ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

ELEMENT POWER IRELAND LTD.

ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED MAIGHNE WIND FARM, IN COUNTY KILDARE AND COUNTY MEATH

VOLUME 2 – MAIN EIS

CHAPTER 10 – WATER QUALITY

MARCH 2015

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10.1 Introduction

This chapter has been prepared to examine the potential impact of the proposed Maighne Wind Farm, and associated infrastructure, on the existing water quality of the local environment. Both surface water and groundwater are considered. The drainage of the proposed development is considered, taking account of mitigation measures to reduce or eliminate any residual impacts on the water quality, however drainage is addressed in more detail in Chapter 10 of the EIS – Hydrology. The residual impacts of the proposed Maighne Wind Farm development on the receiving water quality environment after implementation of the mitigation measures at the site is assessed as negligible.

10.2 Methodology

The following sources of information were considered in this assessment:

- The design layout of the proposed development
- Published literature including consultation responses as described below
- A desk-based assessment of the water quality (surface water and groundwater) in the catchments relevant to the proposed development, including an assessment of the watercourses which will be intercepted by the layout of the proposed development and those which will receive surface water run-off from the proposed development
- A field assessment of the existing hydrological environment, to both verify desk based assessment and record all significant hydrological features
- Water quality sampling in selected locations to determine the existing water quality and to verify the desk based assessment.

10.2.1 Study Area

The total area of the wind farm cluster s for the proposed Maighne Wind Farm is 1,244 ha as illustrated in Figure 2.1. which is included in Volume 2a of the EIS.

The proposed development consists of the erection of up to 47 no. wind turbines with a tip height of up to 169m, access tracks, a sub-station, a permanent meteorological mast, borrow pits and associated works, temporary compounds as well as temporary minor alterations to the public road for the delivery of turbines to the site (turbine delivery route). The turbines are arranged in five wind farm clusters. The clusters are Ballynakill (10 turbines), Windmill (3 turbines), Drehid-Hortland (21 turbines), Derrybrennan (2 turbines) and Cloncumber (11 turbines). All clusters are connected via associated underground medium voltage (MV) cables which run predominately along the public road network linking back to a proposed sub-station on-site at Drehid. Here the power will be converted to AC up to a maximum voltage of 220kV for export to the Irish national grid via high voltage (HV) underground cables to either one of two existing substations located at Woodland, Co. Meath or Maynooth, Co. Kildare.

Whether the connection point to the national electricity transmission grid will be located at the Woodland or Maynooth substations will be determined by EirGrid plc, which is the statutory Transmission System Operator. Accordingly, the documentation submitted with this application for permission identified and evaluates 2 no. HV grid connection routes (which will operate at a voltage up to 220kV). The 2 no. HV grid connection cable routes included in this application will connect the proposed Maighne Wind Farm substation at Drehid to either one of two existing substations located at Woodland, Co. Meath or Maynooth, Co. Kildare. However, only one of these routes will be constructed following the identification of the preferred connection point by the Transmission System Operator.

Tree felling will be required within and around the wind farm infrastructure to accommodate the construction of some turbine foundations, hard stands, crane pads, access tracks and the substation. The estimated total area of tree felling required for the proposed wind farm will be approximately 63ha, which will be subject to confirmation to and the agreement of the Forest Service of the Department of Agriculture, Food and the Marine prior to construction.

The location of the forestry in question is indicated on Figure 2.8 of Volume 2a of the EIS and is located within the following clusters:

- Drehid-Hortland (45ha)
- Windmill (2.2ha)
- Derrybrennan (0.77ha)
- Cloncumber (15ha).

Tree felling will be the subject of a Felling Licence from the Forest Service and will be in accordance with the conditions of such a licence. A Limited Felling Licence will be in place prior to any felling works commencing on site.

The proposed development is located in lands varying in use from agricultural to forestry and commercial peat extraction. A number of industries, commercial and waste management facilities, are also located in the area.

The area of the proposed development is located across a number of river catchments, as shown in Figure 9.1 Waterbody Catchment Map Overview in Chapter 9 of Volume 2 of the EIS. The information in this figure is available to view in more detail in the sub maps, which are included in Volume 2a of this EIS.

