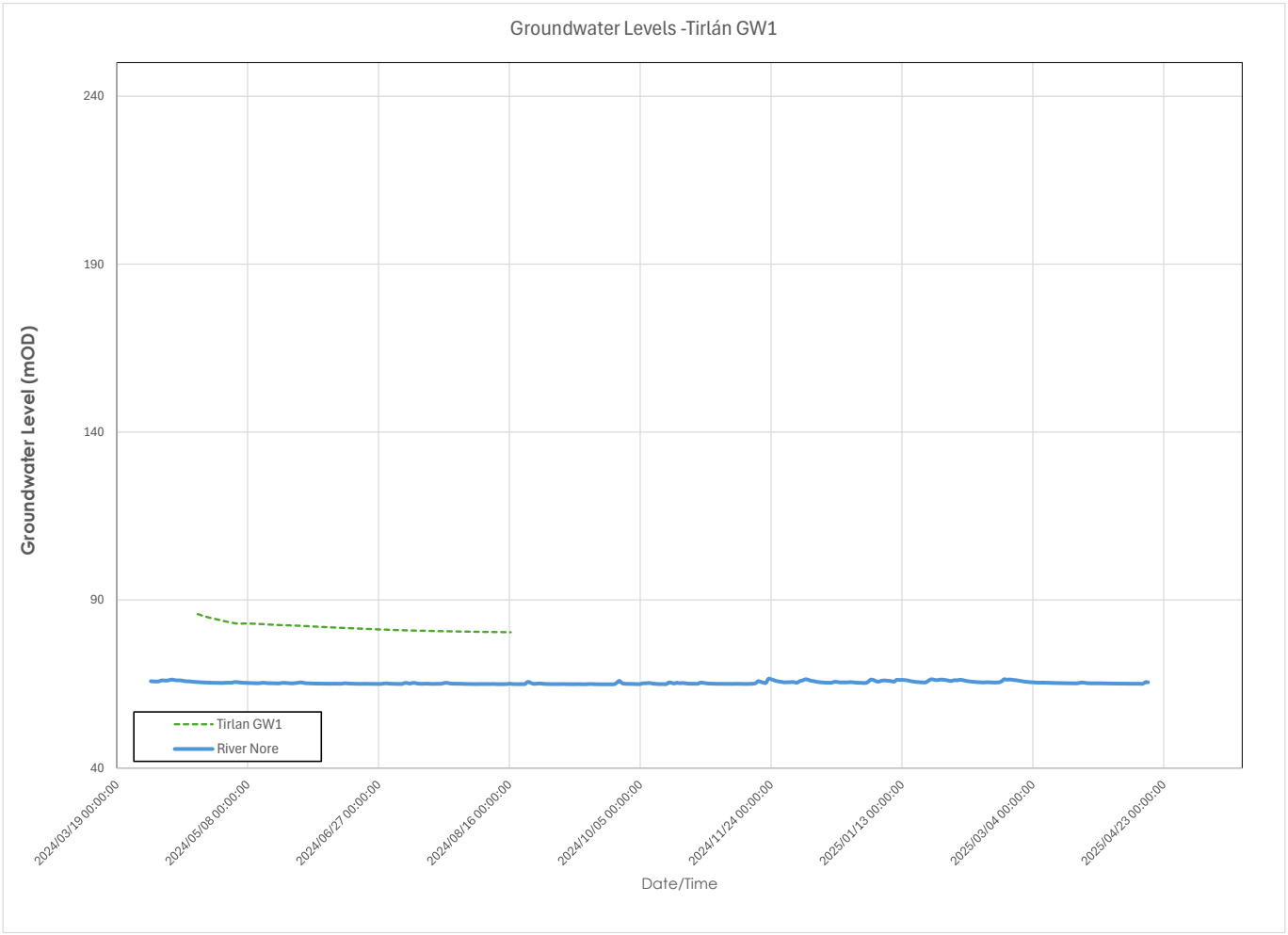


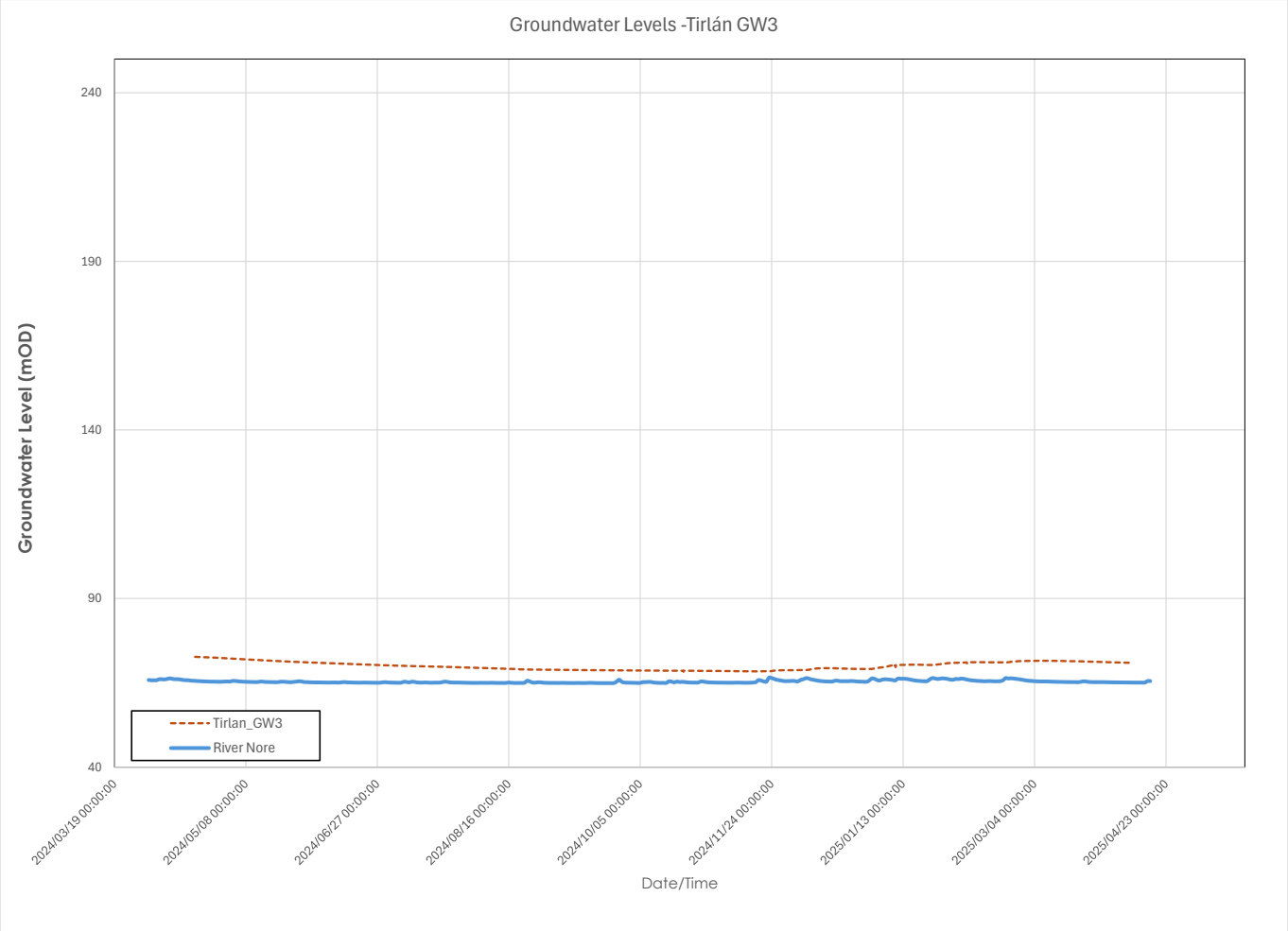


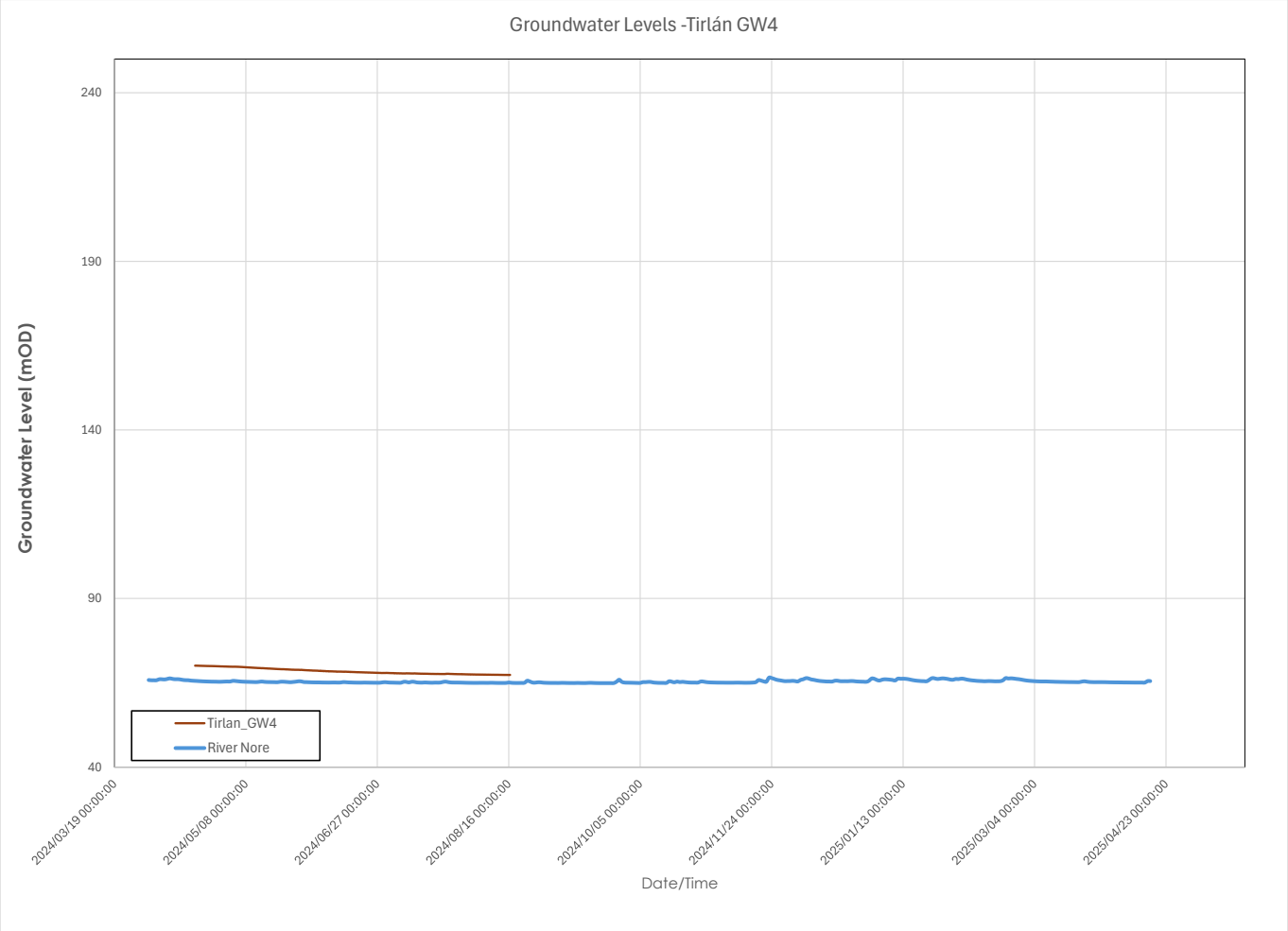


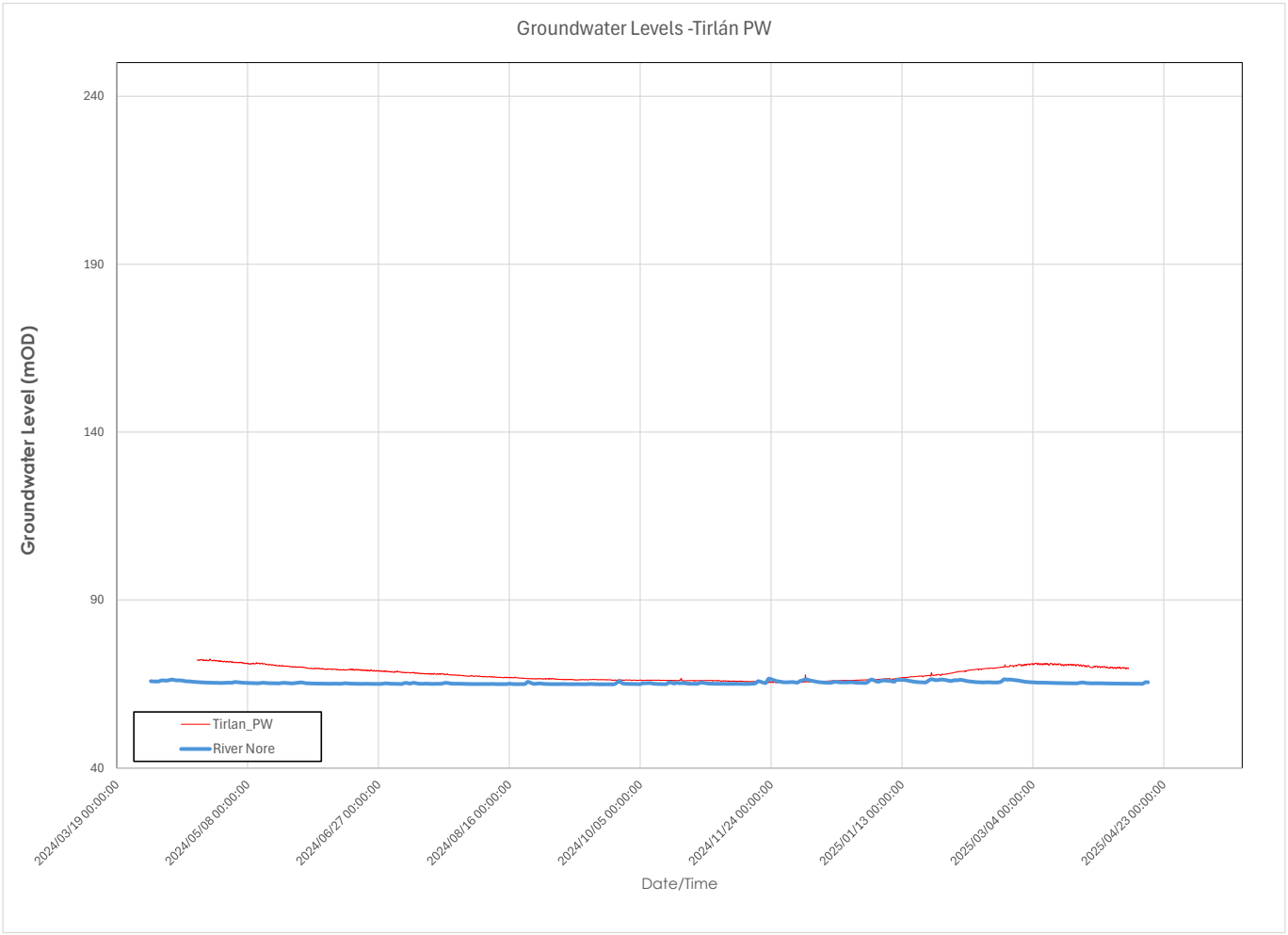


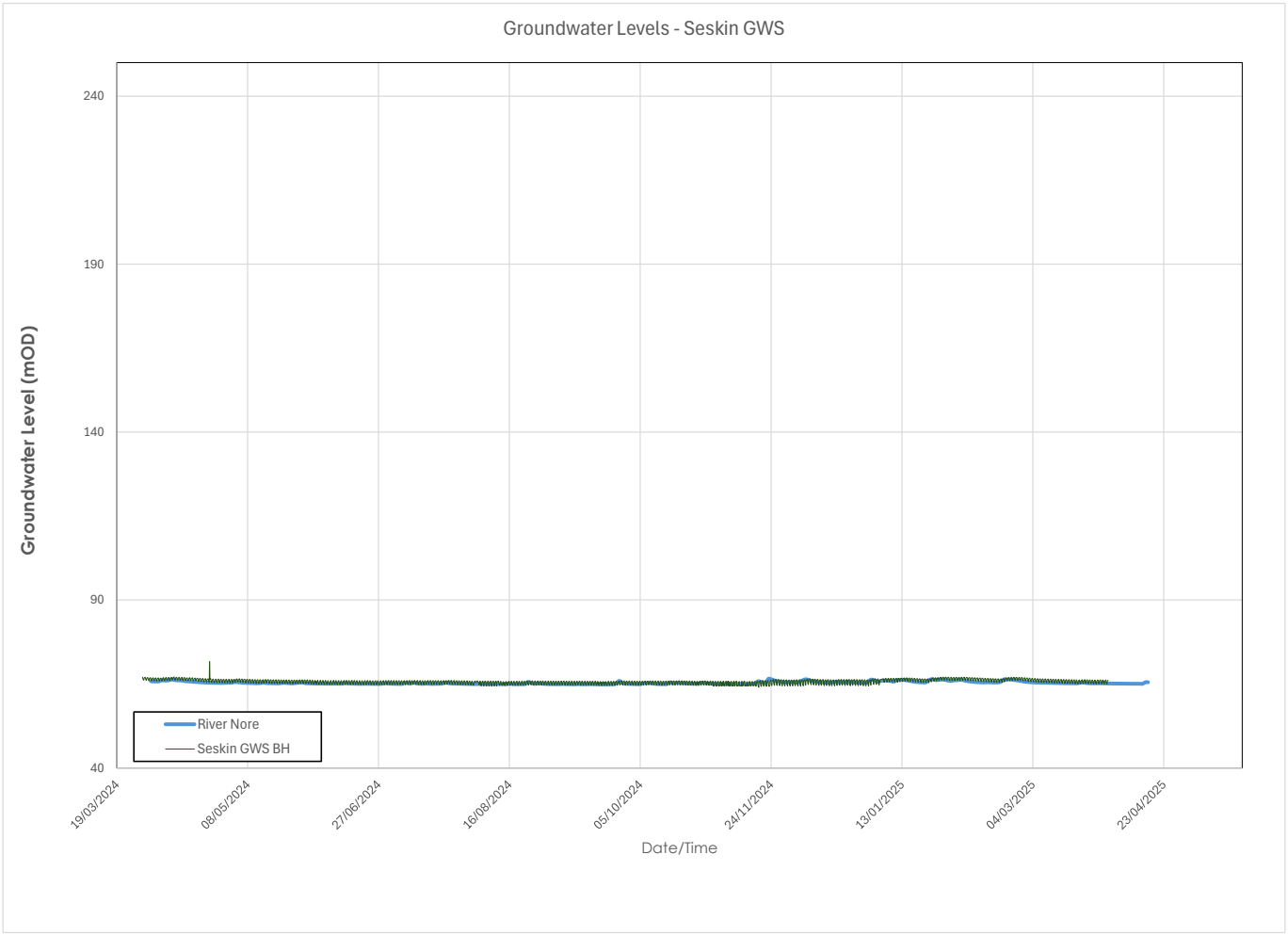












APPENDIX 9-4

WATER FRAMEWORK DIRECTIVE ASSESSMENT REPORT

HYDRO ENVIRONMENTAL SERVICES

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tel: +353 (0)58 44122
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web: www.hydroenvironmental.ie

WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT
SESKIN RENEWABLES WIND FARM, CO. KILKENNY AND CO. LAOIS

FINAL REPORT

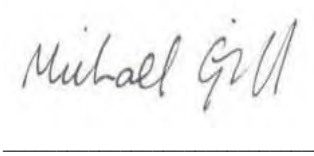
Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

Document Title:	**WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT SESKIN WIND FARM, CO. KILKENNY AND CO. LAOIS**
Issue Date:	**24th June 2025**
Project Number:	**P1653-1**
Project Reporting History:	**P1653-1**
Current revision no:	**FINAL_REV F0**
Author:	**MICHAEL GILL ADAM KEEGAN NITESH DALAL**
Signed:	 **Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services**

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FIGURES (IN TEXT)

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO on behalf of Seskin Renewable Energy Ltd. to complete a Water Framework Directive (WFD) Compliance Assessment for the Proposed Seskin Renewables Wind Farm and Proposed Grid Connection Route, Co. Kilkenny and Co. Laois.

