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Introduction

7.1 This chapter of the EIAR provides a description of the surface water and groundwater conditions in the existing Site (as defined in **Chapter 2** of this EIAR) within the context of the regional setting, and assesses the potential impacts the Proposed Development will have on surface water and groundwater. The Proposed Development is described in detail in **Chapter 2**. Mitigation measures are proposed in the form of avoidance, prevention, offsetting, reinstatement and/or monitoring are included where significant effects are described. Any residual effects are also assessed.

Overview of the Proposed Development

7.2 All elements of the Proposed Development are described in **Chapter 2** of this EIAR including proposed watercourse crossings and the proposed drainage system which include:

- Existing and proposed watercourse crossings are shown in **Figure 7-1**.
- There are two existing crossings. One existing crossing is over an arterial drainage channel, and one over a field drain. These crossings are between Turbines 1 and 3 and will be upgraded. There is a requirement for 2 no. new proposed culverted crossing over a field ditch approaching Turbine 2. This will be installed as part of the track construction works.
- Culverts are designed to cater the correct loadings imposed from construction vehicles.
- The proposed drainage system will be based on two key methods. The first method will involve keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around drainage features, and diverting clean surface runoff around excavations and construction areas. The second method will involve collecting any drainage water from works areas that might carry silts or sediments, and to route them towards settlement ponds prior to controlled diffuse release over vegetated natural surfaces.
- The two proposed new culverts over the field drains will be culverted with a 900mm pipe. To upgrade the existing crossing over the arterial drainage drain, the Section 50 consent from the OPW will be required. The upgraded crossing structure will retain the existing hydraulic profile to mitigate any impact on the local drainage and flood risk.

Statement of Authority

7.3 This chapter of the EIAR was prepared by SLR Consulting Ireland. The project team consists of:

- Dominica Baird BSc, MSc (Hydrogeology), CGeol, EurGeol, MIAH
- Kristian Divjak BSc, MSc (Water Resources Engineering), MIEI
- Orlaith Tyrrell BSc (Geology), MIGI, MIAH

7.4 Dominica Baird is Technical Director (Hydrogeology) and has over twenty years' experience in environmental consulting, specialising in hydrogeology and water. Dominica's areas of expertise cover hydrogeology, groundwater risk assessment and contaminated land with experience gained in London, Edinburgh and Dublin. Dominica has worked on various renewable projects, mainly wind farms, as well as cable routes in Ireland and Scotland as

lead hydrogeologist and has undertaken field surveys including installation of groundwater monitoring wells, water supply surveys and peat surveys. Dominica has presented findings of hydrogeological assessments at oral hearings and prepared briefs of evidence in arbitration cases.

7.5 Kristian Divjak is a civil engineer with over 7 years of experience in flood risk assessments, hydraulics and drainage design. Throughout his career he has worked on projects in Croatia and Ireland. He has worked on numerous renewable energy projects, flood risk assessments and drainage design. He has inspected various sites for potential wind farm and solar farm developments. This allowed him to identify potential risks at early stage of the project and gave him the ability to communicate complex technical information to a range of project stakeholders.

7.6 Orlaith Tyrrell is a Project Hydrogeologist with 2 years' experience working in groundwater consultancy. She is a member of the Institute of Geologists of Ireland (IGI) and of the International Association of Hydrogeologists (IAH). Orlaith has worked on multiple scale renewables projects and has co-authored several EIAR Water chapters for wind farm developments.

Scope of Work

7.7 This Chapter describes the local hydrological and hydrogeological environment at and around the Proposed Development area. The Study Area comprises the Proposed Development Site and the surrounding area up to 2 km to reflect the sensitivity of the subsurface in the area (IGI EIS Guidelines, 2013).

7.8 The scope of this chapter includes:

- An assessment of the existing water (hydrology and hydrogeology) within approximately 2km of the Proposed Development boundary;
- An assessment of the potential impact of the Proposed Development, and associated ancillary works on surface water and groundwater; and
- Where necessary, mitigation measures are proposed to reduce or eliminate any potential adverse impacts.

Consultations

7.9 Consultation took place with a number of organisations including the following relevant bodies:

- GSI, EPA, Irish Water, IFI, and OPW.
- The full list of consultees is presented in **Table 1-2 of Chapter 1**.

Table 7-1: Water Consultation Summary

Stakeholder	Summary Response	Action
Meath County Council	As part of the site is located within a flood risk area. A stage 3 FRA is required and should include OPW CFRAMS and CDP data. MCC also requested the following to be included in the CEMP: Surface Water Quality Management Plan Water Protection and Monitoring Protocol	Stage 3 FRA carried out and Detailed Drainage Survey to consider appropriate mitigation (including embedded mitigation) and inform CEMP. Water quality management measures are identified in this Chapter of the EIAR. Further

Stakeholder	Summary Response	Action
	Site Drainage Management and Emergency Silt Control and Spillage Response Procedures and Dust Control Suppression Strategy.	information also available from the Aquatic survey. (Please see Appendix 5-4) A Water Protection and Monitoring Protocol is set out in this Chapter of the EIAR. An Environmental Incident and Emergency Response Plan is included in the CEMP. (Please see **Appendix 2-2**)
Inland Fisheries Ireland	IFI noted the potential of the Proposed Development to impact on fisheries waters on the Rivers Stonyford, Athboy and Boyne including areas designated as SAC's, angling waters, adult holding areas, nursery and spawning waters, etc. forming parts of the Eastern River Basin District The IFI requested particular regard to the following: All natural watercourses which have to be traversed during site development and road construction works should be effectively bridged prior to commencement. To minimise adverse impacts on the fisheries resource works in rivers, streams and watercourses should normally (except in exceptional circumstances and with the agreement of IFI) be carried out during the period July-September. The IFI also requested: The assessment and review of the soil type and structure at the proposed turbine locations, and along the route of any proposed access track(s)/road(s) including areas where temporary or permanent stock piling of excavated material takes place. This is particularly important if the areas concerned contain peat soils. Systems to be put in place to ensure that there shall be no discharge of suspended solids or any other deleterious matter to watercourses during the construction / operational phase and during any landscaping works. A number of requirements for construction and operation were listed in relation to this concern. The use of pre-cast concrete wherever possible during construction to avoid alteration of pH of water. Biosecurity measures during construction phase to avoid spread of invasive species. No in-stream works without written approval of IFI. All works should also be carried out as per Guidelines	In response to the submission, it should be noted that the development will not require river crossings. A detailed drainage survey for T1 was prepared to inform mitigation measures at this location. Measures are designed to protect surface waters and associated fisheries. These measures have been incorporated into the CEMP.

Regulatory Background

Legislation

7.10 The key EU Legislation which applies to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein are:

- Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending ('EIA Directive')
- Since 2000 water management in EU member states has primarily been directed by the Water Framework Directive (2000/60/EC) and the associate 'daughter' Groundwater Directive (2006/118/EC).

7.11 Other EU Directives to which this EIAR has complied with are listed in **Appendix 7-1** found in Volume III of this EIAR.

7.12 National Legislation which applies to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein is also listed in **Appendix 7-1** found in Volume III of this EIAR.

7.13 Most notably, under Regulation 4 of S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended ('the Groundwater Regulations'), a duty is placed on public authorities to promote compliance with the requirements of the Groundwater Regulations and to take all reasonable steps including, where necessary, the implementation of programmes of measures, to:

"(a) prevent or limit, as appropriate, the input of pollutants into groundwater and prevent the deterioration of the status of all bodies of groundwater;

(b) protect, enhance and restore all bodies of groundwater and ensure a balance between abstraction and recharge of groundwater with the aim of achieving good groundwater quantitative status and good groundwater chemical status by 2015 or, at the latest, by 2027;

(c) reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater;

(d) achieve compliance with any standards and objectives established for a groundwater dependent protected area included in the register of protected areas established under Regulation 8 of the 2003 Regulations [S.I. No. 722 of 2003] by not later than 2015, unless otherwise specified in the Community legislation under which the individual protected areas have been established."

Planning Policy and Development Control

7.14 The Planning Policy and Development Control relating to water at the Site in this EIAR is set out in the:

- Westmeath County Development Plan 2021-2027
- Meath County Development Plan 2021-2027

Table 7-2: Westmeath County Development Plan 2021-2027 – relevant policies and objectives relating to water for development in the transport, infrastructure and energy sectors

Policy No.	Policies and Objectives
CPO 10.88	Ensure that in assessing applications for developments, that consideration is had to the impact on the quality of surface waters having regard to targets and measures set out in the River Basin Management Plan for Ireland 2018-2021 and any subsequent local or regional plans.
CPO 10.89	Ensure that development would not have an unacceptable impact on water quality and quantity including surface water, ground water, designated source protection areas, river corridors and associated wetlands.
CPO 10.94	Ensure that development will only be permitted in instances where there is sufficient capacity for appropriate collection, treatment and disposal (in compliance with the Water Framework Directive and River Basin Management Plan) of waste water.
CPO 10.105	Have regard to the "Guidelines for Planning Authorities on the Planning System and Flood Risk Management" (DoEHLG/OPW 2009) and Circular PL2/2014, through the use of the sequential approach and application of the Justification Tests in Development Management.
CPO 10.106	Ensure that a flood risk assessment is carried out for any development proposal within 200m of a watercourse and at risk of flooding, in accordance with the "Guidelines for Planning Authorities on the Planning System and Flood Risk Management" (DoEHLG/OPW 2009). This assessment shall be appropriate to the scale and nature of risk to the potential development.
CPO 10.109	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.
CPO 10.118	Ensure new development is adequately serviced with surface water drainage infrastructure which meets the requirements of the Water Framework Directive, associated River Basin Management Plans and CFRAM Management Plans.
CPO 10.119	Require that planning applications are accompanied by a comprehensive SUDs assessment that addresses run-off quantity, run-off quality and its impact on the existing habitat and water quality.
CPO 10.121	Ensure appropriate maintenance of surface water drainage infrastructure to avoid Flood risk.

Table 7-3: Meath County Development Plan 2021-2027 – relevant policies and objectives relating to water for infrastructure strategy

Policy No.	Policies and Objectives
INF OBJ 7	To promote the sustainable use of water and water conservation in existing and new development within the County and encourage demand management measures among all water users.
INF POL 14	To co-operate with the EPA and other authorities in the continued implementation of the EU Water Framework Directive.
INF OBJ 16	To ensure that all new developments comply with Section 3.12 of the Greater Dublin Regional Code of Practice for Drainage Works V6 which sets out the requirements for new developments to allow for Climate Change.

Policy No.	Policies and Objectives
INF POL 18	To implement the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoEHLG/OPW, 2009) through the use of the sequential approach and application of Justification Tests for Development Management and Development Plans, during the period of this Plan.
INF POL 20	To require that a Flood Risk Assessment is carried out for any development proposal, where flood risk may be an issue in accordance with the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoECLG/OPW, 2009). This assessment shall be appropriate to the scale and nature of risk to and from the potential development and shall consider the impact of climate change.
INF POL 21	To consult with the Office of Public Works in relation to proposed developments in the vicinity of drainage channels and rivers for which the OPW are responsible.
INF POL 22	To retain a strip of 10 metres on either side of all channels/flood defence embankments where required, to facilitate access thereto.
INF OBJ 29	To strive to achieve 'good status' in all water bodies in compliance with the Water Framework Directive and to cooperate with the implementation of the National River Basin Management Plan 2018-2021.

Guidelines and Technical Standards

7.15 The following key guidelines have been adhered to in this hydrology and hydrogeology assessment:

- Institute of Geologists of Ireland. Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, April 2013;
- EPA. Guidelines on the information to be contained in Environmental Impact Assessment Reports, May 2022;
- National Roads Authority, 2008. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes; and
- DoEHLG/OPW, 2009. Planning System and Flood Risk Management – Guidelines for Planning Authorities.

7.16 Additional guidelines and technical standards which have been adhered to in this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein are listed in **Appendix 7.1** found in Volume III of this EIAR.

Receiving Environment

Study Area

7.17 For the purposes of this assessment, the Study Area comprises the area within a 2km buffer of the proposed permanent footprint of the Proposed Development forms the Study Area (IGI EIS Guidelines, 2013). For the purposes of this assessment, the planning application includes all elements of the Proposed Development, including the Cable Corridor and Proposed Substation as detailed in Chapter 2. The EIAR has also assessed all design permutations from the dimensions set out in Table 2.1 of Chapter 2.

Baseline Study Methodology

7.18 Existing information on the geology, hydrogeology, and hydrological features within the defined Study Area was collated and evaluated.

7.19 The methodology involved in the assessment of the hydrology and hydrogeology within the defined Study Area can be summarised as follows:

- A desk study, in which existing data and relevant regional data sources for the area were examined.
- Site walkovers.
- Localised detailed drainage survey.
- Flood Risk Assessment, and,
- The analysis of the information gathered.

Sources of Information

7.20 The desk study involved the examination of several datasets to determine the hydrological, geological and hydrogeological setting of the area, as detailed in **Table 7-4**. The desk study was undertaken in July to September 2023.

Table 7-4: Regional Data Consultation

Data[1]	Dataset
Soils	Irish Soils Information System - Teagasc
Subsoil Geology	Teagasc/GSI/EPA Subsoil Mapping
Bedrock Geology	GSI Groundwater Data Viewer - Bedrock Geology
Surface Water	OSi Discovery Series mapping; Environmental Protection Agency; Water Framework Directive; and OPW CFRAM.
Groundwater	GSI Groundwater Data Viewer - bedrock and gravel aquifers, vulnerability, water supplies, groundwater recharge; GSI Groundwater body description documents; and Environmental Protection Agency water maps.
Climate	Met Eireann
Protected Areas, Environmental Pressures	Environmental Protection Agency, National Parks and Wildlife Service

Site Walkover

7.21 On 7th April 2022, a walkover study was conducted by SLR Senior Flood Risk Engineer, Kristian Divjak, to assess the hydrology and hydrogeology features of the Proposed

[1] All data accessed June - September 2023.

Development area and identify constraints. The site walkover involved an initial review of available information gathered in the desk study. No constraints for the proposed wind turbine locations for the current scheme were noted in terms of hydrology and hydrogeology during the site visits with the exception of an area of flood risk in proximity to T1 and the location of the River Boyne and River Blackwater cSAC (Code 002299) at this same location, as detailed in Chapter 5.

7.22 A detailed drainage survey was undertaken in the area surrounding turbine T1 at the Site on 11th January 2023.

Site Topography

7.23 The total area of the Proposed Development is 115.81 ha consisting of agricultural land, primarily grazing, private woodland plantation and native woodland. Some of the woodland is within an area that is mapped as cut peat. Several eskers run through the area, particularly in the southern part of the Proposed Development Site.

7.24 The land is generally flat to gently undulating, with a very gradual slope from west to east. The lowest point is along Darcy's Crossroads Stream, which forms part of the northwest boundary of the Proposed Development Site, near turbine locations T1 and T2. The highest point in the Site is southeast of turbine location T3.

Rainfall and Climate

7.25 The nearest synoptic weather station is Mullingar, located approximately 22 km south-west of the Proposed Development. However, Met Éireann note that their Mullingar station "closed in 2007/2008" and more recent data for the Long Term Average (LTA) period 1991 – 2020 is not available for this station as a result.