The northern part of the wind farm drains to the environmentally protected designated sites, River Boyne and River Blackwater candidate Special Area of Conservation (cSAC) (site code: 002299) and Special Protection Area (SPA) (site code: 0004232).

The southern part of the wind farm drains to the River Barrow and River Nore cSAC (site code: 002162). The southern area predominantly drains to tributaries of the River Barrow, the Slate River and the Figile River. It was noted in the aquatic ecological assessment, that the Figile River is a designated salmon spawning watercourse. The Figile River flows into the River Barrow and the lower reaches of the Figile are part of the cSAC. The designation begins at Shean, 14km downstream of the site.

The Royal Canal pNHA (site code: 002103) lies north of the proposed development. It connects the River Liffey in Dublin with the River Shannon in Co. Longford.

The Grand Canal pNHA (site code: 002104) runs through the southern area of the proposed development, connecting the River Liffey in Dublin with the River Shannon in Co. Offaly. A feeder line from Athy and the Barrow, called the Grand Canal (Barrow Line) is a branch of the canal and flows just east of the Cloncumber cluster.

The proposed HV cable routes from the proposed electrical substation at Drehid to the existing substation in Woodlands, Co. Meath is 32km. The route drains to the River Blackwater, the River Rye Water and to tributaries of the River Tolka. The River Rye Water is a tributary of the River Liffey, joining it in Leixlip Demesne. The River Rye Water cSAC and pNHA (site code: 001398) is between Leixlip and Maynooth, 10 km to the south east of the proposed substation at Woodlands. The River Tolka is salmonid and it flows into the environmentally designated South Dublin Bay and River Tolka Estuary SPA (code: 004024), approximately 25km to the south east. The proposed route crosses under the Grand Canal at Kilcock.

The proposed HV cable route from the proposed electrical substation at Drehid to the existing substation at Maynooth, Co. Kildare is 22km. The route drains to the River Blackwater and to the River Rye Water. The River Rye Water cSAC and pNHA (site code: 001398) is approximately 6km north east of the proposed substation at Maynooth. The geographical scope of the study area in relation to water quality included all watercourses within the site boundary. The hydrological links to environmentally designated protected areas downstream of the site, for a distance of 15km, are also examined to establish the sensitivity of the receiving environment. In assessing the impacts of the turbine delivery route and cable routes, the streams crossed by these routes are examined. Where developments exist or are proposed in upstream or downstream waterbodies, with hydrological links to the site, cumulative impacts of these developments are examined.

10.2.2 Relevant Guidance

The scope and methodology for the water quality assessment has been devised in consideration of the following planning, policy and guidance documents:

- Wind Energy Development Planning Guidelines, Department of the Environment, Heritage and Local Government, 2006 (1)
- Best Practice Guidelines for the Irish Wind Energy Industry, Irish Wind Energy Association, 2012 (2)
- Guidelines on the Information to be Contained in Environmental Impact Statements, EPA, 2002(3)
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements, EPA, 2003 (4)
- Water Framework Directive (2000/60/EC) (5)
- Water framework directive Ireland website (6)
- Environmental Protection Agency online maps (7)
- Eastern River Basin District River Basin Management Plan 2009 – 2015 (8)
- South Eastern River Basin Management Plan 2009 - 2015 (9)
- Kildare County Development Plan 2011- 2017 (10)
- Meath County Development Plan 2013 – 2019 (11)
- Geological Survey of Ireland, County Kildare Groundwater Protection Scheme (12)
- Geological Survey of Ireland, County Meath Groundwater Protection Scheme (13)
- K.T Cullen & Co. Ltd, Source Protection Plan for the proposed well field at Johnstown Bridge, Co. Kildare (14)
- UK Pollution Prevention Guidelines (PPG):
    - PPG1: Understanding your environmental responsibilities – Good Environmental Practices (2013) (15)
    - PPG2: Above ground oil storage tanks (2011) (16)
    - PPG3: Pollution Prevention Guidelines (2006) (17)
    - PPG4: The disposal of sewage where no mains drainage is available (2006) (18)
    - PPG5: Works in, near or liable to affect watercourses (2007) (19)
    - PPG6: Working at construction and demolition sites (2012) (20)
    - PPG7: The safe operation of refuelling facilities (2011) (21)
    - PPG8: Safe storage and disposal of used oil (2004) (22)
    - PPG21: Pollution incident response planning (2009) (23)
    - PPG22: Dealing with Spills (2011) (23)
    - PPG26: Drums and Intermediate Bulk Containers (2011) (24)
- Eastern Regional Fisheries Board Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites (2004) (25)
- Forest Service, Department of Marine and Natural Resources (2000) Forestry and Water Quality Guidelines (26)
- Forest Service, Department of Marine and Natural Resources (2000) Forest Harvesting and Environmental Guidelines (27)
- CIRIA (2001) Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (C532) (28)