The purpose of this WFD Compliance Assessment is to determine if any specific components or activities associated with the Proposed Wind Farm site and Proposed Grid Connection Route will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status. This assessment will determine the water bodies with the potential to be impacted, describe the proposed mitigation measures and determine if the project is in compliance with the objectives of the WFD.

This WFD Compliance Assessment is written to accompany Chapter 9 of the Environmental Impact Assessment Report (EIAR) for the Proposed Wind Farm site and the Proposed Grid Connection Route. The Proposed Project is described in full in Chapter 4 of the EIAR. For the purposes of this WFD, and consistent with the EIAR, the various components are described and assessed using the following references: 'Proposed Development, 'Proposed Wind Farm', 'Proposed Grid Connection Route' and the 'Site' (as defined in Chapter 1, Section 1.1.1, of the EIAR).

This report has been complied using the following data sources:

- Environmental Protection Agency database (www.epa.ie)
- Observations recorded during various site visits as described in Section 9.2.2 and 9.3 of EIAR
- Drainage mapping as described in Section 9.2.2 and 9.3.3.2 of EIAR
- Surface Water Quality sampling as described in Section 9.3.5 of EIAR
- Groundwater Quality sampling as described in Section 9.3.8 of EIAR

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types including wind farms.

This WFD assessment was prepared by Michael Gill, Adam Keegan and Nitesh Dalal.

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in karst hydrogeology and also in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, Derrinlough WF and Yellow River WF, and over 100 other wind farm-related projects, as well as Seven Hills WF which is situated within a mapped karst area. Michael has also worked on karst related projects in South and Mid Galway, Roscommon, Tipperary, Laois, Kilkenny, Limerick, Clare, Cork and Waterford.

Adam Keegan PGeo (B.Sc., M.Sc.) is a hydrogeologist with 7 years environmental consultancy experience in Ireland. Adam has worked on numerous Environmental Impact Assessments,

Flood Risk Assessment Reports for infrastructure projects, such as wind farms, strategic housing developments and quarries. Adam has experience in intrusive site investigation works within mapped karst environments and experience in trial and production well drilling within areas mapped as Regionally Karstified Aquifers. Adam has worked on several wind farm EIAR projects, including Seven Hills WF, Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Coole WF.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India. Nitesh holds a M.Sc. in Environmental Science from University College Dublin (2024), a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

1.3 WATER FRAMEWORK DIRECTIVE

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("**WFD**"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003).

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. RBMPs include identifying river basin districts, water bodies, protected areas and any pressures or risks, monitoring and setting environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021.

The River Basin Management Plan (2018 - 2021) objectives, which have been integrated into the design of the proposed wind farm development, include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge for the third cycle.

Furthermore, the Department of Housing, Local Government and Heritage are currently reviewing the submissions made on the Draft 3rd Cycle River Basin Management Plan (2022 - 2027) which was out for public consultation in Q4 of 2021 and Q1 of 2022. As of June 2024, the plan has not been published while the draft plan is available to view at https://www.gov.ie/en/consultation/2bda0-public-consultation-on-the-draft-river-basin-management-plan-for-ireland-2022-2027/.

Our understanding of these objectives is that water bodies, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed.

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

This section identifies those surface water, groundwater bodies and protected areas with potential to be affected by the Proposed Wind Farm site and the Proposed Grid Connection Route and reviews any available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

The Proposed Wind Farm site and the Proposed Grid Connection Route are located in the regional River Nore surface water catchment within Hydrometric Area 15 of the Southeastern River Basin District (SERBD).

On a more local scale the majority of the Proposed Wind Farm site is located within the Nore_SC_070 sub-catchment while small area in the north of the Proposed Wind Farm site is located within the Nore_SC_050 sub-catchment. Within the Nore_SC_050 sub-catchment, the Proposed Wind Farm site is located within the Nore_110 river sub-basin while within the Nore_SC_070 sub-catchment, the Proposed Wind Farm site is located within the Nore_120 river sub-basin, the Lisdowney_010 river sub-basin and the Nore_140 river sub-basin.

Within the Nore_110 river sub-basin, the Durrow Townspark stream exists 700m north of T1, and flows northeast discharging to the River Nore (Nore_110 section of the River Nore). The River Nore then flows south and drains out into Nore_120 section of the River Nore.

Within the Lisdowney_010 river sub-basin, the Archerstown stream flows south, discharging to the Lisdowney stream which drains out into the River Nore (Nore_140). The Archerstown stream is not located within the Wind Farm, with the origin point situated ~30m from the site boundary and ~380m southwest of turbine T4. Within the Nore_140 river sub-basin, the Ballyconra stream, which is mapped 480m southeast of turbine T8, flows south, discharging to the Lisdowney stream and ultimately discharges to the River Nore.

The Proposed Grid Connection route exists within the Nore_120 river sub-basin and varies in distance between 0-850m from the River Nore (Nore_120 section of the river). The Proposed Grid Connection crosses the Nore_120 river section at the proposed watercourse crossing in the townland of Moatpark, Co. Kilkenny.

On a broad scale the majority of the Proposed Grid Connection Route is located within the Nore_SC_070 sub-catchment while a small area is located within the Nore_SC_060 sub-catchment, where the grid route crosses to the eastern side of the River Nore. Within the Nore_SC_070 sub-catchment, the Proposed Grid Connection Route is mapped within the Nore_120 river sub-basin while within the Nore_SC_060 sub-catchment the Proposed Grid Connection Route is also mapped within within the Nore_120 river sub-basin.

Error! Reference source not found. Presents the total upstream sub-catchment area that drains the Proposed Wind Farm site and the Proposed Grid Connection Route, and the total sub-catchment area of the rivers downstream from the site as far as the River Nore. The total upstream sub catchment area is ~2,446km^2. Therefore, the river waterbodies which are in close proximity to the Site that have relatively smaller catchment areas (Lisdowney_010) will be more susceptible to water quality impacts as a result of the Proposed Wind Farm site and the Proposed Grid Connection Route in comparison to the downstream river bodies, located downstream of the Site.

A local hydrology map of the area is shown below in **Figure** A.

Table A: Upstream Catchment Size for River Waterbodies

WFD River Sub-Basin	Total Upstream Catchment Area (km²)
Lisdowney_010	~9.3
Nore_110	~945
Nore_120	~1059
Nore_130	~1070
Nore_140	~1105
Nore_150	~1233
Nore_160	~1562
Nore_170	~1649
Nore_180	~1690
Nore_190	~1747
Nore_200	~1772
Nore_210	~1777
Nore_220	~2239
Nore_230	~2309
Nore_240	~2369
Nore_250	~2446

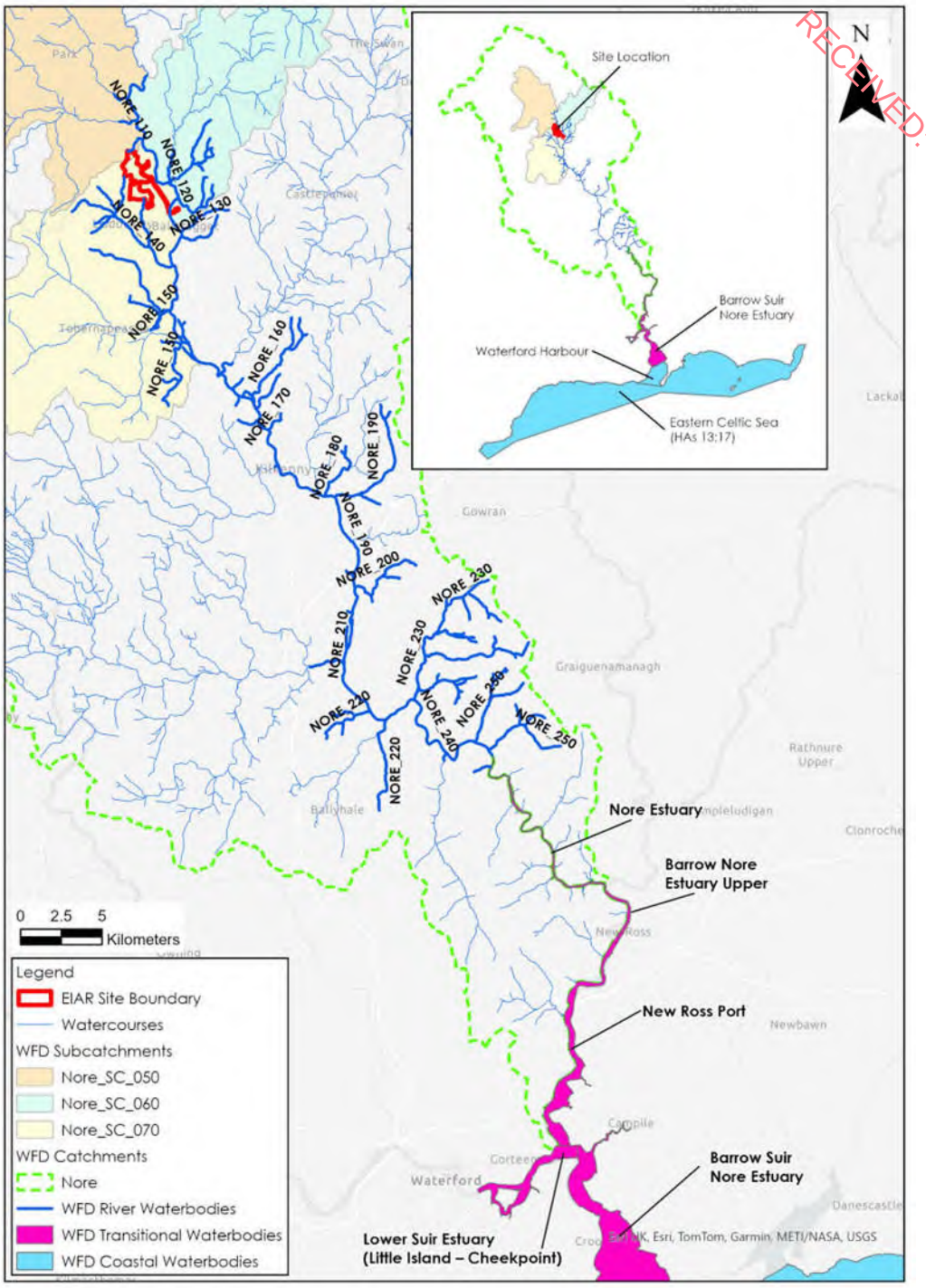

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) downstream of the Proposed Project site are shown in **Table B**. The overall status of SWBs is based on the ecological, chemical and quantitative status of each SWB.