7.26 LTA monthly rainfall data for 1991 – 2020 has instead been sourced from Casement synoptic weather station, the next closest station to the Site located approximately 56 km south-east of the Proposed Development. The LTA annual rainfall in the area at the Casement weather station is 783.5 mm/yr for the period 1991-2020 (Met Eireann, 2023). The LTA monthly rainfall for the period 1991-2020 are shown in **Table 7-5** below.

Table 7-5: LTA (1991-2020) Monthly Rainfall (mm) for Casement Weather Station

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
65	55.2	51.8	55.3	59.1	65.7	59.4	71.2	61.6	81.6	81.9	75.7

7.27 Effective rainfall across the Site is estimated at 599mm/yr. Based on groundwater recharge coefficient estimates from the GSI (www.gsi.ie) an estimate of 509mm/year average annual recharge is given for the majority of the Proposed Development area (groundwater recharge coefficient of ~85%). Due to the variations of groundwater vulnerability at the Site, there are lesser areas to the north and south identified as cut peat where the groundwater where an estimate of 24mm/year average annual recharge is given (groundwater recharge coefficient of ~4%).

Soils and Geology

Soils and Subsoils

7.28 The Irish Soil Information System project has developed a national association soil map for Ireland, the project is co-funded by Teagasc and the (EPA). The soils are discussed in detail in Chapter 6 of this EIAR.

7.29 The soil underlaying the Proposed Development Site is predominantly a typical Luvisol, classified as Elton (1000ET) within National Soil Series. The GSI database reports that the Teagasc soils at the Site are mostly Gravels derived from Limestones (GLs), see **Figure 6-1**. The IFS code is BminSRPT consisting of shallow, peaty, poorly-drained, mainly basic mineral soils. There are lesser areas of cut over raised peat (Cut) and deep, well-drained mineral soils (BminDW).

7.30 The Sub Soil parent material is identified as limestone drift material.

7.31 The west and northern portions of the Site have more variable soil type with a combination of primarily low permeability soils and area of till overlain by poorly drained gley with minor isolated areas of peat and areas of exposed bedrock.

7.32 The subsoils at the Site are gravels derived from Carboniferous limestones, with east-west trending eskers in the area, see **Figure 6-2**. Some of the surface water ponding appear to be associated with the esker subsoils, however, this is not the case for the majority of ponding and eskers in the area of the Main Wind Farm Site.

7.33 Peat has been observed within the Proposed Development area following an assessment and walkover of the existing environment. Further information on soils, soil and peat management can be found in **Chapter 6 Land Soils and Geology**.

Local Bedrock Geology

7.34 The GSI online database shows that the Site is entirely underlain by the Lucan Formation. The formation comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey.

Surface Water - Hydrology

Surface Waterbodies

7.35 The Site is situated near waterbodies listed in and shown on **Figure 7-2** and located within the catchment of the Boyne (ID 07). There are no streams and rivers shown within the Site on the EPA catchment mapping. However, site walkovers have identified surface water bodies (field drains and small streams) within the Study Area.

7.36 The Darcy Crossroads Stream runs along the north-western boundary of the Proposed Development. The Killacroy Stream runs along the northern boundary in the east-west direction where it ultimately joins the Darcy Crossroads Stream. Approximately 1.8 km south-west of the confluence, the Darcy Crossroads Stream flows into the River Stonyford and forms a part of the River Boyne and River Blackwater cSAC (Code 002299). The River Stonyford flows in the south-east direction for approximately 19 km where it joins the River Boyne.

7.37 The Newtown Lough Fen is located to the east of the Northern Cluster and is upstream of the River Stonyford. There are also a series of small surface water ponds across the Study Area, some of which are associated with gravel esker deposits.

7.38 The Water Framework Directive water quality status and river waterbody risk associated with the wind farm are provided in the Water Framework Directive section further in this chapter.

Catchments

7.39 The Proposed Development (including the cable route and Proposed Substation site) areas fall within the boundary the Boyne Catchment (07), as shown in **Figure 7-2** The surface water bodies are comprised of the tributaries of the Darcy Crossroad Stream and the River Stonyford. The River Stonyford joins the River Boyne approximately 19 km southeast of the Site.

7.40 The Proposed Development and cable routes are also situated within two sub-catchments. These are:

- Boyne_SC_050
- Boyne_SC_070

Surface Water Drainage

7.41 Following the site walkovers, a number of streams/drainage channels were identified to be flowing through or adjacent to the Proposed Development.

7.42 Site visits have been conducted in 2022 and 2023 to identify hydrology features within the Site and assist in addressing the potential impacts on hydrology due to the construction, operation, and decommissioning of the Proposed Development.

7.43 The key hydrologic features of the Proposed Development Site are the River Stonyford and its tributary, D'arcys Crossroads Stream. Both the Northern Cluster and Southern Cluster turbines within the Proposed Development Site are located to the east of these watercourses. The surface runoff within the Site generally flows towards these watercourses.

7.44 The pasture fields at the northern part of the Site are drained by field drains, which ultimately discharge into the D'arcys Crossroads Stream. The northern area of the site drains towards the Killacroy Stream, this stream joins the D'arcys Crossroads Stream at the north-western corner of the Site. During the site visit, it was noted that the field drains are poorly drained with no active flows.

7.45 There are a series of small surface water ponds across the Study Area and within the Proposed Development Site, some of which are associated with gravel esker deposits.

7.46 No streams were identified at the Southern Cluster of the Proposed Development. The surface runoff flows towards the local low-lying area and towards the River Stonyford located to the south of the Site.

7.47 A detailed drainage report has been produced for the area surrounding the proposed turbine T1 location due to the nature of the hydrological environment in that area (see **Appendix 7-4**). The key findings of the report are detailed below.

- The Killacroy Stream is located 25 m north of the centre point of T1. The stream flows in a western direction some 550 m where it joins the Darcy Crossroad Stream. During the site walkover a manmade ditch was identified approximately 90 m to the west of

T1. This drain was filled up with standing water (i.e. no flow in the ditch was observed) water and no connectivity with the Killacroy Stream could be identified.

- The lands around T1 slope gently towards the Killacroy Stream and this will be the natural drainage direction in this area, toward the stream. No significant ponded areas were identified in the vicinity of T1 during the walkover.
- Surface water runoff to the east of the proposed road leading towards T1 will be intercepted by a proposed drain and dispersed to the east of the turbine. Surface water from the construction area, including from the turbine foundation excavation, will be collected by swales that connect to a proposed settlement pond. Two settlement ponds are proposed, one will be located approximately 30m to the east of the proposed turbine T1, and one approximately 50m west of the proposed turbine T1. Water entering the ponds will be treated and dispersed diffusely over the land to retain the existing surface water runoff pattern. The proposed drainage will be outside of the River Boyne and Rier Blackwater cSAC. The proposed drainage layout and details are provided in **Appendix 7-4**. Along the Killacroy Stream silt fencing will be installed to prevent fugitive silt material in runoff around the Site from entering the River Boyne And River Blackwater cSAC and D'arcys Crossroads stream.
- There will be no machinery located between the T1 construction working area and riverbank during construction works.

7.48 The report also outlines any protective mitigation measures for nearby surface watercourses which will prevent any deterioration in water quality arising from the Proposed Development at T1.

Flooding

7.49 The Site-Specific Flood Risk Assessment (SSFRA) has been prepared for the Proposed Development, which is provided in **Appendix 7-3** found in Volume III of this EIAR. A brief summary of the assessment is summarised below.

7.50 The OPW is the government agency with statutory responsibility for flooding in Ireland. The OPW and DoEHLG guidelines for planning authorities addressing the management of flood risk in the planning system[2;] where guidelines were followed with respect to the preparation of the SSFRA for the Proposed Development.

Fluvial Flooding

7.51 The OPW National Indicative Fluvial Mapping (NIFM) dataset has been produced nationally for catchments greater than 5 km2 in areas for which flood maps were not produced under the National CFRAM Programme and should be read in this context. The NIFM dataset are 'predictive' flood maps showing indicative areas predicted to be inundated during a theoretical fluvial flood event with an estimated probability of occurrence. According to the NIFM data, part of the site in the Northern Cluster is located within Flood Zone A (probability of flooding greater than 1%) and Flood Zone B (probability of flooding between 1% and 0.1%), as shown in **Figure 4-1** in **Appendix 7-3**. The Southern Cluster of the Site is not at risk of flooding.

[23] The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009): Office of Public Works and the Department of the Environment, Heritage and Local Government.

7.52 Based on the above, a detailed hydraulic model was developed to assess the flood risk. The results of the hydraulic modelling show that only the proposed turbine T1 and access road leading to it is within Flood Zone A. The proposed turbines T2, T3, T4, T5, T6, T7 and T8 are within Flood Zone C (probability of flooding less than 0.1%). The Proposed Substation is also within Flood Zone C, which is the area with the lowest risk of flooding (probability of flooding less than 0.1%). According to the flood guidelines, a substation can be located in Flood Zone C. The figure showing the flood zones is presented in **Figure 6-6** of **Appendix 7-3**.

7.53 The flood depth map shows water depth within the Site being mostly up to 0.20 m for the 0.1% AEP Mid-Range Future Scenario (MRFS). There are three localised low points where flood depth is up to 0.75 m. Flood depth is 0.14 m at the location of proposed turbine T1. The modelled extents of flooding that could occur during the 1% AEP and 0.1% AEP flood events are concentrated around the area of turbine T1.

7.54 A wind turbine is an acceptable development within an area of flood risk (An Bord Pleanála case PL09.306500) if the base of the turbine is elevated at least 300mm above the 1% AEP MRFS flood level. This is in accordance with the flood guidelines.

Pluvial Flooding

7.55 PFRA pluvial maps show small, isolated patches throughout the Proposed Development site. During the site walkover, it was noted these are ponds across the development area. It is considered that the Proposed Development is at low risk of pluvial flooding, as detailed in the SSFRA.

Groundwater Flooding

7.56 There is no evidence from Geological Survey Ireland mapping to suggest that groundwater is a potential source of flood risk to the Proposed Development. The SSFRA concluded that the Proposed Development is at the low risk of groundwater flooding.

Historical Flooding

7.57 According to the OPW database, there are no recorded historical or recurring flood incidents within the Site. The closest flood incident is approximately 0.8km northwest of the Site at the Cross Keys Stream. This is a tributary of the River Stonyford. The recorded flood incident is a recurring flooding, Sranakill CR 190 Recurring (ID 773) caused by low lying lands.

Surface Water Quality

7.58 The EPA regularly monitors water bodies in Ireland as part of their remit under the WFD (2000/60/EC), which requires that rivers are maintained or restored to good/ favourable status. The quality of watercourses is assessed in terms of 4 No. quality classes; ‘unpolluted’ (Class A), ‘slightly polluted’ (Class B), ‘moderately polluted’ (Class C) and ‘seriously polluted’ (Class D). These water quality classes and the water quality monitoring programme are described in the EPA publication ‘Water Quality in Ireland, 2003’. The water quality assessments are largely based on biological surveys. Biological Quality Ratings or Biotic Indices (Q values) ranging from Q1 to Q5 are defined as part of the biological river quality classification system. The relationship of these indices to the water quality classes defined above, are set out in **Table 7-6** below.

Table 7-6: Relationship between Biotic Indices and Water Quality Classes

Biotic Index	Quality Status	Quality Class
Q5, 4-5, 4	Unpolluted	Class A
Q3-4	Slightly Polluted	Class B
Q3, 2-3	Moderately Polluted	Class C
Q2, 1-2, 1	Seriously Polluted	Class D

7.59 There are a number of water quality monitoring locations monitored by the EPA at locations adjacent to and downstream of the Proposed Development and the cable route, shown on **Figure 7-3**. The most recent Biological Water Quality Ratings at these stations are outlined in **Table 7-7** only for those stations where Q-value data is available since 2015. The Q rating is Q3-4 to Q4 at all stations, which indicates “slightly polluted” to “unpolluted” status.

Table 7-7:EPA Biological Water Quality Ratings

Station ID	Station Name	Watercourse	2015	2018	2020
RS07D060030	Snipe's Bridge	D’arcy’s Crossroads Stream	Q3-4	Q3-4	Q3-4
RS07S020065	STONYFORD - Bridge southwest of Ballinlough	Stonyford	Q3-4	Q3-4	Q3-4
RS07A010070	Bridge west of Johnsbrook House	Athboy	Q3-4	Q3-4	Q4

7.60 An aquatic baseline survey was undertaken by Triturus and includes biological water quality sampling, as presented in **Appendix 5.4**. No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from 12 no. wetted riverine in July 2022. Hydromorphological pressures and more intensive bordering land use practices are considered to have created conditions inimical for the establishment of rarer invertebrate species. However, despite evident catchment pressures, a total of 4 no. sites on the Athboy River (site A4), D’arcy’s Crossroads Stream (B3 & B5) and the Stonyford River (B6) achieved Q4 (good status) water quality and thus met the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (Appendix B). The remaining 8 no. sites achieved Q3-4 (moderate status) (B4, B7 & B8) or Q2-3 (A3 & B1) or Q3 (poor status) (A1 & B9).

7.61 Whilst the larger survey watercourses supported improved conditions, the biological water quality of the survey area was evidently impacted via eutrophication, siltation and or historical modifications (hydromorphology). Low summer flows and associated lower water volumes further reduced the water quality within the survey area in July 2022. Channelisation (hydromorphology) as previously mentioned and agricultural derived siltation and enrichment are the primary threats to water quality within the survey area and this was observed during the site surveys.

Cable Route

7.62 The proposed cable route for the Proposed Development is shown on Figure 3-2 of this EIAR. The cable route will connect the wind farm to a 110kV Proposed Substation at Clonmellon.

7.63 The proposed wind farm development will utilise in total four crossings: two new crossings over the field drains, one existing crossing over a field drain, and one existing crossing over a field drain which connects the Newton Lough and D'arcys Crossroads Stream as shown on **Figure 7-1**.

7.64 The identified crossings over the watercourses that are associated with the Proposed Development are listed in **Table 7-8** below.

7.65 The Proposed development at the southern part of the Site will not require any watercourse crossing points.

7.66 The proposed cable route will cross two sections of the Athboy River as it enters Clonmellon to the north of the Proposed Development.

7.67 The specification for cables and cable installation will be in accordance with EirGrid requirements and within the parameters assessed in this EIAR.

Table 7-8: Watercourse Crossings

Crossing Point	Existing / Proposed	X coordinate (ITM)	Y coordinate (ITM)	Crossing type	Watercourse
WF-HF1	Existing	663112	767688	Flatbed Culvert	Field Drain
WF-HF2	Existing	663072	767714	Piped Culvert	Field Drain
WF-HF3	Proposed	662835	767827	Piped Culvert	Field Drain
WF-HF4	Proposed	662698	767830	Piped Culvert	Field Drain
GCR-1	Existing	664687	768427	Piped Culvert	Kilskeer Stream
GCR-2	Existing	664293	768880	Box Culvert	Clonmellon Stream

7.68 Where watercourse crossings are required for the purposes of the cable route, the most relevant of the following methodologies will apply, to be assessed on a case-by-case basis:

- **Piped culvert crossings** – where sufficient cover is available, the cable ducts will be laid above the culvert with a minimum separation distance of 300 mm. Where sufficient cover is not available, cable ducts will be laid under the culverts with a separation distance of 300 mm.
- **Flatbed formation over culvert** – where the cable duct is to be installed over or below an existing culvert where sufficient cover is not available, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert. The ducts will be laid in this trench in a flatbed formation over the existing culvert and it will be encased in 6 mm thick steel galvanised pleat with the concrete surround as per EirGrid specification.