10.2.2.1 Water Framework Directive

The Water Framework Directive (WFD) (2000/60/EC (5)) was adopted by the (then entitled) European Community in 2000. This Directive was transposed into Irish law from December 2003 by, *inter alia*, the European Communities (Water Policy) Regulations 2003, (S.I. No. 722 of 2003) and subsequent amendments. The overriding purpose of the WFD is to achieve at least 'good status' in all European waters by 2015 and ensure that no further deterioration occurs in these waters. European waters are classified as groundwaters, rivers, lakes, transitional and coastal waters. The WFD has been implemented in Ireland by dividing the island of Ireland into eight river basin districts.

Article 6 of the WFD requires each Member State to establish a register for protected areas. The EPA has established this register. The protected areas are divided into six main categories:

- Areas designated for the abstraction of water intended for human consumption
- Areas designated for the protection of economically significant aquatic species
- Areas designated as recreational and bathing waters
- Nutrient sensitive areas

- Areas designated for the protection of habitats (including birds).

There are protected areas under the WFD within the proposed Maighne Wind Farm development boundary. These are areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection. These include Salmonid waters, candidate cSACs and SPAs. These are all water dependant cSACs or SPAs.

Water Framework Directive Waterbody Status

The European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012) give effect to the criteria and standards to be used for classifying surface waters in accordance with the WFD. There are five categories of surface water status: 'High', 'Good', 'Moderate', 'Poor' and 'Bad'.

A surface water body must achieve both good ecological status and good chemical status before it can be considered to be of good status. The chemical status of a water body is assessed based on certain chemical pollutants. The ecological status is assessed based on Biotic Indices or Quality (Q) Values. The EPA scheme of Q Values and its relationship to WFD status is set out in the table.

Table 10.1: WFD Status and EPA Q Values

Q Value	WFD Status
Q5	High
Q4-5	High
Q4	Good
Q3-4	Moderate
Q3	Poor
Q2-3	Poor
Q2	Bad
Q1-2	Bad
Q1	Bad

The European Communities Environmental Objectives (Groundwater) Regulations (SI No. 9 of 2010) give effect to the criteria and standards to be used for classifying groundwaters in accordance with the WFD. Groundwater is either classified as 'Good' or 'Poor' status. A groundwater body must achieve 'Good' status in both quantitative and chemical status.

In accordance with the regulations, waters classified as 'High' or 'Good' must not be allowed to deteriorate. Waters classified as less than good must be restored to at least good status within a prescribed timeframe.

The regulations also state that, for the purpose of classification, a status of less than good is assigned in the case of a water body where the environmental objectives for an associated protected area requiring special protection by virtue of obligations arising from specific national legislation for the protection of water, or for the conservation of habitats and species directly dependent on water, are not met.

Water Framework Directive Risk Assessments

A baseline risk assessment was completed of the water bodies within each River Basin District in 2005. This assessment involved using information on water pollution indicators, point and diffuse pollution sources, water abstraction and existing commercial activities. The risk assessment indicated whether the water body would meet the criteria for 'good status or would be considered 'at risk' of not meeting the standards by 2015. This assessment was presented in a characterisation report submitted to the European Union in March 2005. This assessment provided the baseline information to prepare the River Basin Management Plan and Programme of Measures necessary to comply with the WFD standards.

10.2.2.2 County Development Plans

The proposed Maighne Wind Farm is located primarily in County Kildare, with a small portion being within County Meath (2 no. turbines in the Ballynakill Cluster).. A review of the Kildare County Development Plan 2011-2017 and of the Meath County Development Plan 2013 – 2019 was carried out to determine their specific objectives in relation to water quality.