Local Groundwater Body (GWB) and Surface water Body (SWB) status information is available from (www.catchments.ie).

The Site is primarily drained by the Lisdowney_010 stream waterbody which is assigned a 2016-2021 Status of "Moderate" and is deemed to be "At risk" of missing out on the WFDs 2027 objectives, with agriculture listed as the significant pressure. The Lisdowney_010 stream waterbody feeds into the River Nore (Nore_140).

The very northern portion of the Site is drained by the Nore_110 river waterbody which achieved a "Good" Status and is deemed to be "Not at risk" of failing to achieve its WFDs 2027 objectives. The Nore_110 flows down into the Nore_120 river water body.

The River Nore (Nore_120 to Nore_250) achieved a "Good" status in the latest WFD cycle except for Nore_120, Nore_190 and Nore_230 which have achieved "Moderate" status in the latest WFD cycle. The Nore_130 to Nore_180 and the Nore_250 are "not at risk" of failing to achieve its WFDs 2027 objectives while the Nore_190 to Nore_220 and the Nore_240 are "under review" and the Nore_120 and the Nore_230 is "at risk" of failing to achieve its WFDs 2027 objectives. There is no significant pressure identified on any of the section of Nore River (Nore_120 to Nore_250), apart from Agriculture as an identified significant pressure on the Nore_120 and Urban run-off identified as a significant pressure on the Nore_230.

The transitional waterbodies downstream of the Nore river are Nore Estuary, Barrow Nore Estuary Upper, New Ross Port, Lower Suir Estuary (Little Island – Cheekpoint) and the Barrow Suir Nore Estuary. All the transitional bodies have achieved a "Moderate" status and are "at risk" of failing to achieve its WFDs 2027 objectives. Agriculture is the significant pressure identified on these transitional waterbodies with additional urban run-off as identified significant pressure on Barrow Nore Estuary Upper.

The Waterford Harbour and the Eastern Celtic Sea (HAs 13;17) are the coastal water bodies downstream. The Waterford Harbour achieved "Moderate" status in the latest WFD cycle and is "at risk" of failing to achieve its WFDs 2027 objectives with agriculture and urban run-off identified as significant pressure while the Eastern Celtic Sea (HAs 13;17) have achieved "High" status in the latest WFD cycle and is "not at risk" of failing to achieve its WFDs 2027 objectives. There is no significant pressure identified on the Eastern Celtic Sea (HAs 13;17).

The SWB status for the 2016-2021 WFD cycle are shown on Error! Reference source not found..

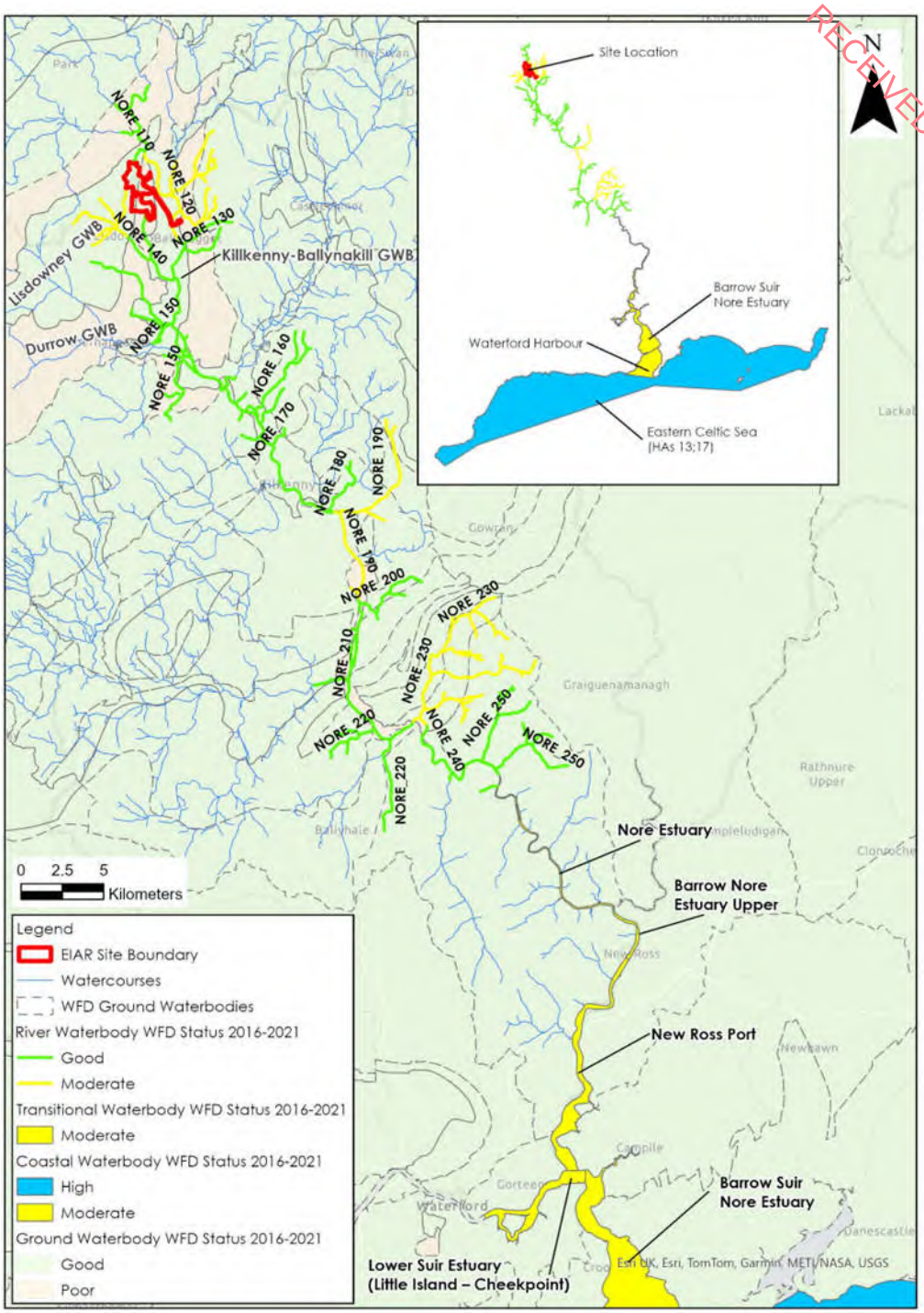

Figure B: WFD Surface Waterbody and Groundwater Body Status (2016-2021)

Table B: Summary WFD Information for Surface Water Bodies

SWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk 3rd Cycle	Pressures
Lisdowney_010	Moderate	Good	Moderate	At risk	Agriculture
Nore_110	Good	Good	Good	Not at risk	-
Nore_120	Unassigned	Good	Moderate	At Risk	Agriculture
Nore_130	Good	Good	Good	Not at risk	-
Nore_140	Unassigned	Good	Good	Not at risk	-
Nore_150	Good	Good	Good	Not at risk	-
Nore_160	Unassigned	Good	Good	Not at risk	-
Nore_170	Good	Good	Good	Not at risk	-
Nore_180	Good	Good	Good	Not at risk	-
Nore_190	Unassigned	Moderate	Moderate	Review	-
Nore_200	Unassigned	Moderate	Good	Review	-
Nore_210	Moderate	Good	Good	Review	-
Nore_220	Good	Moderate	Good	Review	-
Nore_230	Good	Moderate	Moderate	At risk	Urban Run-off
Nore_240	Good	Moderate	Good	Review	-
Nore_250	Good	Good	Good	Not at risk	-
Nore Estuary	Moderate	Good	Moderate	At risk	Agriculture
Barrow Nore Estuary Upper	Good	Moderate	Moderate	At risk	Agriculture and Urban run-off
New Ross Port	Moderate	Moderate	Moderate	At risk	Agriculture
Lower Suir Estuary (Little Island – Cheekpoint)	Moderate	Good	Moderate	At risk	Agriculture
Barrow Suir Nore Estuary	Good	Moderate	Moderate	At risk	Agriculture

Waterford Harbour	Good	Moderate	Moderate	At risk	Agriculture and Urban run-off
Eastern Celtic Sea (HAs 13;17)	Unassigned	Good	High	Not at risk	-

2.4 GROUNDWATER BODY IDENTIFICATION

The Proposed Wind Farm site is underlain by 5 no. bedrock formations. The northern most section is underlain by Moyadd Coal Formation classified as Poor Aquifer - Bedrock which is Generally Unproductive (Pu) which is adjacent to the Bregaun Flagstone Formation classified as Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones (Pi). The east of the Proposed Wind Farm site is underlain by the Clogrenan Formation and the southeast of the Proposed Wind Farm site is underlain by the Ballyadams Formation Limestone, both classified as Regionally Important Aquifer - Karstified (diffuse) (Rkd). The southwestern part of the Proposed Wind Farm site is underlain by Killeshin Siltstone Formation which is classified as a Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones (Pi).