7.69 New crossings will be designed to convey 1% AEP MRFS (Annual exceedance probability Mid-range future scenario) storm event with minimum 300mm freeboard level. This is in line with the OPW requirements.

Access Tracks

7.70 The Proposed Development includes c. 6 km of internal access tracks. Existing access tracks and local public roads will be utilised wherever possible. Drainage infrastructure along the tracks will be provided where necessary (refer to drainage drawings)

7.71 The Main Wind Farm Site will utilise in total three crossings: two new crossings over the field drains and one existing crossing over a field drain. These crossings are shown on **Figure 7-1** (Watercourse crossings) in this EIAR. Proposed methods for crossing existing watercourses along the cable routes are set out in **Table 7-8**.

Turbine Delivery Route

7.72 There will be no works proposed along the vast majority of the TDR, with only relatively minor temporary works proposed at a number of specific locations (see **Appendix 14-1**). Therefore, there will be no potential for hydrological impacts along this route. Temporary works at these locations will involve some topsoil stripping and placement of hardcore to allow passage of the wind turbine components.

Groundwater: Hydrogeology

Aquifer Classification

7.73 According to the GSI groundwater resources maps and classification system, the dark limestone and shale bedrock of the Lucan Formation underlying the Proposed Development is classified as a Locally Important Aquifer (Ll) - Bedrock which is Moderately Productive only in Local Zones, see **Figure 7-4**.

7.74 Groundwater flow is considered to be entirely through interconnected networks of fractures, with flow from high elevations to low elevations.

7.75 The GSI subsoils mapping shows the presence of localised eskers across the Study Area, these are not classified as aquifers and there is no gravel aquifer in the Study Area.

Groundwater Vulnerability

7.76 The GSI's national groundwater vulnerability map has indicated the groundwater vulnerability in the Proposed Development is predominantly classified as 'High', with lesser areas classified as 'Moderate', see **Figure 7-5**. Groundwater vulnerability underlying each of the elements of the proposed development are discussed below.

7.77 As can be seen on **Figure 7-5**, in the Northern Cluster Turbines 1 and 3 are underlain by a groundwater vulnerability rating of M – Moderate, while Turbine 2 is underlain by a groundwater vulnerability rating of H – High.

7.78 The Proposed Substation is underlain by a groundwater vulnerability rating of H - High.

7.79 In the Southern Cluster, all locations except Turbine 7 are underlain by aquifers with a groundwater vulnerability rating of H - High. Turbine 7 is underlain by a groundwater vulnerability rating of M - Moderate.

7.80 The groundwater vulnerability rating has a strong influence on groundwater recharge, and areas where the aquifer has a higher groundwater vulnerability rating correspond with areas of higher groundwater recharge.

Table 7-9::Groundwater Vulnerability Underlying Each of the Main Features of the Proposed Development

Feature	Groundwater Vulnerability Classification
Turbines T1 and T3 (Northern Cluster)	High
Turbine T2 (Northern Cluster)	Moderate
Turbines T4-T6 and T8 (Southern Cluster)	High
Turbine T7 (Southern Cluster)	Moderate
Cable Route	Predominantly High with minor areas of Moderate vulnerability.
Borrow Pits	High (northern) and Moderate (southern)
Proposed Substation Compound	High
Temporary Construction Compounds	High at both TCC1 and TCC2
Access Track	Predominantly High with minor areas of Moderate vulnerability.

Groundwater Bodies

7.81 The Groundwater Body (GWB) is the management unit under the Water Framework Directive (WFD), and groundwater body locations are shown on the GSI Groundwater maps. The Study Area is underlain by the Athboy Groundwater Body.

7.82 A groundwater body is also shown associated with the Newtown Lough Fen groundwater-dependent terrestrial ecosystem (GWDTE). The GWDTE-Newtown Lough Fen (SAC002299) groundwater body is shown to the southeast of the lough. There is no gravel aquifer in the area.

7.83 The Proposed Development is underlain by the Athboy Groundwater Body, including the Proposed Substation at Clonmellon. The proposed cable route extends north through the Newtown Lough Fen GWDTE. It is noted that the cable route will be within the roadway and will not impact on the Groundwater Body. The GWDTE is 310m from the Main Wind Farm Site, near T3 in the Northern Cluster (see **Figure 7-2**).

7.84 The GSI has issued a Summary of Initial Characterisation report3 for the Athboy GWB. The GSI online database indicates that both the Athboy GWB and Newtown Lough Fen GWDTE is poorly productive, however the Initial Characterisation report notes that the aquifer type is mostly locally important. The bedrock aquifer underlying the Proposed Development is classified as Locally Important.

7.85 Both GWBs are all good status/quality under the WFD and classified as not at risk.

[3] Available at:https://gsi.geodata.gov.ie/downloads/Groundwater/Reports/GWB/AthboyGWB.pdf [Accessed January 2024].

Athboy GWB

7.86 This large GWB extends from Navan in the northeast to Tyrrellspass and Rochfortbridge in Westmeath. The area is low-lying; some isolated hills rarely rise above 150 m AOD.

7.87 The GWB is composed primarily of moderate permeability rocks, although localized zones of enhanced permeability do occur. Groundwater flow will mainly occur laterally through the upper weathered zone of the aquifer. Below this, flow occurs along fractures, faults and karstic conduits.

7.88 Recharge occurs diffusely through the subsoils and via outcrops and in some local areas direct recharge may be possible via sinking streams. The aquifers are generally unconfined but may be locally confined where the subsoil is thicker and/or less permeable. Regional groundwater flow is from northwest to southeast, but locally, groundwater discharges to the streams and rivers crossing the aquifer.

Newtown Lough Fen GWDTE

7.89 The Newtown Lough Fen GWDTE overlaps with the area of the River Boyne and River Blackwater cSAC (002299) in the vicinity of Newtown Lough and the Northern Cluster. The cSAC forms the boundary of the Proposed Development at the Northern Cluster. The GSI has not issued a report for the GWDTE.

Karst

7.90 According to the GSI groundwater karst database, there are no identified karst features within a 5 km zone from the Proposed Development and cable route.

7.91 The nearest mapped karst feature to the Site is an enclosed depression located c. 6.5km northwest of the site boundary.

7.92 The karst features at a distance from the Proposed Development are associated with the limestone bedrock of the Lucan Formation and the Derravaragh Cherts.

Public Water Scheme (PWS) Areas

7.93 A review of the EPA, GSI and NFGWS databases show that there are no public water schemes in the vicinity of the Proposed Development area. Schemes at a distance from the Site include the Athboy PWS and Multifarnham Groundwater Supply (GWS), as shown on **Figure 7-6.**

7.94 The nearest public supply Source Protection Areas (SPA) is Athboy PWS, located c.8.5 km southeast of the Proposed Development site at Athboy town. The supply source is a production well, drilled in 1995 to a depth of 61m below ground level. Surface water is also pumped from the River Tully, a tributary of the Athboy River, to supplement the water supply from the well. The abstraction rate at the well is 1,080m^3/d.

7.95 The nearest NFGWS site is Multifarnham GWS, located c.18.4 km west of the Proposed Development site. The GWS is supplied through a spring situated in a Locally Important Karstified Aquifer (Lk) and has been noted to have an abstraction rate of 500$m^{3/}$d.

Groundwater Supply Wells

7.96 Geological Survey Ireland (GSI) has an online database of wells and springs in Ireland; however it should be noted this database is not extensive.

7.97 According to the GSI well database, there are no wells within the 2km Study Area surrounding the Site. Wells in the wider area are shown on **Figure 7-6.**

7.98 The closest well to the Site is located just outside the Study Area in Delvin town, c. 2.1 km southwest of the Proposed Development. The well is 8.2m deep with bedrock encountered at 6.4m depth. The well is of unknown use and the yield is good (327.3 m3/day). The location accuracy of the well is up to 500m.

Cable Route and Access Tracks

7.99 The groundwater vulnerability underlying the proposed cable route and access tracks is predominantly high vulnerability, with minor sections being underlain by areas of moderate vulnerability.

7.100 The entirety of the cable route and access tracks overly a Locally Important Aquifer (Ll) - Bedrock which is Moderately Productive only in Local Zones. There are no karst features recorded along the proposed routes.

7.101 There are no source protection areas for water supplies in the vicinity of the proposed cable route or access tracks.

Turbine Delivery Route

7.102 There will be no works proposed along the vast majority of the TDR, with only relatively minor temporary works proposed at a number of specific locations (refer to **Appendix 14-1**). Therefore, there will be no potential for hydrogeological impacts along the vast majority of this route. Temporary works at these locations will involve some topsoil stripping and placement of hardcore to allow passage of the wind turbine components.

Water Framework Directive

7.103 The EU Water Framework Directive[5] (WFD) became EU law in December 2000 and provides for a single European framework to assess water quality (Ecological status) and allows for the comparison of results across European Member States. The WFD covers rivers, lakes, estuaries or transitional waters, coastal waters as well as groundwaters. Details on the WFD are presented in **Appendix 7-2** found in Volume III of this EIAR.

Surface Water

7.104 The Main Wind Farm Site and Cable Corridor fall within the boundary of the Boyne Catchment (07). There are no streams and rivers shown within the site on the EPA catchment mapping. However, site walkovers have identified local streams within the Proposed Development Site. The surface water features at the Site and surrounding area are outlined in **Figure 7-2**

7.105 The Darcy Crossroads Stream runs along the north-western boundary of the Proposed Development area. The Killacroy Stream runs along the northern boundary in the east-west direction where it ultimately joins the Darcy Crossroad Stream. Approximately 1.8 km south-west of the confluence, the Darcy Crossroad Stream flows into the River Stonyford. The River Stonyford flows in the south-east direction for approximately 19 km where it joins the River Boyne. The Newtown Lough Fen is located to the east of the Northern Cluster and is upstream of the River Stonyford. The subject streams form a part of the River Boyne and River Blackwater cSAC (Code 002299).

7.106 The Boyne catchment includes the area drained by the River Boyne and by all streams entering tidal water between The Haven and Mornington Point, Co. Meath, draining a total area of 2,694km². The largest urban centre in the catchment is Drogheda. The other main urban centres are Navan, Trim, Kells, Virginia, Bailieborough, Athboy, Kinnegad, Edenderry and Enfield. The total population of the catchment is approximately 196,400 with a population density of 73 people per km². This catchment is characterised by an undulating landscape in the south which changes to a more hummocky, drumlin topography (steep-sided, lenticular hills) in the north. The catchment is underlain by metamorphic rocks in the north and limestone bedrock in the centre and south of the catchment. There are extensive sand and gravel areas in this catchment, particularly along the upper reaches of the Boyne.

7.107 The Proposed Development and Cable Corridor are also situated within two sub-catchments. These are:

- Boyne_SC_050
- Boyne_SC_070

7.108 WFD water quality status and river waterbody risk associated with the wind farm and grid connection are provided in **Table 7-10** below. The surface waterbodies in the Boyne_SC_050, in proximity to the main wind farm site, are all at risk with poor-moderate water quality status. The surface waterbodies in the Boyne_SC_070, along the Proposed Cable Corridor and near the Proposed Substation at Clonmellon, are not at risk with good water quality status.

Table 7-10: Waterbodies and WFD Classification

Catchment (Catchment ID)	WFD Sub-catchment (Sub-catchment ID)	River Network EPA Name (Segment Code)	River Waterbody WFD Status 2016-2021 (River Name & Code)	River Waterbody WFD Risk 2016-2021
Boyne (07)	Boyne_SC_050 (07_12)	STONYFORD_010 (IE_EA_07S020065)	Moderate	At risk
		STONYFORD_020 (IE_EA_07S020075)	Poor	At risk
		STONYFORD_030 (IE_EA_07S020100)	Poor	At risk
		D'ARCY'S CROSSROADS STREAM_010 (IE_EA_07D060030)	Moderate	At risk
	Boyne_SC_070 (07_13)	ATHBOY_030 (IE_EA_07A010070)	Good	Not at risk

Groundwater

7.109 There are two groundwater bodies underlying the Study Area. The predominant groundwater body is the Athboy GWB which is not at risk under the WFD 2016-2021 and has a good water quality status.

7.110 A groundwater body is also shown associated with the Newtown Lough Fen. The GWDTE-Newtown Lough Fen (SAC002299) groundwater body is shown to the southeast of the

lough. The GWB is also not at risk under the WFD 2016-2021 and has good water quality status.

Ecological Designated Sites

7.111 There are eight SACs and two SPAs within 20 km of the Proposed Development (see **Figure 5-3** and **Figure 5-5**). Of these, the River Barrow and River Nore cSAC is the only one with a strong potential hydrological connection to the Proposed Development.

7.112 The Proposed Development is adjacent to the River Boyne and River Blackwater cSAC, while the Proposed Substation, Cable Corridor or any TDR node are further away from the cSAC.

7.113 Proposed enhancement measures, consisting of fencing along the Killacroy Stream at T1 as well as some hedgerow / treeline planting, will overlap with the cSAC. Implementation of the enhancement measures within the cSAC will be subject to discussion and agreement with NPWS.

7.114 There are no other designated areas within the 2km assessment area. The River Boyne and River Blackwater SPA is located 4.1km southeast of the Proposed Development. The next closest designated site is the Girley (Drewstown) Bog SAC, located 7.9km northeast of the Proposed Development.

Water Environment Receptors

7.115 From the baseline study undertaken here, the following water environment sensitive receptors have been identified in the receiving environment:

- Local streams at the site boundary, Darcy Crossroads Stream and Killacroy Stream;
- River Boyne and River Blackwater cSAC;
- Newtown Lough Fen GWDTE;
- Locally important bedrock aquifer beneath the site;
- Local groundwater supply wells in the surrounding area.

7.116 For each identified receptor, the significance and sensitivity of the receptor is assessed in **Table 7-11** below and a rating (High/Medium/Low/Negligible) applied, based on the methodology outlined in existing guidance and reproduced in **Appendix 7-5** found in Volume III of this EIAR.

Table 7-11: Existing Environment - Significance and Sensitivity / Importance

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H/M/L/N)
1	Water courses at the site	Local streams at the site boundary. Darcy Crossroads Stream runs along the north-western boundary of the site. The Killacroy Stream runs along the northern boundary.	Expected to be in hydraulic continuity with the site through groundwater - surface water interactions (recharge and discharge) and located downgradient.	Medium - Attribute has a medium quality or value on a local scale.

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H/M/L/N)
2	Designated Sites	Adjacent to the River Boyne and River Blackwater SAC (Code 002299) The SAC forms the northwestern boundary of the site and is c25m from the T1 location. Enhancement measures may be undertaken within cSAC, subject to agreement. The GWDTE is 310m from the Main Wind Farm Site. The cable route crosses the GWDTE but will be within the roadway and will not impact on the Groundwater Body.	Potentially located in a hydrogeological continuity area within the site. Expected to be in hydrological continuity within the site.	High - Attribute has a high quality or value on a local scale
3	Bedrock aquifers beneath the site	Bedrock aquifer is classified as locally important. Gravel eskers are not classified as gravel aquifers	Bedrock aquifers may be in hydraulic continuity with surface water courses through groundwater - surface water interactions (recharge and discharge).	Medium - Attribute has a medium quality or value on a local scale.
4	Local groundwater supply wells	Private water supplies in the vicinity of the site not listed on GSI database	Any unlisted local groundwater supply wells (agriculture and/or domestic supply).	Low - Attribute has a low quality or value on a local scale (no source protection area, potable water source supplying <50 homes)

Potential Impacts

Evaluation Methodology

7.117 The impacts on the surface water and groundwater environment of the Proposed Development are assessed in this chapter without any mitigation measures in place.

7.118 The methodology applied here is a qualitative risk assessment methodology in which the nature of the potential impacts is described in terms of the character, magnitude, duration, probability and consequence of the impact are considered.

7.119 The description of the potential impact is screened against the significance and sensitivity of the receiving environment to determine the significance of the impact.

7.120 This approach provides a mechanism for identifying the areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by

the Proposed Development. This approach allows effort to be focused on reducing risk where the greatest benefit may result.

7.121 The assessment of risk is based on a matrix on importance of attributes and magnitude of impacts. Various criteria tables outline the assessments for the likelihood and magnitude of hydrological and hydrogeological impacts; these can be found in **Appendix 7-6** and **Appendix 7-7**, both of which can be found in Volume III of this EIAR.

7.122 In addition to their nature and significance, the potential impacts will be assessed in terms of their duration, whether they are direct or indirect impacts.

7.123 The following sections identify the impacts of the Proposed Development on the hydrogeological and hydrological environments. It also assesses the likelihood of occurrence of each identified impact in accordance with the above. As noted above, the impacts are initially assessed with no mitigation or design measures incorporated to reduce the effects.

Do Nothing Scenario

7.124 If the Proposed Development does not proceed, the Site will remain as an agriculture and forestry site where normal agricultural and forestry activities are expected to continue into the future. Forestry operations (including the associated drainage measures) are expected to continue at the site. Agricultural practices (including the associated drainage measures) are expected to continue at the site. The associated pressures on the local water quality will continue without separate intervention. The proposed enhancement measures, consisting of fencing along the Killacroy Stream at T1 as well as some hedgerow / treeline planting, will not be undertaken.

7.125 Section 7.60 and Section 7.61 outlines the results of the aquatic biological water quality survey, presented in the aquatic baseline survey (**Appendix 5-4**). Two sites reported Q3 (poor status) (A1 & B9). The aquatic survey found that whilst the larger survey watercourses supported improved conditions, the biological water quality of the survey area was evidently impacted via eutrophication, siltation and or historical modifications (hydromorphology). Low summer flows and associated lower water volumes further reduced the water quality within the survey area in July 2022. Channelisation (hydromorphology) as previously mentioned and agricultural derived siltation and enrichment are the primary threats to water quality within the survey area and this was observed during the site surveys.

Potential Impacts: Construction

7.126 The potential impacts during construction are detailed in this section and summarised in the table below. For the Proposed Development, the construction sequence will be as follows:

- tree felling, between 19.62 ha and 20.09 ha,
- the provision of new site tracks,
- drainage infrastructure to be constructed in parallel with access track construction,
- construction of the turbine foundations (both turbine types presented in **Table 1-2**), and
- the provision of the hardstand areas and associated drainage,

7.127 Construction of the internal cable network in conjunction with connection works to the National Grid will be carried out in tandem to the Proposed Development sequenced activities outlined above.

7.128 A CEMP is contained in **Appendix 2-2** found in Volume III of this EIAR, which includes a description of construction techniques and proposed management measures that will be implemented during the construction phase of the Proposed Development.

7.129 The CEMP sets out the key environmental management measures associated with the construction of the Proposed Development, to ensure that during these phases of the Proposed Development, the environment is protected, and any potential impacts are minimised. In the event that An Bord Pleanála (ABP) decides to grant approval for the Proposed Development, the final CEMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by ABP.

Erosion and Sediment

7.130 Construction phase activities of the Proposed Development will require earthworks resulting in the removal of vegetation cover and excavation of mineral subsoil. Cut peat areas have been identified on site. Exposed and disturbed ground, particularly peat, may increase the risk of erosion and subsequent sediment laden surface water runoff. The release of suspended solids is primarily a consequence of the physical disturbance of the ground during the construction phase, if not correctly compacted.

7.131 The construction phase of the Proposed Development will involve the following earthworks activities that could have potential impacts on surface water and groundwater conditions:

- Construction of temporary and permanent infrastructure on site, including turbine foundations, hardstands, site access tracks, substation, construction compounds, and all associated onsite infrastructure;
- Laying of underground electrical cabling, both within the Proposed Development, and as part of the Cable Corridor;
- 3 no. watercourse crossings;
- Minor works at a number of locations along the TDR, including excavations for cable route trenches and the temporary alterations;
- Borrow Pit excavations; and
- Stockpiling material.

7.132 Potential sources of sediment laden water include:

- Soil stripping, if necessary, to construct the access tracks, site compounds, turbine foundations, hardstands, turbines/hardstanding/tracks and substation;
- Run-off and erosion from soil stockpiles (prior to reinstatement/profiling/side casting);
- Drainage and seepage water resulting from infrastructure excavation;
- Construction of the cable trench resulting in entrainment of sediment from the excavations during construction; and
- Erosion of sediment from emplaced/upgraded site drainage channels and at water crossings.

7.133 These activities can result in the release of suspended solids to surface watercourses and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality of downstream water bodies.

Pollution Risk

7.134 During the construction phase, there is the potential for a pollution event to affect surface water and local groundwater bodies impacting on their water quality. It is noted the local streams are located at the boundary of the Proposed Development.

7.135 Contamination of surface water runoff from machinery, leakage and spills of chemicals from vehicle use and the construction of hardstanding also have the potential to affect surface water bodies. Potential pollutants include oil, fuels and cement.

7.136 This would have a negative effect on the receptor and the resulting degradation of the water quality could impact on any unlisted private water supplies abstracting from the watercourse/aquifer.

Fluvial Flooding

7.137 Tree felling, access track construction, construction of the turbine foundations and other new, hard surfaces have the potential to result in a small increase in surface water run-off in the catchment. An increase in run-off has the potential to result in soil erosion and consequently sediment release into nearby receiving watercourses.

Groundwater Levels & Flow

7.138 Dewatering of borrow pits and other deep excavations (i.e. turbine bases) have the potential to impact on local groundwater levels. Groundwater level impacts are not anticipated to be significant due to the local hydrogeological regime.

7.139 Groundwater inflows may need to be pumped, resulting in short term localised drawdown of the water table and discharges to surface water channels. This could impact on groundwater levels and groundwater wells.

Potential Impacts: Operational

7.140 The potential impacts during the operational stage are detailed in this section and summarised in the table below. The expected physical lifetime of the Proposed Development with respect to the Main Wind Farm Site is 35 years, and permission is sought for a 35 year operation period, commencing from full operational commissioning of the Proposed Development at the end of the proposed construction phase.

7.141 During the operational phase of the Proposed Development, it is anticipated that routine maintenance of infrastructure and tracks will be required across the Site. This may include work such as maintaining access tracks and drainage and carrying out wind turbine maintenance. Mitigation measures applied during the construction phase, and outlined in the CEMP, will be adhered to during any operational phase maintenance activities.

7.142 There will be a limited number of vehicles required onsite for routine maintenance and operational activities. Twice a year each turbine will undergo a scheduled service. The operation of the wind turbines will be monitored remotely. Storage of fuels/oils onsite will be limited to the hydraulic oil required in turbine gearboxes and this is bunded to (110% bund capacity) to prevent fluid escaping.

7.143 During the operation of the Proposed Development, it is not anticipated that there will be any excavation or stockpiled material, reducing the potential for erosion and sedimentation effects. Should any excavation be required for maintenance of tracks, this is likely to be limited. Any excavation, handling and placement of material from borrow pits, related to

potential maintenance works, will be subject to the same safeguards that will be used during the construction phase of the Proposed Development.

7.144 Immediately post-construction, newly excavated drains and track dressings may be prone to erosion as any vegetation would not have matured. Appropriate design of the drainage system, incorporating sediment traps, will reduce the potential for the increased delivery of sediment to natural watercourses. Potential effects from sedimentation or erosion during the operational phase are considered to come from linear features on steeper slopes, where velocities in drainage channels are higher. Immediately post-construction, flow attenuation measures will remain and be maintained to slow runoff velocities and prevent erosion until vegetation becomes established.

7.145 Should any non-routine maintenance be required at the sections of track crossing wet areas (defined visually onsite by a contractor or operational personnel) there will be potential for erosion and sedimentation effects to occur due to the existence of disturbed material. Should this type of activity be required, then the good practice measures as detailed for the construction phase will be implemented on a case-by-case basis.

7.146 Operation of the Proposed Development requires limited activities relative to the construction phase. The presence of access tracks and hardstanding, as opposed to their construction, may affect the potential infiltration and groundwater conditions as well as the sub-surface flow paths around the infrastructure. In addition, cabling and crane hardstanding will also remain in situ to serve the Proposed Development.

7.147 Drainage will be installed to service new sections of access track, which could also potentially alter recharge.

Potential Impacts: Decommissioning

7.148 During the decommissioning phase of the Proposed Development, cranes will disassemble the above ground turbine components which will be removed off-site for recycling.

7.149 It is proposed that foundations will be covered over and allowed to re-vegetate naturally. Leaving turbine foundations in situ is considered a more environmentally sensible option as to remove the reinforced concrete associated with each turbine would result in environmental nuisances such as noise and vibration and dust. It is proposed that the internal site access tracks will be left in situ, subject to agreement with An Bord Pleanála and the relevant landowners.

7.150 The Proposed Substation will be taken in charge by ESBN /EirGrid upon completion and will be left in place forming part of the national electricity network.

7.151 Underground cabling will be cut back and left in situ.

7.152 These impacts have been assessed as similar to the Construction Phase and, therefore, the mitigation measures for the Construction Phase will also be implemented during decommissioning.

7.153 A detailed decommissioning plan will be agreed in advance of construction with An Bord Pleanála.

Table 7-12: Description of Impacts and Impact Rating

No.	Potential Impact	Impact Rating (No Mitigation)	Significance of Effect (No Mitigation)
Construction Stage – Surface Water (Direct)			
1	Reduction in surface water quality from sediment release during construction	**Low- Medium** - Potential to affect surface water quality in the local streams at the boundary and onsite ponds during soil stripping and construction of turbine foundations, hardstands, site access tracks, substation, underground cabling, water crossings. Peat is located within the study area.	Slight - Moderate
2	Reduction in surface water quality from accidental spillage of oil, fuels and cement during construction	**Low - Medium** - Potential to affect surface water quality in the local streams at the boundary and onsite ponds during soil stripping and construction of turbine foundations, hardstands, site access tracks, substation, underground cabling, water crossings.	Slight - Moderate
3	Increase in risk of flooding due to increase in surface water run-off and sediment release	**Low** - Risk of an increase in downstream flooding is considered to be low due to the small increase in run-off from surfaced and hard stand areas for the Proposed Development relative to overall catchment areas.	Not Significant - Slight
Construction Stage – Surface Water (Indirect)			
4	Impact on designated sites from potential reduction in surface water quality from sediment release / accidental spillage at downstream locations	**Low - Medium**- Potential to affect surface water quality in the River Boyne and River Blackwater SAC & SPA with potential hydrological and/or hydrogeological connection. Any leakage / spillage will be accidental only and of limited volume.	Moderate
Construction Stage – Groundwater (Direct)			
5	Reduction in groundwater quality from sediment release during construction	**Low** - Potential to affect groundwater quality in underlying bedrock aquifer beneath the site through vertical migration. Areas of exposed bedrock / gravel will be localised (borrow pit excavations / turbine bases). Bedrock aquifer is locally important at the Proposed Development.	Slight
6	Reduction in groundwater quality from the accidental spillage of oil, fuels and cement	**Low** - Potential to affect groundwater quality in underlying bedrock aquifer beneath the site through vertical migration. Bedrock aquifer is locally important at the Proposed Development. Any leakage / spillage will be accidental only and of limited volume.	Slight
7	Reduction in groundwater levels from dewatering of borrow pits and other deep excavations	**Low – Negligible -** Potential to lower groundwater quality in underlying bedrock aquifer is limited by the localised and short term nature of any dewatering required.	Not Significant

No.	Potential Impact	Impact Rating (No Mitigation)	Significance of Effect (No Mitigation)
Construction Stage – Groundwater (Indirect)			
8	Reduction in groundwater quality at local domestic water supplies from sediment release / accidental spillage	**Low** - Potential to affect groundwater quality in domestic water supplies in wider area through vertical migration followed by lateral migration. Most of the identified domestic water supplies are of unknown use and are poor yield. Impact is unlikely as areas of exposed bedrock / gravel will be localised. Any leakage / spillage will be accidental only and of limited volume.	Slight
9	Impact on designated sites potentially in hydrogeological continuity with the site from potential reduction in groundwater quality from sediment release / accidental spillage	**Low** - Potential to affect groundwater quality the River Boyne and River Blackwater SAC & SPA through vertical migration followed by lateral migration.	Slight - Moderate
10	Impact on designated sites potentially in hydrogeological continuity with the site from potential reduction in groundwater levels from dewatering of adjacent turbine bases	**Low** - Potential to affect groundwater levels in the River Boyne and River Blackwater SAC & SPA through temporary lowering of groundwater levels, if required. Impact is limited by the localised and short term nature of any dewatering required.	Slight - Moderate
Operational Stage – Surface Water (Direct)			
11	Reduction in surface water quality from sediment release / accidental spillage	**Low – Negligible Potential** to affect surface water quality in the local surface waterbodies from site access and maintenance. Impact to surface water quality is unlikely due to short term nature of maintenance works.	Not Significant - Slight
12	Increase in risk of flooding due to increase in surface water run-off	**Low - Negligible Risk** of an increase in downstream flooding is limited due to the small increase in run-off from surfaced and hard stand areas for the Proposed Development relative to overall catchment areas	Not Significant - Slight
Operational Stage – Groundwater (Direct)			
13	Reduction in groundwater quality from sediment release / accidental spillage	Negligible Potential to affect groundwater quality in the local in underlying bedrock aquifers beneath the Site through vertical migration from site access and maintenance. Impact to groundwater quality is unlikely due to short term nature of maintenance works.	Not Significant

Mitigation Measures

7.154 As stated in **Chapter 2**, the design of the Proposed Development has considered a range of best practice construction measures which will ensure avoidance and reduction of impacts throughout the construction, operational and decommissioning phases. Additional measures have been developed to mitigate the impacts identified in the preceding section.