In terms of bedrock Groundwater Bodies (GWBs), the Proposed Wind Farm site is underlain by the Lisdowney GWB and the Durrow GWB.

The Proposed Grid Connection Route is underlain by Clogrenan Formation, classified as Regionally Important Aquifer - Karstified (diffuse) (Rkd), Ballyadams Formation classified as Regionally Important Aquifer - Karstified (diffuse) and Regionally important gravel aquifer (Rg) and Durrow Formation classified as Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll).

In terms of GWBs, the Proposed Grid Connection is underlain by Killkenny-Ballynakill Gravels GWB and Durrow GWB.

2.5 GROUNDWATER BODY CLASSIFICATION

The Lisdowney (IE_SE_G_088) and Durrow (IE_SE_G_156) Groundwater Bodies (GWB) underlie the Proposed Wind Farm site. The Killkenny-Ballynakill Gravels (IE_SE_G_163) and Durrow (IE_SE_G_156) Groundwater Bodies underlie the Proposed Grid Connection Route. The Lisdowney and Killkenny-Ballynakill GWBs has achieved "Good" status in the latest WFD cycle and is "not at risk" of failing to meet its WFD objectives with no significant pressure on these GWBs. The Durrow GWB is currently assigned a 'Poor Status' and is "At risk" of failing to meet its WFD objectives, with agriculture listed as the significant pressure.

The GWB status for the 2016-2021 WFD cycles are shown on **Figure** B.

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk 3rd Cycle	Pressures
Lisdowney	Good	Good	Good	Not at risk	-
Durrow	Good	Poor	Poor	At risk	Agriculture
Killkenny-Ballynakill	Good	Good	Good	Not at risk	-

2.6 ZONE OF INFLUENCE

The potential zone of influence of the Proposed Wind Farm site and the Proposed Grid Connection Route extend to the following SWBs, GWBS, and Transitional and Coastal water bodies:

- SWBs – Lisdowney_010, Nore River (Nore_110 to Nore_250).
- GWBs – Lisdowney GWB, Durrow GWB and Killkenny-Ballynakill GWB.
- Transitional and Coastal waterbodies – Nore Estuary, Barrow Nore Estuary Upper, New Ross Port, Lower Suir Estuary (Little Island – Cheekpoint), Barrow Suir Nore Estuary, Waterford Harbour and Eastern Celtic Sea (HAs 13;17).

2.7 PROTECTED AREA IDENTIFICATION

The WFD requires that activities are also in compliance with other relevant legislation, as considered below. Nature conservation designations, bathing waters, Nutrient Sensitive Areas (NSA's), shellfish protected areas and Drinking Water Protected Area's (DWPA) within the vicinity of the Site are considered at as part of the assessment.

2.7.1 Nature Conservation Designations

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

The closest designated site to the Proposed Wind Farm site is the River Barrow and River Nore SAC (Site Code: 002162), which is situated 0.33km from the Proposed Wind Farm site and overlaps with the Proposed Grid Connection route along the N77. The proposed Grid Connection runs adjacent to the River Barrow and River Nore SAC along the N77 national road and briefly intercepts it at the proposed watercourse crossing. Rivers and streams that drain the Proposed Wind Farm site or the Proposed Grid Connection Route ultimately drain towards the River Barrow and River Nore SAC.

The River Nore/Abbeyleix Woods Complex pNHA (Site Code: 002076) and the River Nore SPA (Site Code: 004233) exist 0.33km from the Proposed Wind Farm site and overlap with the Proposed Grid Connection route along the N77.

Lisbigney Bog SAC/pNHA (Site Code: 000869) is located ~4.3km northeast of the Proposed Wind Farm site. There is no surface water connection between the Proposed Wind Farm site and Lisbigney Bog.

Cullahill Mountain SAC/pNHA (Site Code: 000831) is located ~6.7km to the west of the Proposed Wind Farm site and there is no hydrological connection between the this desginated site and the Proposed Wind Farm site.

The Spahill and Clomantagh Hill SAC/pNHA (Site Code: 000849) is located ~10.3km southwest of the Proposed Wind Farm site. There is no surface water connection between the Proposed Wind Farm site and this SAC/pNHA.

Waterford Harbour pNHA (Site Code: 000787) is located downstream of the Proposed Project site within Waterford Harbour.

2.7.2 Bathing Waters

Bathing waters are those designated under the Bathing Water Directive (76/160/EEC) or the later revised Bathing Water Directive (2006/7/EC).

There are no bathing waters in or directly adjacent to the catchment identified under the Bathing Water Regulations 2008.

2.7.3 Nutrient Sensitive Areas

Nutrient Sensitive Areas (NSA) comprise Nitrate Vulnerable Zones and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under the Urban Wastewater Treatment Directive (UWWTD)(91/271/EEC). Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

There are various section of the Nore River (Nore_190 to Nore_250) downstream of the Proposed Wind Farm site that are listed as NSAs. The Nore Estuary, Barrow Nore Estuary Upper, New Ross Port and Lower Suir Estuary (Little Island – Cheekpoint) transitional waterbodies downstream of the Proposed Wind Farm site are listed as NSAs.

2.7.4 Shellfish Waters

The Shellfish Waters Directive (2006/113/EC) aims to protect or improve shellfish waters in order to support shellfish life and growth.

Downstream of the site, Waterford Harbour (Cheekpoint/Arthurstown/Creadan) is listed as a Shellfish Water Protection Area.

2.7.5 Salmonid Waters

The Salmonid Regulations (S.I. 293 / 1988) identifies the protected river that are designated as Designated Salmonid Waters under S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations 1988, 14th August 1988. The Council Directive 78/659/EEC of 18th July 1978 on the quality of fresh waters needing protection or improvement in order to support fish life and the Council Directive 92/42/EEC of 21st May 1992 on the conservation of natural habitats and of wild fauna and flora was transposed into Irish law under the Fish Directive S.I. 293/1988 and Habitats Directive S.I. 477/2011.

The Nore River (Nore_110 to Nore_250) are identified as designated Salmonid Waters and are located downstream of the Proposed Wind Farm site.

2.7.6 Drinking Water

The Nore_120 DWPA, the Nore_160 DWPA and the Nore_220 DWPA downstream of the Proposed Wind Farm site are listed as Drinking Water Protected Areas (DWPA's). All GWB's in Ireland are considered as DWPAs. The southern portion of the Proposed Wind Farm site is mapped within Ballyconra PWS Public Water Supply Source Protection Area. The eastern side of the central portion of the Proposed Wind Farm site is mapped in the Seskin Group Water Scheme Preliminary Source Protection Area.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 23 no. surface waterbodies which are located in the vicinity and downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route. These include 16 no. river waterbodies, 5 no. transitional waterbodies and 2 no. coastal waterbodies. In addition, 3 no. groundwater bodies underlie the Proposed Wind Farm site and the Proposed Grid Connection Route. Furthermore, there are a number of protected areas in the vicinity and downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route.

3.1 SURFACE WATER BODIES

As shown in **Figure** A above, there are 23 no. SWBs are located in the vicinity or downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route.

With consideration for the construction, operational and decommissioning phases of the Proposed Wind Farm site, it is considered that the Lisdowney_010, Nore_110, Nore_120 and Nore_140 river sub basins will be brought through to the WFD Impact Assessment as elements of the Proposed Wind Farm site and the Proposed Grid Connection Route are located within these river sub basins. The Nore_130 river sub-basin is brought forward also due to its proximity to the Nore_120 and Nore_140 sub-basins.

Further downstream, the Nore River (Nore_150 to Nore_250), the transitional waterbodies and the coastal waterbodies have been screened out due to their distant location (>6km) and increased volume of water within the SWB.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, the Lisdowney, Durrow and Killkenny-Ballynakill GWBs have been screened in due to their location directly underlying the Proposed Wind Farm site and the Proposed Grid Connection Route. The site works must not in any way result in a deterioration in the status of these GWBs and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

3.3 PROTECTED AREAS

The River Barrow and River Nore SAC (002162) has been screened into the assessment as it includes the River Nore which flows adjacent to and immediately downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route.

The River Nore SPA (004233) and the River Nore/Abbeyleix Woods Complex pNHA (002076) will also be brought through to the WFD Impact Assessment as it includes the River Nore which flows adjacent to and immediately downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route.

Lisbigney Bog SAC/pNHA is located upstream and there is no surface water connection between the Proposed Wind Farm site and Lisbigney Bog SAC/pNHA, therefore the SAC has been screened out of the WFD Impact Assessment.

The Cullahill Mountain SAC/pNHA and Spahill and Clomantagh Hill SAC/pNHA have been screened out as there are no hydrological or hydrogeological connections between the Proposed Wind Farm site and the SAC/pNHA.

Waterford Harbour pNHA has been screened out as the area is distant location from the Proposed Development and there is increase volume of water within transitional and coastal waters.

The Nore_120 DWPA has been screened in as the Proposed Wind Farm site and the Proposed Grid Connection Route is mapped within the Nore_120 river sub-basin. The Nore_160 DWPA and the Nore_220 has been screened out due to their distant location and increase volume of water within Nore River.

The Seskin Group Water Scheme SPA and Ballyconra PWS will be brought into the WFD Impact Assessment as the parts of the Proposed Wind Farm site is mapped within these Public Water Supply Scheme.

3.4 WFD SCREENING SUMMARY

A summary of WFD Screening discussed above is shown in **Table D**.