Mitigation by Avoidance

7.155 The Proposed Development has undergone design iterations and evolution in response to the constraints identified as part of the baseline studies and field studies so as to avoid potential effects on receptors where possible.

7.156 In identifying and avoiding sensitive surface waters, the Proposed Development has implemented 'avoidance of impact' measures. Mitigation by avoidance is viewed as part of the 'Reasonable Alternatives' outlined in Chapter 3.

7.157 A 50m buffer distance between watercourses and any proposed development including construction activities including fuel storage was applied to those watercourses within the Site. No works will occur within this buffer with the exception of the development of T1. Where the 50 m buffer cannot be provided at this location, a drainage report has been undertaken and mitigation measures provided for (see **Appendix 7-4**).

Mitigation by Prevention and Reduction

7.158 A number of mitigation measures are outlined below and are considered as in-built to the design of the Project. These mitigation measures are a combination of measures to comply with legislation and best practice construction methods to be implemented in order to prevent water (surface water and groundwater) pollution and deterioration of water quality. Examples of these measures are the storage of potentially polluting materials in fully bunded tanks and controlling / reducing runoff from hardstand areas.

Mitigation Measures – Construction

7.159 In order to mitigate potential impacts during the construction phase, best practice construction methods will be implemented in order to prevent water (surface water and groundwater) pollution. Good practice measures will be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes.

7.160 A CEMP (**Appendix 2-2** found in Volume 3 of the EIAR) has been developed for the Project to ensure adequate protection of the water environment. All personnel working on the Project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.

7.161 During the construction phase, all works associated with the construction of the Proposed Development will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015). Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016).

Buffer to Water Courses

7.162 A buffer distance of 50m will be between watercourses, including the gravel ponds, and any proposed construction activities or infrastructure. Where the 50 m buffer cannot be provided

at T1, a drainage report has been undertaken and mitigation measures provided for (see **Appendix 7-4**). The mitigation measures include the provision of a silt fence between the T1 construction area and the River Boyne and River Blackwater SAC boundary (Code 002299). Water from the construction area, including from the turbine foundation excavation, will be collected by a swale which connects to a settlement pond for treatment. The clean treated water from the settlement ponds will be discharged from the ponds via a diffused outfall (for example, a weir). This will allow water to disperse locally and preserve the pre-construction surface runoff pattern. Along the Killacroy Stream, at T1, silt fencing will be installed to prevent fugitive silt material in runoff around the site from entering the SAC and stream. There will be no machinery located between the excavation area and the riverbank. During the construction phase the quality of water in the Killacroy Stream will be monitored, details are provided in **Appendix 7-4.**

Groundwater Levels

7.163 Temporary lowering of groundwater levels may be required during the construction of the turbine bases and borrow pits. The impact will be limited by the localised and short-term nature of any dewatering required.

7.164 There could be an indirect impact on designated sites potentially in hydrogeological continuity with the construction site, in particular the River Boyne and River Blackwater SAC (Code 002299), the boundary of which is close to the T1 construction area.

7.165 The T1 construction area is expected to be underlain by low permeability superficial deposits consisting of Fen Peat (see **Figure 6-2-b**, in **Appendix 6-1**). Higher permeability sand and gravel eskers are not present in the T1 area. The superficial deposits are expected to be underlain by the Lucan Limestone bedrock aquifer.

7.166 Prior to construction of the turbine base at T1, a groundwater monitoring borehole will be extended to confirm the ground conditions and determine the depth to groundwater. Due to the presence of low permeability superficial deposits at the T1 area, shallow groundwater is not expected to be encountered and it is not expected that there would be any impact on groundwater levels in the nearby SAC during construction. However, should significant dewatering be required during the construction of the turbine base at T1, sheet piling will be placed between the construction area and the SAC, so that there would be no change in the groundwater level at the SAC. Details of any piling options are included in the CEMP and the following options can be considered:

7.167 Installation of sheet piling/caisson especially on the side of greater ingress. This will be to stem the flow, and any water draining into the excavation will still be pumped from a localised sump, and

7.168 Where ground levels permit, the ingressing water would be diverted to flow naturally back onto the land to infiltrate back into the ground.

7.169 The Newtown Lough Fen GWDTE is located at distance from the T1 and T3 construction areas. The superficial deposits between the T1 and T3 construction areas and the Newtown Lough Fen GWDTE consist of low permeability Fen Peat and moderate permeability Alluvium. Again, there are no high permeability sand and gravel eskers in the area and shallow groundwater is not expected to be encountered during construction. Should dewatering be required in the bedrock aquifer, the requirement would be temporary and localised, and would not impact on the Newtown Lough Fen GWDTE SAC at distance.

Good Practice Measures

7.170 Implementation of good practice measures as a matter of course during the construction of the Proposed Development are not considered to be mitigation measures but form an integral part of the design/construction process. Key good practice measures are stated below and the assessment incorporates these measures as part of the Proposed Development.

7.171 Measures to prevent the release of any pollution/sediment will be implemented as follows:

- prior to construction, section specific drainage plans will be produced. These will take into account any existing local drainage which may not be mapped and incorporate any section specific measures identified during the assessment;
- measures for dealing with pollution/sedimentation/flood risk incidents are included in the CEMP (see **Appendix 2-2** of Volume 3 of this EIAR). This will include incorporating elements of SuDS design into the site drainage, and using swales, check dams, silt traps, buffer strips, silt fences, and infiltration trenches where appropriate;
- the CEMP (see **Appendix 2-2** of Volume 3 of this EIAR) contains details on the location of spill kits, 'hotspots' where pollution may be more likely to originate from, provide details to construction personnel on how to identify the source of any spill and state procedures to be adopted in the case of a spill event. As identified in the CEMP, a specialist spill response contractor will be identified to deal with any major environment incident;
    - a wet weather protocol has been developed. This will detail the procedures to be adopted by all staff during periods of heavy rainfall. Heavy rainfall event is defined as:
    - 10 mm/hr (high intensity local rainfall events).
    - 25 mm in a 24 hour period (heavy frontal rainfall lasting most of the day).
    - half monthly average rainfall in any 7 days.
- Toolbox talks will be given to engineering / construction / supervising personnel. Roles will be assigned, and the inspection and maintenance regimes of sediment and runoff control measures will be adopted during these periods; and
- In extreme cases, the above protocol will dictate that work onsite may have to be temporarily suspended until weather/ground conditions allow. An Ecological Clerk of Works (ECoW) will be appointed during the period of construction and post-construction restoration, as approved by An Bord Pleanála, and would provide environmental advice on matters such as this. Further detail on the powers of the ECoW are outlined in the CEMP.

Site Drainage

7.172 During the construction phase of the Proposed Development, design and construction measures will be adopted, in order to prevent silt, chemicals and/or other contaminants from being washed into existing watercourses. The proposed measures are listed in the following section and also outlined in Section 4.3 of the T1 Drainage Report in **Appendix 7-4**. Areas exposed due to the removal of existing vegetation are more susceptible to erosion during heavy rainfall so areas will be reinstated prior to heavy rainfall to minimise this effect.

7.173 This will include specific guidance in relation to drainage (and control of pollution to the water environment) around the following aspects of site infrastructure, as outlined in the

DoHLGH guidance “The Planning System and Flood Risk Management - Guidelines for Planning Authorities”:

- access routes;
- foundations;
- hardstanding areas and new structures

7.174 The appropriate methodologies to cover water control and the means of drainage from all hard surfaces and structures within the Site are described in the following sections.

Management of Sediment and Surface Waters

7.175 Good practice construction techniques outlined in Section 5 of the CEMP will be adopted for the management of sediment and surface water run-off generated during the construction phase of the Proposed Development.

7.176 Drainage from the Site includes elements of Sustainable Drainage Systems (SuDS) design. SuDS replicate natural drainage patterns and have a number of benefits:

- SuDS will attenuate run-off, thus reducing peak flow and any flooding issues that might arise downstream; and
- SuDS will treat run-off, which can reduce sediment and pollutant volumes in run-off before discharging back into the water environment; and
- SuDS measures, such as lagoons or retention ponds, where appropriate and correctly implemented will produce suitable environments for wildlife.

7.177 Good practice measures for the management of earthworks to reduce erosion and sedimentation are outlined in the CEMP and will be implemented as follows:

- Granular, non-organic material required to be stored temporarily would be compacted, to reduce the potential for erosion and transfer of sediment and stockpiled in designated areas at least 50m from a watercourse.
- Material excavated during new and upgraded access track construction would be stored adjacent to the track and granular, non-organic material compacted in order to limit instability and erosion potential. Peat would not be allowed to dry out, through rewetting and monitored irrigation.
- Stockpiling of excavated material would be managed such that the potential contamination of down slope water supplies and/or natural drainage systems is mitigated / minimised.
- stockpiled material will either be seeded or appropriately covered;
- Temporary interception bunds and drainage ditches would be constructed upslope of the borrow pit(s) to prevent surface water runoff from entering the excavation. Swales would be implemented to convey and attenuate excess surface water flow away from borrow pit(s);
- Limited dewatering of the borrow pit(s) may be necessary. Water would be treated by a settlement lagoon(s) and then discharge onto vegetated surfaces. Outflow from settlement lagoon(s) in proximity to the borrow pit(s) would discharge to surface water drains.
- clean and dirty (silty) water encountered onsite during the construction works will be separated, and dirty water will pass through a number of settlement lagoons and

silt/sediment traps to remove silt before re-entering the water environment through percolation to ground or discharge to the surrounding drainage system;

- if soil/subsoil material is stockpiled on a slope, silt fences will be located at the top of the slope to reduce sediment transport, silt fences would also be erected between areas at risk of erosion and watercourses;
- drainage systems will be designed to minimise sedimentation into natural watercourses - this includes buffer strips, silt traps, check dams and infiltration trenches.;
- silt/sediment traps, silt busters, single size aggregate, geotextiles or straw bales will be used as required to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment will avoid periods of heavy rainfall, as instructed by the ECoW;
- Permanent swales and drainage ditches adjacent to access tracks would have outlets at required intervals to reduce the volume of water collected in a single channel and, therefore, reduce the potential for erosion. Outfall pipes would drain into a bunded section of the drainage ditch to allow suspended solids to settle;
- New access tracks would be designed to have adequate cross fall or camber to avoid ponding of rainwater and surface run-off. Run-off from the access tracks and existing drainage ditches would be directed into swales that would be designed to intercept, filtrate and convey the runoff. Check dams would be installed within the swales and existing drainage ditches where required in order to increase the attenuation of run-off and allow sediment to drop out; and
- construction personnel and the Principal Contractor will carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas, in consultation with the appointed ECoW.

Foul Drainage

7.178 Any waste that is generated during the development's construction phase will be collected, separated and stored in dedicated receptacles at the temporary construction compounds during construction works. A fully authorised waste management contractor will be appointed prior to the commencement of construction works. This contractor will provide the appropriate receptacles for the collection of the various waste streams able ensure regular emptying and/or collection of these receptacles. Appropriate licensed waste facilities in the surrounding area will be used as part of Waste Management arrangements. Effluent and waste from onsite construction will be captured onsite in a foul holding tank at temporary construction compound locations and stored for offsite disposal by a licensed contractor. During operation, effluent and waste will be collected from staff welfare facilities located at the Proposed Permanent Operational Compound and Proposed Substation and stored for offsite disposal by a licensed contractor.

Pollution Risk

7.179 Good practice measures in relation to pollution prevention will be implemented as follows:

- refuelling will take place at least 50m from watercourses and where possible it will not occur when there is risk that oil from a spill could directly enter the water environment, for example, periods of heavy rainfall or when standing water is present will be avoided;

- a vehicle management plan and speed limit will be strictly enforced onsite to minimise the potential for accidents to occur;
- drip trays will be placed under all stationary vehicles which could potentially leak fuel/oils;
- water will be prevented as far as possible, from entering excavations such as borrow pits;
- areas of battery storage will be bunded and positively drained so that the quality of runoff within the bunded area can be visually monitored prior to release by tap, and contained if required;
- procedures will be adhered to for storage of fuels and other potentially contaminative materials to minimise the potential for accidental spillage (e.g. stored in 110% bunded storage facilities); and
- an appropriately sized spill kit(s) would be provided and maintained onsite, consideration would be given to suitable locations across the active areas of the site and to having vehicles including plant carry a spill kit. This kit would contain materials, such as absorbent granules and pads, absorbent booms and collection bags. These are designed to halt the spread of spillages and would be deployed, as necessary, should a spillage occur elsewhere within the construction compound.

7.180 In relation to forestry clearance, the following measures to protect water quality are proposed:

- As outlined in Section 7.157, a 50m buffer distance between watercourses and any proposed development including construction activities including fuel storage has been applied to those watercourses within the Site.
- To capture and control suspended sediment, silt traps must be installed within relevant watercourses. These should be constructed along and towards the point of outflow of mound drains, where a firm bank exists, and a ten-metre ‘buffer zone’ containing sufficient vegetation (e.g. grasses, reeds, and shrubs) to filter out any remaining sediment and nutrients can be implemented. Silt traps must be cleared out periodically to ensure they remain fully functional. The build-up of sediment should be emptied onto a level section of the forest floor several metres from any watercourse.
- To further reduce the risk of run-off and sediment mobilisation, felling and extraction of timber should, as far as possible, be conducted during periods of dry weather.
- The refuelling and chemical/fuel storage area on-site must be sited in a dry, sheltered, flat location, at least fifty metres from any watercourse.
- Where it is necessary to cross watercourses/drains during harvesting operations, temporary crossing points are required. These may comprise logs lined lengthwise and overlaid with a geotextile membrane and brash to capture falling soil from machinery wheels. The condition of temporary crossing points must be carefully monitored throughout operations, and these should be cleaned out and supplemented (as necessary). Where it is necessary to cross a watercourse, a clear span log structure must be implemented.

Pluvial Flood Risk

7.181 It is proposed to adopt SuDS as part of the Proposed Development. SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of runoff that might have been experienced at Site prior to development. Good practice in relation to

the management of surface water runoff rates and volumes and potential for localised pluvial flood risk will be implemented as follows:

- drainage systems are designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse;
- onsite drainage will be subject to routine checks by construction personnel and the Principal Contractor, in consultation with the ECoW, to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding;
- The proposed drainage management systems will attenuate runoff rates and reduce runoff volumes to ensure minimal effect upon flood risk;
- as per good practice for pollution and sediment management, prior to construction, section specific drainage plans will be developed in accordance with the mitigation set out above and construction personnel made familiar with the implementation of these.
- Drainage design for the Proposed Development is set out in the planning drawings accompanying this EIAR.

Water Quality Monitoring

7.182 Water quality monitoring during the construction phase will be undertaken by the Applicant for the surface water catchments that serve the Site, to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids. Monitoring will be carried out at a specified frequency on these catchments.

7.183 With regard to the protection of the water environment the following risks will be addressed:

- siltation of watercourses;
- discolouration of raw water;
- potential pollution from construction traffic due to diesel spillage or similar;
- alteration of raw water quality resulting from imported track construction material;
- excavation and earthworks
- use of large quantities of concrete;
- site compound and associated drainage/foul drainage and diesel spill issues; and
- the Project Supervisor Construction Stage (PSCS) will compile a monitoring and maintenance plan for the drainage system and surface water runs which will as a minimum include:
- visual monitoring/inspections during site works and water crossing construction works, the relevant drainage/surface water features potentially being impacted by these works will be inspected on a daily basis by the Environmental Clerk of Works (ECoW) while works are ongoing in this area;
- surface water monitoring is to be continued at the 13 no. riverine survey sites which were assessed for biological water quality through Q-sampling in July 2022 during the aquatic baseline survey (see Appendix 5-4).
- A Water Quality Monitoring Plan (WQMP) will be implemented as part of the Construction Method Statement (CMS), which will be submitted to the appropriate

planning authorities prior to construction and development. The WQMP will be implemented to monitor surface water quality, fish populations and macroinvertebrate community prior to, during and post-construction. A robust baseline of water quality in surface watercourses / drainage channels downstream of construction works will be established prior to construction commencing and used as a benchmark of water quality for the construction phase monitoring.

7.184 The purpose of the WQMP is to:

- Ensure that the commitments put forward in the EIAR are fulfilled with regards to identified ground and surface water receptors;
- Provide a specification for monitoring prior to, during and after construction;
- Provide a record of water quality across the site that can be compared to rainfall and site activities;
- Provide reassurance of the effectiveness of pollution prevention measures installed to protect surface watercourses throughout the construction period; and
- Provide data to identify any potential pollution incidents, and to inform a structured approach to manage and control such incidences.

7.185 The WQMP will outline details for the monitoring of surface watercourses down gradient of works areas including watercourse crossings, access tracks, turbine foundations and borrow pits and at control sites (up gradient of works areas), and will include:

- Continued extensive surface water monitoring at the 13 no. riverine survey sites, as noted above;
- Planning level monitoring locations;
- Frequency of monitoring prior to, during and after construction – likely to be monthly;
- Parameters for field hydrochemistry testing and laboratory analysis including as a minimum pH, electrical conductivity, suspended solids, dissolved metals, nutrients and hydrocarbons;
- Sampling and analysis protocols;
- Relevant environmental quality standards (EQS);
- Responsibilities for monitoring –the ECoW will be responsible for daily monitoring of watercourses particularly around active works areas and watercourse crossings;
- Procedures to be followed in the event of an environmental incident; and
- Recording and communicating of results.

7.186 Details of the Private Water Supply (PWS) Action Plan are provided in Section 8.1 of the CEMP. A PWS will be developed and will include details regarding all water monitoring and reporting, pollution incident reporting and emergency mitigation measures to address a temporary or permanent material change in either the quality or quantity of an existing private water supply. The PWS Action plan shall include as a minimum:

- the provision of an emergency hotline telephone number for householders so that they can contact the project with any concern regarding water quality or quantity;
- the contact details of householders downgradient of work areas to alert in the event of a pollution incident;

- the provision of an alternative water supply, if required, during any periods of PWS disruption; and/or
- to supply affected properties with filters for particulate removal.

Emergency Response

7.187 Drainage networks provide a conduit for rapid transport of silty water and potential contamination from surface spills of fuels / oils, concrete or chemicals. A pollution emergency incident will be implemented and will include any discharge to the drainage network that could potentially cause environmental damage. Examples of pollution emergency incidents include:

- fuel drips or spills during refuelling;
- leaking plant or equipment;
- leaks from fuel or chemical containers;
- contaminated water or sediment / silt entering a watercourse or drainage network;
- windblown dust and waste;
- excess silt deposition in drainage ditches, channels, culverts following heavy rainfall events;
- operational failures of pumps and pipelines; and
- failures of treatment or sediment controls.

7.188 The PSCS will be required to prepare an Environmental Incident and Emergency Response Plan (in accordance with Section 6.1 of the CEMP which will provide emergency response contacts, reporting procedures, and procedures for dealing with all potential pollution incidents during the construction of the Proposed Development.

Mitigation Measures: Operational

7.189 During the operational phase of the Proposed Development, it is anticipated that routine maintenance of infrastructure and tracks will be required across the Site. This may include work such as maintaining access tracks and drainage and carrying out wind turbine maintenance.

7.190 Should any maintenance be required onsite which would involve construction type activities; mitigation measures will be adhered to along with the measures in the CEMP to avoid potential effects.

7.191 During the operation of the Proposed Development, it is not anticipated that there will be any excavation or stockpiled material, reducing the potential for erosion and sedimentation effects. Should any excavation be required, this is likely to be limited and required for maintenance of tracks etc. Any excavation, handling and placement of material from borrow pits will be subject to the same safeguards that will be used during the construction phase of the Proposed Development.

Mitigation Measures: Decommissioning

7.192 The risk of a pollution incident occurring will be managed using good practice measures as detailed in the CEMP. Many of these practices are concerned with undertaking construction

activities away from watercourses and identifying safe areas for stockpiling or storage of potential pollutants that could otherwise lead to the pollution of watercourses.

7.193 Potential pollution events occurring during the construction of the turbines or any hardstanding will be controlled by good practice measures and will be subject to some attenuation in the soils before reaching groundwater.

7.194 Adherence to good practice measures would ensure that any material generated is not transported into nearby watercourses.

7.195 Location specific good practice measures will be in place for sediment control for each of the track construction activities and borrow pits to control the amount of fine sediment that could potentially enter a watercourse if not managed appropriately. These measures will be dependent upon the final borrow pit designs and stone quality, but would include inception bunds and drainage ditches and swales. Check dams, silt traps and buffer strips will also be utilised where possible.

7.196 In particular, drainage, some of which will be temporary, will be required around turbine working areas, the construction compound and borrow pits to manage surface flows. Excavation of turbine foundations may require temporary de-watering for the period of the foundation build. These drainage activities may lead to temporary changes in the water table surrounding these construction activities (where de-watering is required below the level of the natural water table).

7.197 Excavations associated with constructions works (e.g. cut tracks, turbine bases foundations, cable trenches, borrow pits) can result in local lowering of the water table. Dewatering associated with construction of wind turbine foundations is commonly temporary and dewatering following construction will not be required.

Residual Impacts

7.198 With the above mitigation measures in place at the Site, it is projected that the following reduction in the assessed significance of impacts will result in:

- Reduction of the potential impact on surface quality in bedrock aquifer from accidental fuel leakage/ spillage during the operational stage from “moderate” to “slight” (No. 8).
- Reduction in surface water quality from sediment release during the construction stage from “moderate” to “slight” (No. 1);
- Reduction in the surface water quality from accidental spillage of oils, fuels and cement during the construction stage from “moderate” to “slight” (No. 2);
- Reduction in the groundwater quality from accidental spillage of oils, fuels and cement during the construction stage from “slight - moderate” to “slight – not significant” (No. 6);

7.199 The significance of all other potential impacts during the construction and operational stage will be reduced to “**slight**” or lower to the water environment receptors.

7.200 Additionally, the Proposed Development will not cause a deterioration of the status of any surface or groundwater body under the WFD and will not undermine the attainment by any such body of good status.

Cumulative Effects

7.201 For the assessment of cumulative effects, any other permitted or proposed and unbuilt projects in proximity to the site (wind energy or other) have been considered where they have the potential to generate an in-combination or cumulative impact with the Proposed Development.

7.202 In terms of all proposed and permitted developments within vicinity of the site, the details of projects considered in the cumulative assessment are presented in **Appendix 1-2** 'Projects Considered in the Cumulative Assessment' found in Volume III of this EIAR – this is the cumulative long list of projects. The short list of these projects which are included as part of this assessment are set out in **Table 2-5** of the EIAR. These projects were selected for two reasons: 1) they are wind farms within 20km of the Proposed Development or 2) they utilise the same road networks as the Proposed Development.

7.203 The closest proposed and permitted wind farm development is the Bord na Móna Powergen Ltd wind farm, located 4.8km to the south. The Bracklyn Wind Farm is located 5km to the south. The distance of 4.8km to the nearest wind farm will ensure that there are no significant adverse cumulative impacts on Water in the local area.

Summary and Statement of Significant Effects

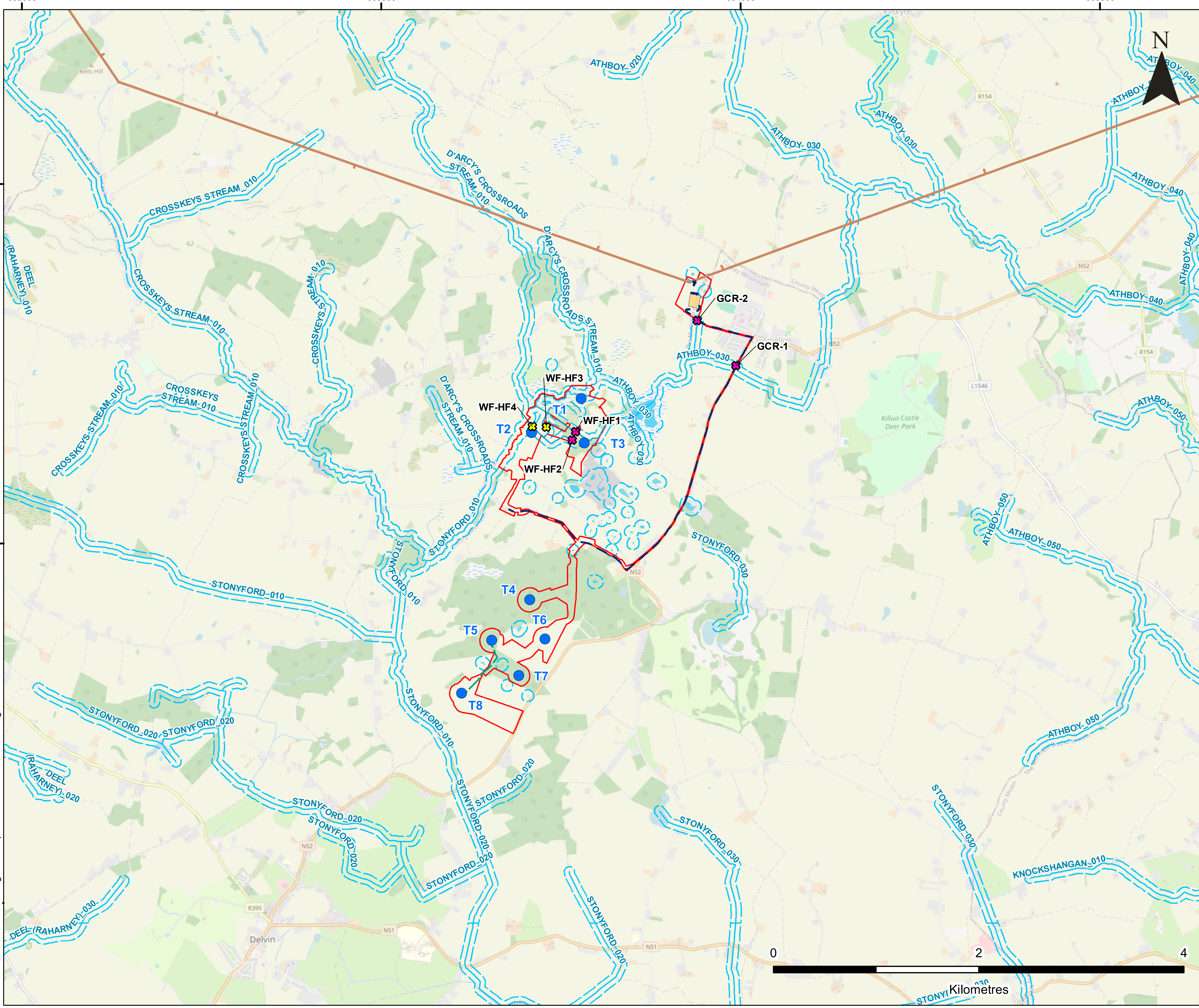
7.204 This chapter has presented an assessment of the potential impacts of the Proposed Development on surface water and groundwater.

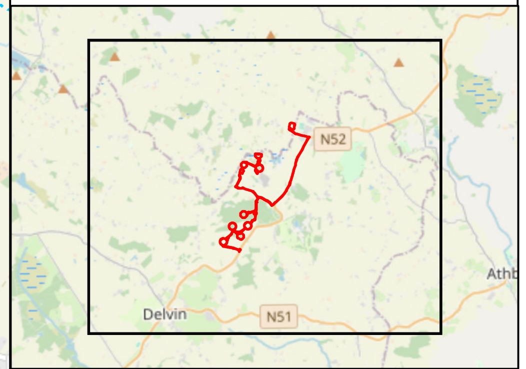
7.205 The design of the Proposed Development includes a range of best practice construction measures to ensure avoidance and reduction of impacts throughout the construction, operational and decommissioning phases. Additional measures will also be implemented to mitigate the potential impacts identified on the water environment receptors.

7.206 This chapter comprehensively assesses all scenarios within the Turbine Range which is described in Chapter 2 of this EIAR. The potential impacts that could arise from the Proposed Development during the construction, operational and decommissioning phases are set out in this conclusion.

7.207 With mitigation measures in place at the Site, the significance of potential impacts during the construction and operational stage will be reduced to "slight" or lower to the water environment receptors.