Table D: Screening of WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	River	Lisdowney_010	**Yes**	The west side of the Proposed Wind Farm site is mapped within the Lisdowney_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Wind Farm site on this SWB.
	River	Nore_110	**Yes**	The north side of the Proposed Wind Farm site is mapped within the Nore_110 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Wind Farm site on this SWB.
	River	Nore_120	**Yes**	The Proposed Wind Farm site and the Proposed Grid Connection Route is mapped within the Nore_120 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Wind Farm site and the Proposed Grid Connection Route on this SWB.
	River	Nore_130	**Yes**	The Nore_130 is situated between the Nore_120 and Nore_140 river sub-basins, which contain elements of the Proposed Wind Farm and Proposed Grid Connection. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Nore_140	**Yes**	The southern area of the Proposed Wind Farm site is mapped within the Nore_140 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Wind Farm site on this SWB.
	River	Nore_150	No	The Nore_150 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~1,233km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_160	No	The Nore_160 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~1,562km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_170	No	The Nore_170 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~1,649km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_180	No	The Nore_180 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~1,690km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_190	No	The Nore_190 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~1,747km^2. Therefore, the Proposed

				Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_200	No	The Nore_200 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~1,772km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_210	No	The Nore_210 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~1,777km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_220	No	The Nore_220 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~2,239km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_230	No	The Nore_230 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~2,309km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_240	No	The Nore_240 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~2,369km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	River	Nore_250	No	The Nore_250 SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This SWB has an upstream catchment area of ~2,446km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	Transitional	Nore Estuary	No	The Nore Estuary SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	Transitional	Barrow Nore Estuary Upper	No	The Barrow Nore Estuary Upper SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	Transitional	New Ross Port	No	The New Ross Port SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	Transitional	Lower Suir Estuary (Little Island – Cheekpoint)	No	The Lower Suir Estuary (Little Island – Cheekpoint) SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	Transitional	Barrow Suir Nore Estuary	No	The Barrow Suir Nore Estuary SWB has been screened out due to its distant location

				from the Proposed Wind Farm site and the increasing volumes of water. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	Coastal	Waterford Harbour	No	The Waterford Harbour SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
	Coastal	Eastern Celtic Sea (HAs 13;17)	No	The Eastern Celtic Sea (HAs 13;17) SWB has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water. Therefore, the Proposed Wind Farm site has no potential to impact the status of this SWB.
Groundwater Body	Groundwater	Lisdowney	**Yes**	The Proposed Wind Farm site is mapped to overlie the Lisdowney GWB. Therefore, an assessment is required to consider the impacts of the Proposed Wind Farm site on this GWB.
	Groundwater	Durrow	**Yes**	The Proposed Wind Farm site and the Proposed Grid Connection Route are mapped to overlie the Durrow GWB. Therefore, an assessment is required to consider the impacts of the Proposed Wind Farm site and the Proposed Grid Connection Route on this GWB.
	Groundwater	Killkenny-Ballynakill	**Yes**	The Proposed Grid Connection Route are mapped to overlie the Killkenny-Ballynakill GWB. Therefore, an assessment is required to consider the impacts of the Proposed Grid Connection Route on this GWB.
Protected Areas	Designated Sites	River Barrow and River Nore SAC	**Yes**	The River Barrow and River Nore SAC has been screened into the assessment as it includes sections of the River Nore which flows adjacent to and immediately downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route.
		River Nore SPA	**Yes**	The River Nore SPA has been screened into the assessment as it includes sections of the River Nore which flows adjacent to and immediately downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route.
		River Nore/ Abbeyleix Woods Complex pNHA	**Yes**	The River Nore/Abbeyleix Woods Complex pNHA has been screened into the assessment as it includes sections of the River Nore which flows adjacent to and immediately downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route.
		Lisbigney Bog SAC/pNHA	No	Lisbigney Bog SAC/pNHA has been screened out as there are no hydrological or hydrogeological connections between the Proposed Wind Farm site and the SAC/pNHA.
		Cullahill Mountain SAC/pNHA	No	Cullahill Mountain SAC/pNHA has been screened out as there are no hydrological or hydrogeological connections between the Proposed Wind Farm site and the SAC/pNHA.
		Spahill and Clomantagh Hill SAC/pNHA	No	Spahill and Clomantagh Hill SAC/pNHA has been screened out as there are no hydrological or hydrogeological connections between the Proposed Wind Farm site and the SAC/pNHA.

		Waterford Harbour pNHA	No	Waterford Harbour pNHA has been screened out due to distant location and increased volume of water. Therefore, the Proposed Wind Farm site has no potential to impact the status of this pNHA.
	Drinking Water Protected Areas	Nore_120	**Yes**	The Proposed Wind Farm site and the Proposed Grid Connection Route is mapped within the Nore_120 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Wind Farm site and the Proposed Grid Connection Connection Route on this DWPA.
		Nore_160	No	The Nore_160 DWPA has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This DWPA has an upstream catchment area of ~1,562km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this DWPA.
		Nore_220	No	The Nore_220 DWPA has been screened out due to its distant location from the Proposed Wind Farm site and the increasing volumes of water within the River Nore. This DWPA has an upstream catchment area of ~2,239km^2. Therefore, the Proposed Wind Farm site has no potential to impact the status of this DWPA.
		Seskin Group Water Scheme SPA	**Yes**	The southern portion of the Proposed Wind Farm site is mapped within Ballyconra PWS Public Water Supply Source Protection Area. An assessment is required to consider the potential impacts of the Proposed Wind Farm site on this Group Water Scheme.
		Ballyconra PWS	**Yes**	The eastern side of the central portion of the Proposed Wind Farm site is mapped in Seskin Group Water Scheme Preliminary Source Protection Area. An assessment is required to consider the potential impacts of the Proposed Wind Farm site on this PWS.

4. WFD COMPLIANCE ASSESSMENT

4.1 DEVELOPMENT PROPOSALS

The Proposed Development is described in full in Chapter 4 of the EIAR.

Due to the nature of wind energy developments (and associated grid connections and TDR works), being near surface construction activities, impacts on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risks to groundwater will be chemical pollution of groundwater from cementitious materials, hydrocarbon spillage and leakages.

The primary risk to surface waters will be entrained suspended sediments (soil particles) in site runoff during earthworks along with the release of cement-based compounds and/or hydrocarbons. The Proposed Development may also result in changes to surface water runoff volumes and flow patterns.

There are a number of potential adverse effects to both surface and groundwater.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Surface Water Quality Effects from Works within the Proposed Wind Farm site

Construction phase activities including site levelling, roadway construction and turbine/substation foundation excavation will require earthworks resulting in removal of vegetation cover and excavation of peat, soil and subsoils. The main risk will be from surface water runoff from bare soil and spoil areas during construction works.

Hydrocarbons and cement-based compounds will be used during the construction phase. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater and surface waters at all construction sites. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbons have a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

Release of effluent from wastewater treatment systems also has the potential to impact on surface waters if site conditions are not suitable for an on-site percolation unit.

Construction phase activities can result in the release of suspended solids and pollutants in runoff water and could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which in turn could affect the water quality and fish stocks in the downstream SWBs.

The SWB likely to be most impacted by these activities is the Lisdowney_010, Nore_110, Nore_120, Nore_130 and Nore_140 SWB. Further downstream, the potential for water quality effects will decrease downstream due to the increasing volumes of water within the respective SWBs.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the Proposed Development in the unmitigated scenario are outlined in **Table E**.

Table E: Surface Water Quality Impacts during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Lisdowney_010	IE_SE_15L020100	Moderate	Poor
Nore_110	IE_SE_15N011300	Good	Moderate
Nore_120	IE_SE_15N011400	Moderate	Poor
Nore_130	IE_SE_15N011500	Good	Moderate
Nore_140	IE_SE_15N011600	Good	Moderate
Nore_150	IE_SE_15N011700	Good	Good
Nore_160	IE_SE_15N011750	Good	Good

4.2.1.2 Potential Surface Water Quality Effects Along the Proposed Grid Connection Route

The Proposed Grid Connection Route will run underground along the N77 roadway which runs adjacent to the River Nore (between ~25-850m). Due to the close proximity of local waterbodies to the Proposed Grid Connection Route at the crossing locations there is a potential for surface water quality impacts during trench excavation work due to runoff from the road surface. This runoff may contain elevated concentrations of suspended sediment, cementitious runoff and/or hydrocarbons.

Some minor groundwater/surface water seepages will likely occur in trench excavations and substation foundation excavations and this will create additional volumes of water to be treated by the runoff management system. Inflows will likely require management and treatment to reduce suspended sediments.

Construction activities along the Proposed Grid Connection Route only have the potential for short term effects due to the minor and transient nature of the works. This limits the potential for the Proposed Project to alter the overall status of a SWB.

A summary of potential status change to SWBs arising from works along the Proposed Grid Connection Route during the construction phase of the Proposed Project in the unmitigated scenario are outlined in **Table F.**

Table F: Potential Surface Water Quality Effects along the Proposed Grid Connection Route During Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Nore_120	IE_SE_15N011400	Moderate	Poor
Nore_130	IE_SE_15N011500	Good	Moderate
Nore_140	IE_SE_15N011600	Good	Moderate
Nore_150	IE_SE_15N011700	Good	Good
Nore_160	IE_SE_15N011750	Good	Good

4.2.1.3 Potential Groundwater Quality/Quantity Effects

The accidental spillage of hydrocarbons, the release of effluent from wastewater treatment systems and the release of cement-based products have the potential to negatively impact on groundwater water quality at the Proposed Wind Farm site.

Any contaminants which may be accidently released on-site are more likely to reach the bedrock rather than nearby streams and rivers across the majority of the site. In addition, groundwater seepages may occur in turbine base excavations, particularly those on lower elevations and this will create additional volumes of water to be treated by the drainage management system. Furthermore, temporary dewatering of excavations (turbine bases etc) may drawdown the local groundwater table.

Piling, which may be undertaken at some turbine locations, does not require active dewatering (albeit some temporary displacement of local groundwater may occur) and therefore has no potential to significantly affect groundwater levels during construction.