Figures





02036.00812.0097.0 Existing and Proposed Watercourse Crossings

KNOCKANARRAGH WIND FARM LIMITED

SLR
7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN D14 N2Y7
IRELAND
T: 0129 64667
www.slrconsulting.com

KNOCKANARRAGH WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT REPORT

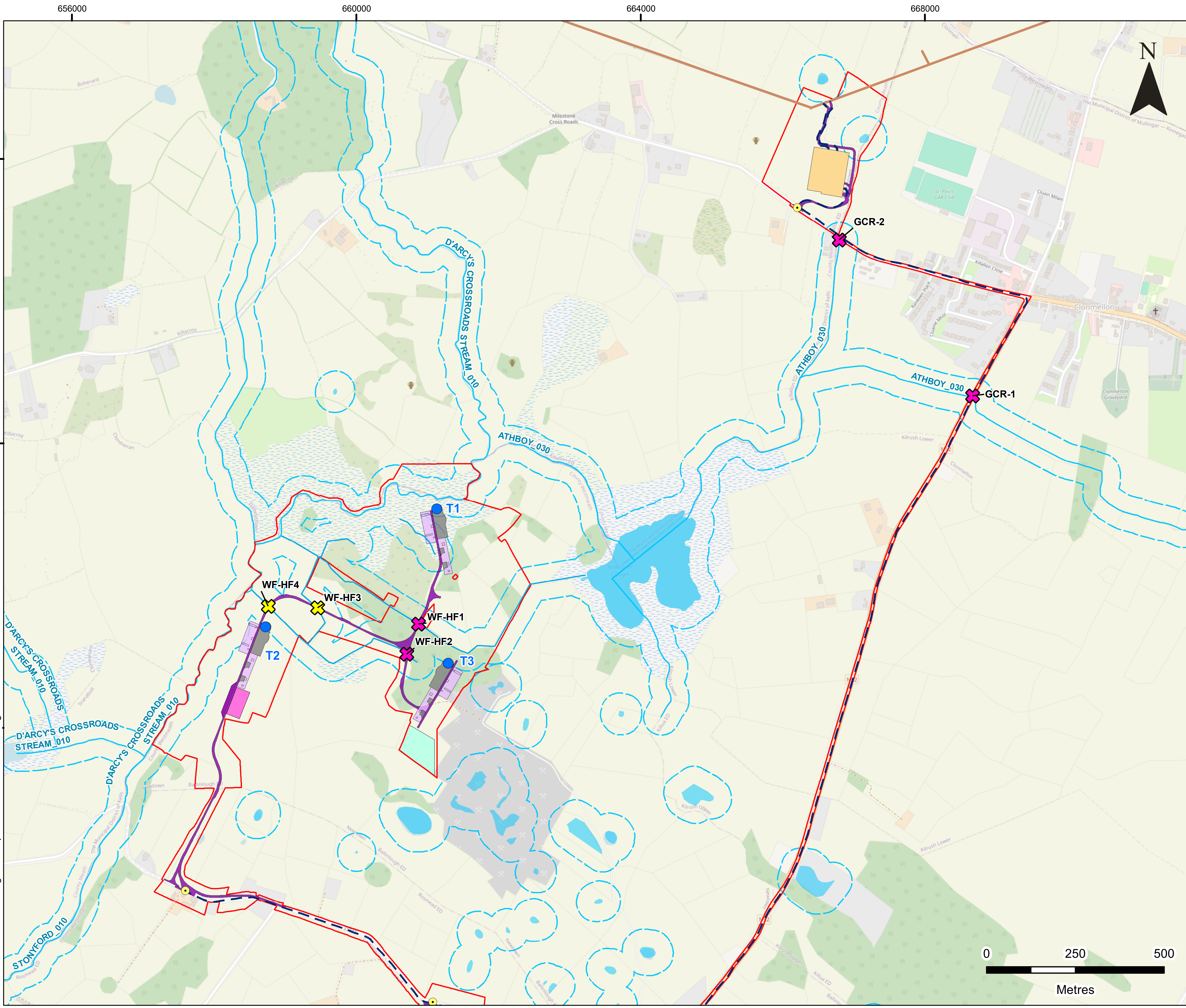
WATER

EXISTING & PROPOSED WATERCOURSE CROSSING - OVERVIEW

FIGURE 7-1-a

Scale 1:35,000 @ A3

Date MARCH 2024



LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Site Access
- Proposed Cable Route
- Proposed Access Track
- Proposed Temporary Construction Compound
- Proposed Substation Location
- Proposed Borrow Pit

Proposed Crane Hardstanding

- Permanent
- Temporary
- Existing High Voltage Transmission Line
- Existing Watercourse Crossing
- Proposed Watercourse Crossing
- Watercourse
- Waterbody
- Watercourse & Waterbody 50 m Buffer

KNOCKANARRAGH WIND FARM LIMITED

SLR
7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN D14 N2Y7
IRELAND
T: 0129 64667
www.slrconsulting.com

KNOCKANARRAGH WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT REPORT

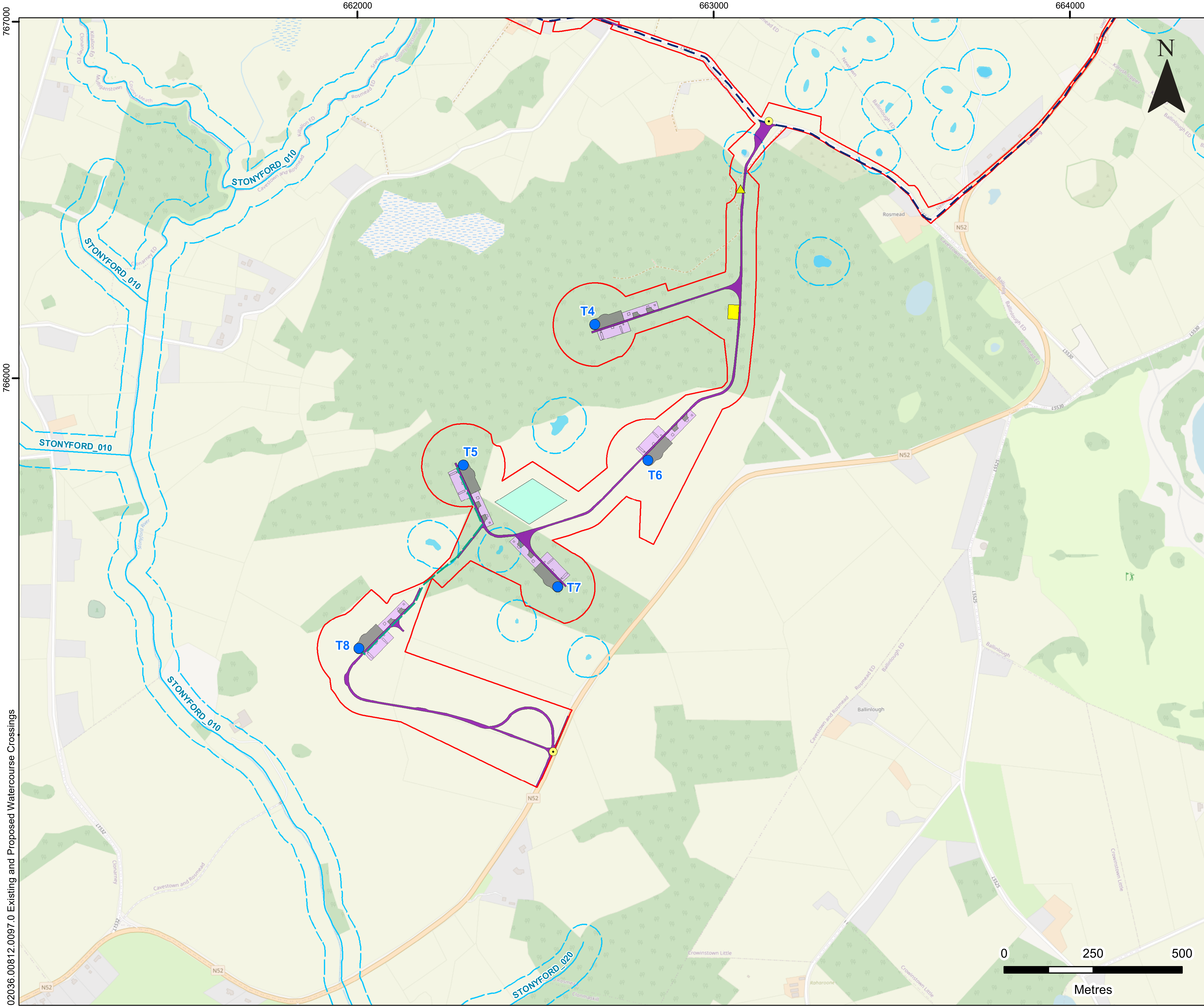
WATER

EXISTING & PROPOSED WATERCOURSE CROSSING - NORTHERN CLUSTER

FIGURE 7-1-b

Scale 1:10,000 @ A3 | Date MARCH 2024

02036.00812.0097.0 Existing and Proposed Watercourse Crossings



LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Main Ring Unit
- Proposed Site Access
- Proposed Internal Collector Cable
- Proposed Cable Route
- Proposed Access Track
- Proposed Operational Compound
- Proposed Borrow Pit

Proposed Crane Hardstanding

- Permanent
- Temporary
- Watercourse
- Waterbody
- Watercourse & Waterbody 50 m Buffer

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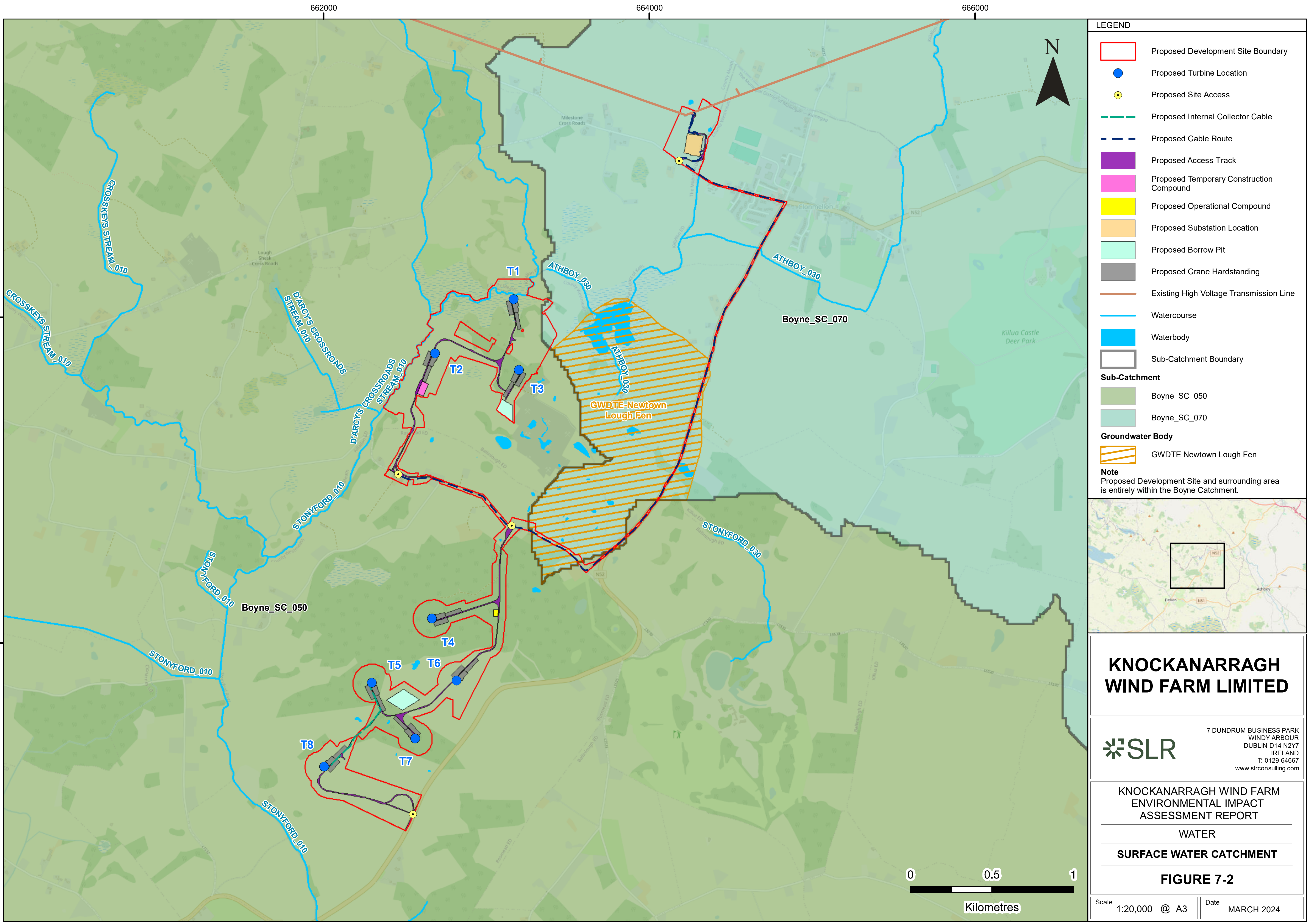
WATER

EXISTING & PROPOSED WATERCOURSE CROSSING - SOUTHERN CLUSTER

FIGURE 7-1-c

Scale	Date
1:10,000 @ A3	MARCH 2024



02036.00812.0098.0 Surface Water Catchment

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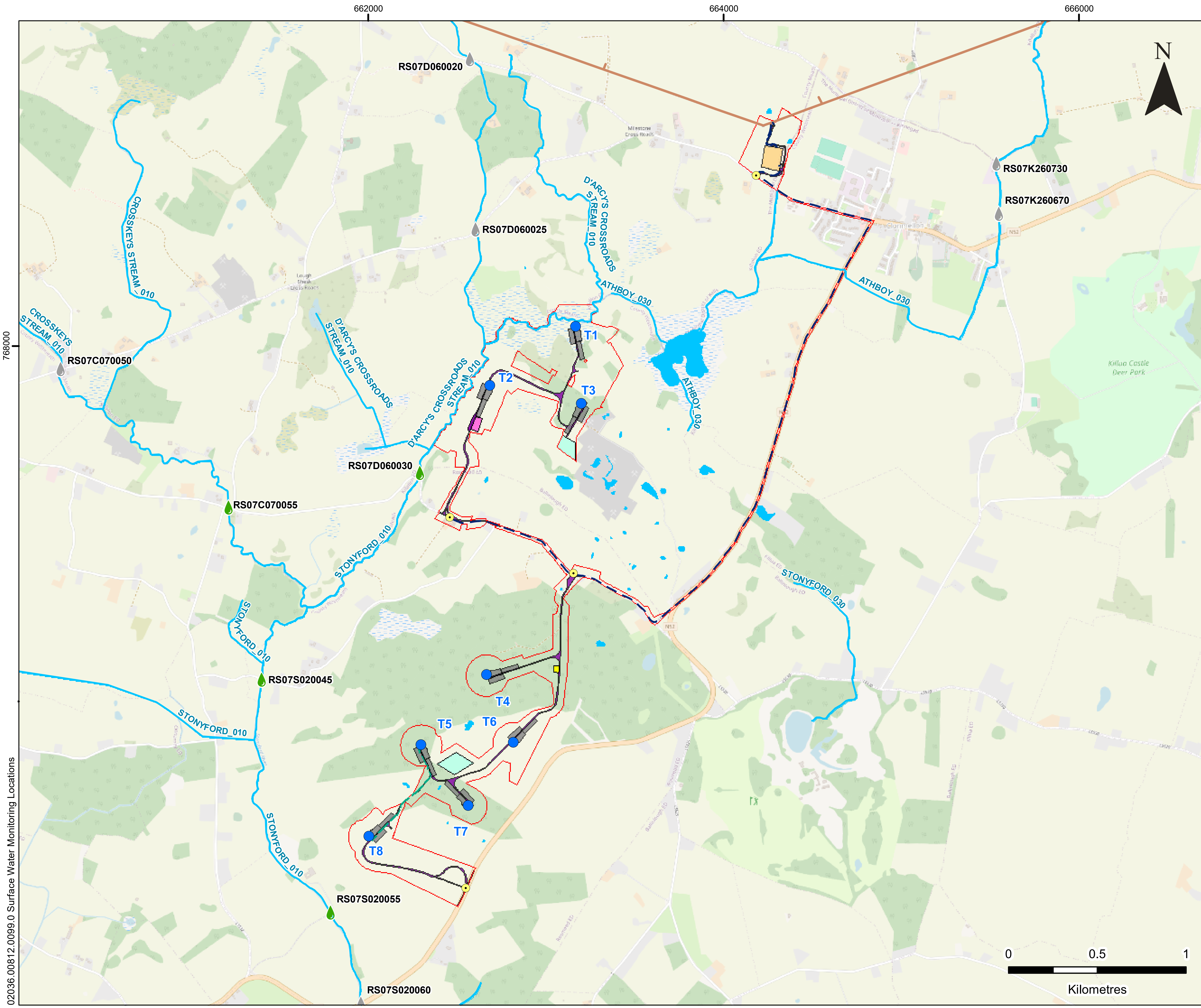
WATER

SURFACE WATER CATCHMENT

FIGURE 7-2

Scale 1:20,000 @ A3 | Date MARCH 2024



LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Site Access
- Proposed Internal Collector Cable
- Proposed Cable Route
- Proposed Access Track
- Proposed Temporary Construction Compound
- Proposed Operational Compound
- Proposed Substation Location
- Proposed Borrow Pit
- Proposed Crane Hardstanding
- Existing High Voltage Transmission Line
- Watercourse
- Waterbody

Surface Water Monitoring Location - Last Recorded Q-Value

- Q3 - Q4 Slightly Polluted
- No Q-Value

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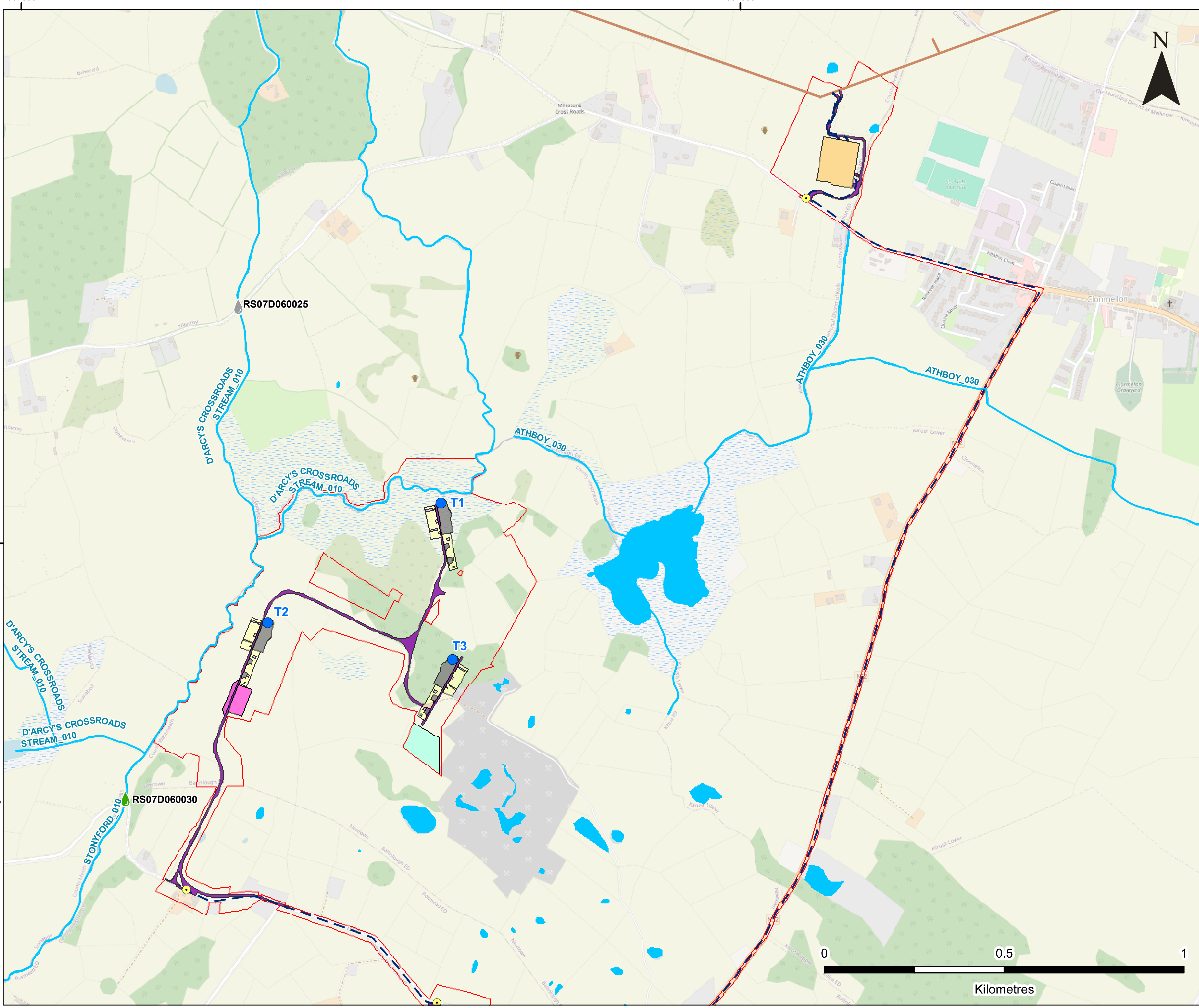
WATER

SURFACE WATER MONITORING LOCATIONS

FIGURE 7-3

Scale 1:20,000 @ A3 | Date MARCH 2024



LEGEND

Proposed Development Site Boundary
Proposed Turbine Location
Proposed Site Access
Proposed Cable Route
Proposed Access Track
Proposed Temporary Construction Compound
Proposed Substation Location
Proposed Hardstanding
Proposed Borrow Pit

CraneHardstanding

Proposed Crane Hardstanding

Permanent Hardstanding
Temporary Hardstanding
Level and Clearance Area
Existing High Voltage Transmission Line
Watercourse
Waterbody

Surface Water Monitoring Location - Last Recorded Q-Value

Q3 - Q4 Slightly Polluted

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WATER

SURFACE WATER MONITORING LOCATIONS

FIGURE 7-3

Scale 1:10,000 @ A3

Date MARCH 2024

02036.00812.0099.0 Surface Water Monitoring Locations

662000

664000

766000

RS07D060030

RS07C070055

STONYFORD_010

STONYFORD_010

RS07S020045

STONYFORD_010

STONYFORD_010

RS07S020055

T4

T5

T6

T7

T8

N52

N52

N52

N

0 0.5 1

Kilometres

02036.00812.0099.0 Surface Water Monitoring Locations

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Site Access
- Proposed Internal Collector Cable
- Proposed Cable Route
- Proposed Access Track
- Proposed Operational Compound
- Proposed Hardstanding
- Proposed Borrow Pit

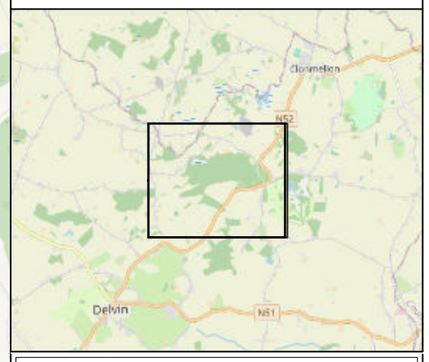
CraneHardstanding

Proposed Crane Hardstanding

- Permanent Hardstanding
- Temporary Hardstanding
- Level and Clearance Area
- Watercourse
- Waterbody

Surface Water Monitoring Location - Last Recorded Q-Value

- Q3 - Q4 Slightly Polluted



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WATER

SURFACE WATER MONITORING LOCATIONS

FIGURE 7-3

Scale 1:10,000 @ A3

Date MARCH 2024

662000
664000
666000
768000
766000

T1
T2
T3
T4
T5
T7
T8

N

Milestone Cross Roads
Lough Shesk Cross Roads
Clonmellon
Killua Castle Deer Park
N52
N51
Delvin
Athboy

0 0.5 1
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Site Access
- Proposed Internal Collector Cable
- Proposed Cable Route
- Proposed Access Track
- Proposed Temporary Construction Compound
- Proposed Operational Compound
- Proposed Substation Location
- Proposed Borrow Pit
- Proposed Crane Hardstanding
- Existing High Voltage Transmission Line
- Bedrock Fault Line

Bedrock Aquifer

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

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WATER

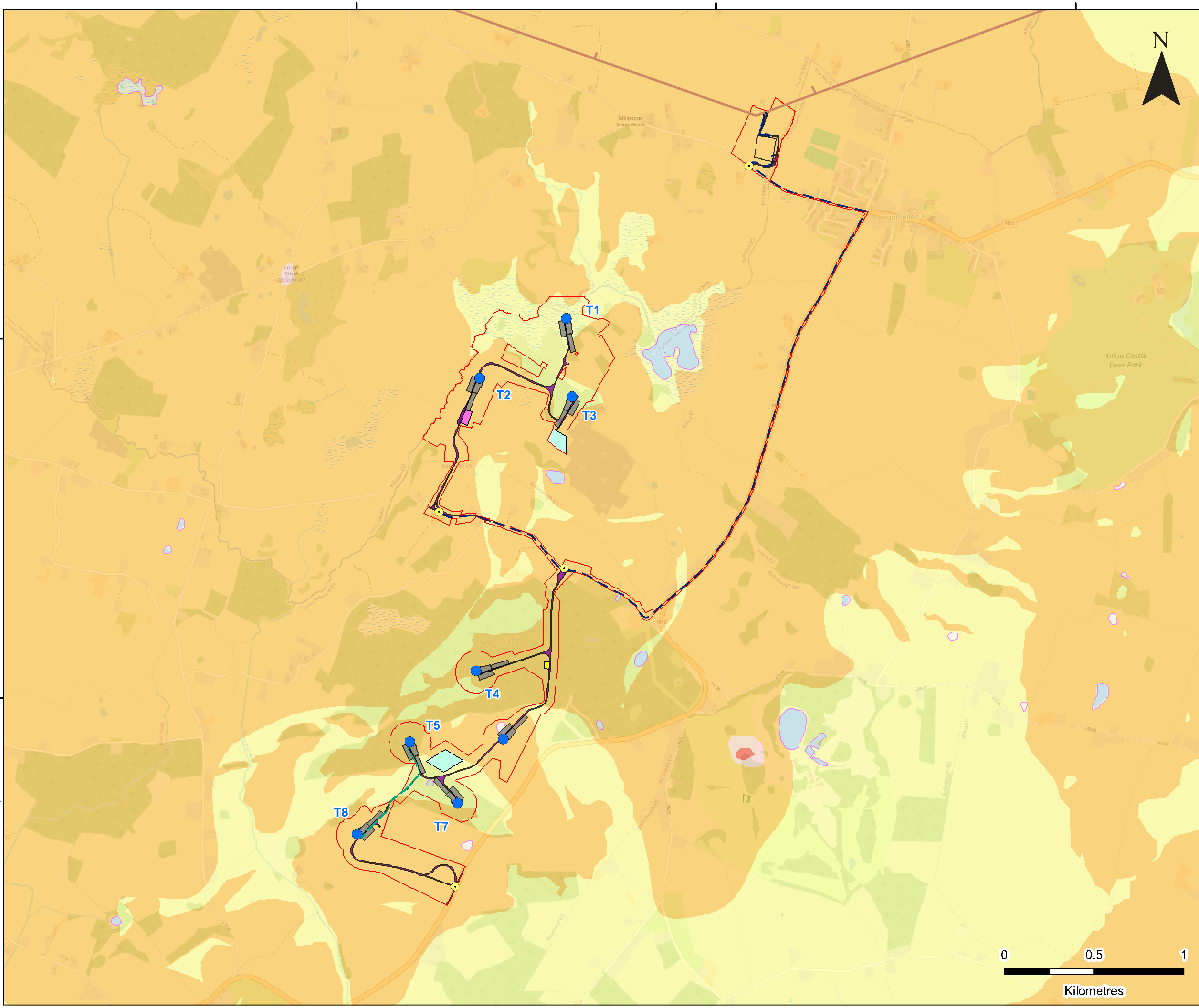
BEDROCK AQUIFER

FIGURE 7-4

Scale 1:20,000 @ A3

Date MARCH 2024

02036.00812.0100.0 Bedrock Aquifer and Karst Features



02036.00812.0101.0 Groundwater Vulnerability

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Site Access
- Proposed Internal Collector Cable
- Proposed Cable Route
- Proposed Access Track
- Proposed Temporary Construction Compound
- Proposed Operational Compound
- Proposed Substation Location
- Proposed Borrow Pit
- Proposed Crane Hardstanding
- Existing High Voltage Transmission Line

Groundwater Vulnerability

- Rock At or Near Surface or Karst
- Extreme
- High
- Moderate
- Water

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WATER

GROUNDWATER VULNERABILITY

FIGURE 7-5

Scale 1:20,000 @ A3 | Date MARCH 2024

662000

664000

768000

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Site Access
- Proposed Cable Route
- Proposed Access Track
- Proposed Temporary Construction Compound
- Proposed Substation Location
- Proposed Borrow Pit
- Existing High Voltage Transmission Line

Groundwater Vulnerability

- High
- Moderate
- Water

0 0.5 1

Kilometres

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WATER

GROUNDWATER VULNERABILITY

FIGURE 7-5

Scale 1:10,000 @ A3

Date MARCH 2024

02036.00812.0101.0 Groundwater Vulnerability

662000

664000

766000

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Site Access
- Proposed Internal Collector Cable
- Proposed Cable Route
- Proposed Access Track
- Proposed Operational Compound
- Proposed Borrow Pit

Groundwater Vulnerability

- Rock At or Near Surface or Karst
- Extreme
- High
- Moderate
- Water

0 0.5 1

Kilometres

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GROUNDWATER VULNERABILITY

FIGURE 7-5

Scale 1:10,000 @ A3

Date MARCH 2024

02036.00812.0101.0 Groundwater Vulnerability

660000
662000
664000
666000
668000
770000
768000

T1
T2
T3
T4
T5
T6
T7
T8

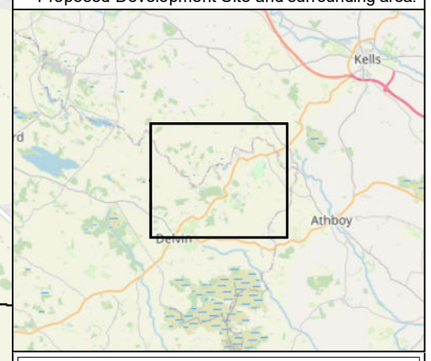
Clonmellon
Killua Castle Deer Park
N52
R154
L1546
R395
N51
County Meath
County Westmeath
The Municipal District of Kells

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Site Access
- Proposed Internal Collector Cable
- Proposed Cable Route
- Proposed Access
- Proposed Temporary Construction Compound
- Proposed Operational Compound
- Proposed Substation Location
- Proposed Borrow Pit
- Proposed Crane Hardstanding
- Existing High Voltage Transmission Line
- GSI Groundwater Supply Well

Note
Private Water Supply Well circle repesents the area in which a well may be located within.
1-2 km Accuracy Wells not included.
No Public Supply Protection Area Within Proposed Development Site and surrounding area.



0
1
2
Kilometres

02036.00812.0103.0 Groundwater Supply Wells and Groundwater Monitoring Well

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WATER

GSI GROUNDWATER SUPPLY WELLS

FIGURE 7-6

Scale 1:30,000 @ A3

Date MARCH 2024

Appendices

Appendix 7-1: EU Directives / National Legislation and Regulations / Guidelines / Technical Standards

Appendix 7-2: Water Framework Directive

Appendix 7-3: Flood Risk Assessment

Appendix 7-4: T1 Drainage Assessment Review

Appendix 7-5: Rating of Existing Environmental Significance / Sensitivity (IGI, 2013 Guidelines)

Appendix 7-6: Description of Effects (EPA, 2022)

Appendix 7-7: Classification of the Significance of Impacts (EPA, 2022)

(Refer to EIAR Volume III for Appendices)