Groundwater flows in the bedrock of the borrow pit will be limited to minor seepages at the subsoil-bedrock interface. No regional groundwater flows will be intercepted during the operation of the borrow pit, which will exist above the modelled groundwater level of ~100mOD at the location of the borrow pit, based on recorded groundwater levels across the Site (refer to Figure 9-11 of Chapter 9).

Groundwater level impacts due to the Proposed Wind Farm site are not anticipated to be significant due to the local hydrogeological regime. No groundwater level impacts are predicted from the turbine base construction, construction of the collector cabling trench, access roads, substation, compounds or met mast due to the relatively shallow nature of the excavation (i.e. 0 -~3-4m).

The Proposed Grid Connection Route is located in the Durrow and Killkenny-Ballynakill Gravels GWBs. However, due to the shallow, short-term and transient nature of the proposed works, there is no potential for any effects during earthworks and excavation works on the GWBs.

A summary of potential status change to GWBs arising from potential groundwater quality impacts during the construction phase of the Proposed Project in the unmitigated scenario are outlined in **Table G.**

Table G: Groundwater Quality Impacts during Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Lisdowney	IE_SE_G_088	Good	Good
Durrow	IE_SE_G_156	Poor	Poor
Killkenny-Ballynakill Gravels	IE_SE_G_163	Good	Good

4.2.1.4 Potential Protected Area Impacts

The hydrological and hydrogeological water connections from the Proposed Project could transfer poor quality surface water that may affect the conservation objectives of these designated sites. The designated sites included in this assessment and deemed to be hydrologically or hydrogeologically connected to the Proposed Wind Farm site include:

River Barrow and River Nore SAC: This SAC is located adjacent to and immediately downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route. Any potential deterioration in surface water quality has the potential to affect this SAC.

River Nore SPA: This SPA is located adjacent to and immediately downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route. Any potential deterioration in surface water quality has the potential to affect this SPA.

River Nore/Abbeyleix Woods Complex pNHA: This pNHA consists of the River Nore, which is located adjacent to and immediately downstream of the Proposed Wind Farm site and the Proposed Grid Connection Route. Any potential deterioration in surface water quality has the potential to affect this pNHA.

Other Designated sites are either not connected hydrologically with the Proposed Wind Farm site or are located at a distance with increased volume of water in it. Therefore, the Proposed Wind Farm site have no potential to impact these designated site.

4.2.2 Operational Phase (Unmitigated)

Potential effects associated with the operational phase of the Proposed Wind Farm site will be much reduced in comparison to the construction phase. Any effects will occur at the Proposed Wind Farm site and will be associated with minor maintenance works.

4.2.2.1 Potential Surface Water Quantity Effects Downstream of Proposed Development Site

Progressive replacement of the soil or vegetated surfaces with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the Development and increase flood risk downstream of the development.

During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and causing hydromorphological effects.

A summary of potential status change to SWBs arising from increased runoff during the operation stage of the Proposed wind Farm site in the unmitigated scenario are outlined in **Table H**.

Table H: Potential Impact on Surface Water Flows during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Lisdowney_010	IE_SE_15L020100	Moderate	Poor
Nore_110	IE_SE_15N011300	Good	Moderate
Nore_120	IE_SE_15N011400	Moderate	Poor
Nore_130	IE_SE_15N011500	Good	Moderate
Nore_140	IE_SE_15N011600	Good	Moderate
Nore_150	IE_SE_15N011700	Good	Good
Nore_160	IE_SE_15N011750	Good	Good

4.2.2.2 Surface Water Quality Impacts from Operational Site Drainage

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads and hardstand areas. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.

A summary of potential status change to SWBs arising from surface water quality impacts during the operation stage of the Proposed Wind Farm site in the unmitigated scenario are outlined in

Table I.

Table I: Surface Water Quality Impacts during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Lisdowney_010	IE_SE_15L020100	Moderate	Poor
Nore_110	IE_SE_15N011300	Good	Moderate
Nore_120	IE_SE_15N011400	Moderate	Poor
Nore_130	IE_SE_15N011500	Good	Moderate
Nore_140	IE_SE_15N011600	Good	Moderate
Nore_150	IE_SE_15N011700	Good	Good
Nore_160	IE_SE_15N011750	Good	Good

4.2.2.3 Potential Protected Area Impacts

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete.

Therefore, the risk of any operational phase activities that may affect the conservation objectives of the protected areas is greatly reduced.

4.3 MITIGATION MEASURES

In order to mitigate against the potential negative effects on surface and groundwater quality, quantity and flow patterns, mitigation measures will be implemented during the construction and operational phases of the Proposed Project. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures to Protect Surface Water Quality during Earthworks

A suite of general SuDs drainage controls available for surface water management are summarised (along with their application) in **Table** J below. These include avoidance controls, source controls, in-line controls, water treatment controls, and outfall controls.

Table J: Summary of Drainage Mitigation & their Application

Management Type	Description of SuDs drainage control method	Applicable Works Area
Avoidance Controls:	• Application of buffer zones to natural watercourses where possible to avoid excavations in close proximity to watercourses and avoid the release of suspended sediment into watercourses; • Using small working areas; and, • Working in appropriate weather and suspending certain work activities in advance of forecasted wet weather.	Construction work areas where sediment is being generated.

Source Controls:	• Use of upstream interceptor drains and downstream collector drains, vee-drains, diversion drains, flumes and culvert pipes.	Construction work areas where sediment is being generated.
	• Using small working areas; • Covering stockpiles; • Weathering off / sealing stockpiles and promoting vegetation growth.	Stockpiles areas

In-Line Controls:	• Interceptor drains, vee-drains, oversized swales/collector drains;
	• Erosion and velocity control measures such as:
	  o sand bags;
	  o oyster bags filled with gravel;
	  o filter fabrics;
	  o straw bales;
	  o flow limiters;
	  o weirs or baffles;
	  o and/or other similar/equivalent or appropriate systems.
	• Silt fences, filter fabrics;
	• Collection sumps, temporary sumps, pumping systems;
	• Attenuation lagoons;
	• Sediment traps, stilling / settlement ponds.
		Interceptor and collection drainage systems

Water Treatment Controls:	• Temporary sumps; • Attenuation ponds; • Temporary storage lagoons; • Sediment traps, Stilling / Settlement ponds, silt bags; • Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.	Surface water treatment locations
Outfall Controls:	• Level spreaders; • Buffered outfalls; • Vegetation filters; • Silt bags; • Flow limiters and weirs.	Drainage run outfalls and overland discharge points

Each element of the Proposed Project will have an array of drainage control measures to ensure protection of downstream watercourses. Each drainage control element is not stand alone but occurs as part of a treatment train of control systems (i.e., check dams, silt traps, settlement ponds etc).

4.3.1.2 Mitigation Measures to Protect Against the Release of Hydrocarbons

Mitigation measures proposed to avoid the release of hydrocarbons at the Wind Farm site and along the Grid Connection route include:

- Minimal refuelling or maintenance of vehicles or plant will take place on-site. Off-site refuelling will occur where possible;
- On site re-fuelling of machinery will be carried out using a double skinned fuel truck;
- The fuel truck will be re-filled off site, and will drive to where machinery is located;
- The fuel truck will also carry fuel absorbent material and pads in the event of any accidental spillages;
- The fuel truck will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site;
- Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Onsite refuelling will be carried out by trained personnel only;
- Fuels stored on site will be minimized and will be appropriately bunded;

- Surface water runoff from temporary construction compounds will be collected and drained via silt traps and hydrocarbons interceptors prior to recharge to ground;
- A permit to fuel will be put in place;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose;
- An emergency plan for the construction phase to deal with accidental spillages is included within the Construction and Environmental Management Plan; and,
- Spill kits will be available to deal with any accidental spillage in and outside the re-fuelling area.

4.3.1.3 Mitigation Measures to Prevent Groundwater and Surface Water Contamination from Wastewater Disposal

Mitigation measures proposed to avoid the release of wastewater at the Wind Farm site include:

- It is proposed to manage wastewater from the staff welfare facilities in the control buildings/substation by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site.

4.3.1.4 Mitigation Measures to Prevent the Release of Cement-Based Products

Best practice methods for cement-based compounds:

- No batching of wet-concrete products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of concrete contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined concrete washout ponds;
- Weather forecasting will be used to plan dry days for pouring concrete; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.5 Mitigation Measures to Prevent Morphological Changes to Surface Water Crossing and Drainage Patterns

The proposed mitigation measures include:

- The proposed newwatercourse crossing near turbine T8 will be clear span bridge crossing and the existing banks will remain undisturbed. No in-stream excavation works are proposed at these locations and therefore there will be no direct impact on the stream at the proposed crossing locations. Abutments will be constructed from precast units combined with in-situ foundations;
- All guidance / mitigation measures required by the OPW and/or the Inland Fisheries Ireland (IFI)1 is incorporated into the design of the proposed crossings;
- All drainage measures will be installed in advance of the works;
- Plant and equipment will not be permitted to track across the watercourse;

[1] Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters

- A foundation base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required;
- Access to the opposite side of the watercourse for excavation and foundation installation will require the installation of a temporary pre-cast concrete or metal bridge across the watercourse to provide temporary access for the excavator. Plant and equipment will not be permitted to track across the watercourse;
- Once the foundation base has been completed, the pre-cast concrete clear-span structure will be installed using a crane which will be set up on the bank of the watercourse and will be lifted into place from the bank with no contact with the watercourse;
- Once the crossing is in position stone backfill will be placed and compacted against the structure up to the required level above the foundations;
- Underground cabling ducting will be contained within the road make-up of the proposed crossing;
- As a further precaution, near stream construction work, will only be carried out during the period permitted by IFI for in-stream works according to the IFI (2016) guidance document "Guidelines on protection of fisheries during construction works in and adjacent to waters", i.e., July 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 (any deviation from this will be done in discussion with the IFI);
- Where works are necessary inside the 50m buffer double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase; and,
- All new river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

4.3.1.6 Mitigation Measures to Prevent Water Quality Effect to surface Watercourses along the Proposed Grid Connection Route

Prior to the commencement of substation, cable trenching, access road or end mast works the following key temporary drainage measures will be installed:

- All existing roadside drains (where present) that intercept the proposed works area will be temporarily blocked down-gradient of the works using check dams/silt traps;
- Culverts, manholes and other drainage inlets (where present) will also be temporarily blocked;
- A double silt fence perimeter will be placed along the road verge on the down-slope side of works areas that are located inside the watercourse 50m buffer zone.

The following mitigation measures are proposed for the underground cabling watercourse crossing works:

- No stock-piling of construction materials will take place along the grid route;
- No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works will not take place at periods of high rainfall, and will be scaled back or suspended if heavy rain is forecast;
- Local road drainage, culverts and manholes will be temporarily blocked during the works;
- Machinery deliveries will be arranged using existing structures along the public road;
- All machinery operations will take place away from the stream and ditch banks, apart from where crossings occur. Although no instream works are proposed or will occur;
- Any excess construction material will be immediately removed from the area and sent to a licenced waste facility;
- No stockpiling of materials will be permitted in the constraint zones;

- Spill kits will be available in each item of plant required to complete the stream crossing; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.
- The area around the Clear Bore™ (or similar alternative) batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages;
- One or more lines of silt fences will be placed between the works area and adjacent rivers and streams on both banks;
- Accidental spillage of fluids will be cleaned up immediately and transported off site for disposal at a licensed facility; and,
- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

4.3.1.7 Mitigation Measures to Protect Groundwater Quality

The potential pollution of groundwater during the construction phase will be mitigated by the provision of appropriate controls and working methods. These include best practice methods for storage and handling of fuels and chemicals and wastewater outlined in Sections 4.3.1.2, 4.3.1.3 and 4.3.1.4 above.

4.3.1.8 Mitigation Measures to Protect Water Quality along the Turbine Delivery Route

Proposed Mitigation Measures:

- All works are minor and localised and cover very small areas;
- These works are distributed over a wide area;
- All works are temporary in nature; and,
- Application of the Pre-Construction Drainage Measures for surface water quality protection.

4.3.1.9 Mitigation Measures for Protected Areas

The potential for material to enter the downstream protected areas is negligible as mitigation controls as described above will be implemented. These measures include the use of silt fences, silt traps and check dams. Emphasis will also be placed on prevention of hydrocarbon releases to local watercourses.

It can be concluded that with best practice methods adhered to during the construction of the Proposed Development, as outlined above, the potential to affect the qualifying interests of downstream designated sites is not significant.

4.3.2 Operational Phase

4.3.2.1 Increased Site Runoff and Hydromorphology Effects

The operational phase drainage system of the Proposed Development will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- 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. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;

- Swales/road-side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds have been designed in consideration of the greenfield runoff rate.

4.3.2.2 Mitigation Measures to Protect Surface Water Quality

The mitigation measures to protect against poor quality runoff during the operational phase of the Proposed Project are the same as those outlined in **Section 4.3.1.1** above.

Mitigation measures for oils and fuels during the operational phase of the Proposed Project are the same as those outlined in **Section 4.3.1.2** above.

4.3.2.3 Mitigation Measures to Protect Groundwater Quality

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants.

4.3.2.4 Mitigation Measures for Protected Areas

The mitigation measures to protect against poor quality runoff during the operational phase of the proposed development are the same as those outlined in **Section 4.3.1.1** above.

Mitigation measures for oils and fuels during the operational phase of the proposed development are the same as those outlines in **Section 4.3.1.2** above.

It can be concluded that with best practice methods adhered to during the operation phase of the Proposed Project, the potential for the project to impact upon the qualifying interests of the local designated sites is not significant.

4.3.3 Decommissioning Phase

The potential impacts associated with decommissioning of the Proposed Wind Farm site will be similar to those associated with construction but of a reduced magnitude due to the reduced scale of the proposed decommissioning works in comparison to construction phase works.

During decommissioning, it will be possible to reverse or at least reduce some of the potential effects caused during construction, and to a lesser extent operation, by rehabilitating constructed areas such as turbine bases and hard standing areas. The turbine bases will be rehabilitated by covering with local soil/subsoil 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.

The Proposed Wind Farm site roadways will be kept in place. The electrical cabling connecting the site infrastructure to the on-site substation will be removed, while the ducting itself will remain in-situ rather than excavating and removing it, as this is considered to have less of a potential environmental impact, in terms of soil exposure, and thus on the possibility of the generation of suspended sediment which could enter nearby watercourses.

The turbines will be removed by disassembling them in a reverse order to their erection. This will be completed using the same model cranes as used in their construction. They will then be transported off-site along their original delivery route. The disassembly and removal of the turbines will not have an impact on the hydrological/hydrogeological environment at the Wind Farm site.

Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site.

As noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is, therefore:

> *"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".*

Some of the impacts will be avoided by leaving elements of the Proposed Wind Farm site in place where appropriate. The Proposed Grid connection substation and underground cabling will be retained by EirGrid/ESB as a permanent part of the national grid.

No significant effects on the hydrological and hydrogeological environment are envisaged during the decommissioning stage of the Proposed Wind Farm site.

4.3.4 Potential Effects with the Implementation of Mitigation

In all instances, the mitigation measures described in **Section 4.3** will allow all relevant waterbodies to maintain their existing status and meet future WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in

Table K below.

Table K: Summary of WFD Status for Unmitigated and Mitigated Scenarios

SWB	WFD Code	Current Status	Assessed Potential Status Change – Unmitigated	Assessed Potential Status Change – Mitigated
Surface Water Bodies				
Lisdowney_010	IE_SE_15L020100	Moderate	Poor	Moderate
Nore_110	IE_SE_15N011300	Good	Moderate	Good
Nore_120	IE_SE_15N011400	Moderate	Poor	Moderate
Nore_130	IE_SE_15N011500	Good	Moderate	Good
Nore_140	IE_SE_15N011600	Good	Moderate	Good
Nore_150	IE_SE_15N011700	Good	Good	Good
Nore_160	IE_SE_15N011750	Good	Good	Good
Nore_170	IE_SE_15N011950	Good	Good	Good
Nore_180	IE_SE_15N012000	Good	Good	Good
Nore_190	IE_SE_15N012090	Poor	Poor	Poor
Nore_200	IE_SE_15N012130	Good	Good	Good
Nore_210	IE_SE_15N01220	Good	Good	Good
Nore_220	IE_SE_15N012310	Good	Good	Good
Nore_230	IE_SE_15N012330	Moderate	Moderate	Moderate
Nore_240	IE_SE_15N012400	Good	Good	Good
Nore_250	IE_SE_15N012500	Good	Good	Good
Nore Estuary	IE_SE_100_0400	Moderate	Moderate	Moderate
Barrow Nore Estuary Upper	IE_SE_100_0250	Moderate	Moderate	Moderate
New Ross Port	IE_SE_100_0200	Moderate	Moderate	Moderate
Lower Suir Estuary (Little Island – Cheekpoint)	IE_SE_100_0500	Moderate	Moderate	Moderate
Barrow Suir Nore Estuary	IE_SE_100_0100	Moderate	Moderate	Moderate
Waterford Harbour	IE_SE_100_0000	Moderate	Moderate	Moderate
Eastern Celtic Sea (HAs 13;17)	IE_SE_050_0000	High	High	High
Groundwater Body				

Lisdowney	IE_SE_G_088	Good	Good	Good
Durrow	IE_SE_G_156	Poor	Poor	Poor
Killkenny-Ballynakill Gravels	IE_SE_G_163	Good	Good	Good

4.4 CUMULATIVE ASSESSMENT

A detailed cumulative assessment has been carried out for all planning applications (granted and awaiting decisions) within a combined river sub-basin zone within the vicinity of the Site defined within Appendix 2-3 of the EIAR.

A dataset of 3,910 no. planning applications within the defined potential cumulative boundary (defined by boundaries of downgradient water catchments) has been completed. Of the 3,910 no. applications, 406 no. applications are for agricultural buildings, typically slatted sheds and milking parlors. There are 163 no. commercial units within the dataset and 2,288 no. residential dwellings. There are 22 no. wind farms listed within 25km of the Site. Based on the scale of the works, their proximity to the Proposed Development and the temporal period of likely works, no cumulative effects will occur as a result of the Proposed Development. As such, there will be no potential for effects on the WFD status of any surface water or groundwater body, as a result of cumulative effects associated with the Proposed Development.

5. WFD ASSESSMENT CONCLUSION

WFD status for SWBs (Surface Water Bodies) and GWBs (Groundwater Bodies) hydraulically linked to the Proposed Wind Farm site and the Proposed Grid Connection Route are defined in **Section 2** above.

The Proposed Wind Farm site does not involve any abstraction of groundwater or alteration of drainage patterns. Therefore, the quantitative status (i.e., the available quantity (volume) of groundwater and surface water locally) to the receiving waters will remain unaltered during the construction and operational phase of the Proposed Wind Farm site and the Proposed Grid Connection Route.

There is no direct discharge from the Proposed Wind Farm site and the Proposed Grid Connection Route to downstream receiving waters. Mitigation for the protection of surface water during the construction, operation and decommissioning phases of the Proposed Wind Farm site and the Proposed Grid Connection Route will ensure the qualitative status of the receiving waters will not be altered by the Proposed Wind Farm site and the Proposed Grid Connection Route.

There is also mitigation proposed to protect groundwater quality within the Proposed Wind Farm site and the Proposed Grid Connection Route during the construction, operational and decommissioning phases of the Proposed Wind Farm site and the Proposed Grid Connection Route. These mitigation measures will ensure the qualitative status of the underlying GWB will not be altered by the Proposed Wind Farm site and the Proposed Grid Connection Route.

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Proposed Wind Farm site and the Proposed Grid Connection Route. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs are protected from any potential deterioration.

As such, the Proposed Wind Farm site and the Proposed Grid Connection Route:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC).

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