Kildare County Development Plan 2011 -2017

The Kildare County Development Plan 2011-2017 lays down specific objectives in relation to water quality as follows:

WQ 1 To co-operate with the EPA and other authorities, in the continued implementation of the EU Water Framework Directive and assist and co-operate with the lead authorities for the Eastern River Basin District and the South Eastern River Basin District

WQ 2 To ensure, through the implementation of the River Basin Management Plans and their associated Programmes of Measures and any other associated legislation, the protection and improvement of all drinking water, surface water and ground waters throughout the county

WQ 3 To work, in co-operation with relevant organisations and major stakeholders, to ensure a co-ordinated approach to the protection and improvement of the county's water resources

WQ 4 To continue efforts to improve water quality under the Local Government (Water Pollution) Act 1977, (as amended) and by implementing the measures outlined under the Nitrates Directive (91/676/EEC) and complying with the requirements of the Surface Water Legislation Environmental Objectives (Surface Waters) Regulations 2009 and other relevant Regulations

WQ 5 To promote public awareness of water quality issues and the measures required to protect both surface water and groundwater bodies.

The water and drainage objectives of Kildare County Council, specifically relating to water quality and surface water run-off are:

WD 4 To improve water quality in the county in accordance with current European and National legislation

WD 5 To continually monitor and review the water quality standards of Kildare County Council in light of European Communities (Drinking Water) Regulations 2007 (SI 278 of 2007), as may be amended and to ensure continuing compliance

SW 6: To ensure that all developments have regard to the surface water management policies in the Greater Dublin Strategic Drainage Study (GDSDS)

SW 12: To seek to ensure that development will not interfere with or interrupt existing surface water drainage systems

SW 20: To ensure development proposals in rural areas (excluding one-off rural housing) demonstrate compliance with the following:

- the ability of a site in an unserviced area to accommodate an on-site waste water disposal system in accordance with the County Kildare Groundwater Protection Scheme, and any other relevant documents / legislation as may be introduced during the Plan period
- the ability of a site in an unserviced area to accommodate an appropriate on-site surface water management system in accordance with the policies of the Greater Dublin Strategic Drainage Study (2005), in particular those of Sustainable Urban Drainage Systems (SUDS)
- the need to comply with the requirements of The Planning System and Flood Risk Management Guidelines for Planning Authorities published by the Minister for the Environment, Heritage and Local Government in November 2009.

The environmental services policy and objectives are:

PC 1 To preserve and maintain water, air and noise quality in the county in accordance with good practice and relevant legislation

EN 7 To ensure that septic tanks and proprietary wastewater treatment systems comply in full with the requirements of the Environmental Protection Agency Code of Practice 2009, Department of Environment, Heritage and Local Government Circular January 2010, and any subsequent revisions thereof during the period of this Plan

EN 8 To require new developments to connect to the public foul sewer where feasible for both trade and domestic effluent and to discourage discharge of treated effluent to groundwater, particularly in areas of high groundwater vulnerability.

Meath County Development Plan 2013 -2019

The Meath County Development Plan 2013-2019 lays down specific policies in relation to water quality as follows:

WS POL 2 To protect and develop, in a sustainable manner, the existing groundwater sources and aquifers in the county and to control development in a manner consistent with the proper management of these resources

WS POL 17 To ensure that all new developments have access to or are provided with satisfactory drainage systems in the interests of public health and to avoid the pollution of ground and surface waters

WS POL 19 To protect groundwater resources having regard to the County Meath Groundwater Protection Plan

WS POL 20 To ensure through the implementation of the River Basin Management Plans and their associated programmes of measures, and any other associated legislation, the protection and improvement of all drinking water, surface water and ground waters throughout the county

WS POL 21 To work, in co-operation with relevant organisations and major stakeholders to ensure a co-ordinated approach to the protection and improvement of the county's water resources

WS POL 22 To continue efforts to improve water quality under the Local Government (Water Pollution) Act 1977, as amended and by implementing the measures outlined under the Nitrates Directive (91/676/EEC) and complying with the requirements of the Surface Water Legislation Environment Objectives (Surface Waters) Regulations 2009 and other relevant regulations

WS POL 23 To promote public awareness of water quality issues and the measures required to protect both surface water and ground water bodies

WS POL 24 To manage groundwater resources particularly having regard to the abstraction and recharge rates of ground-waterbodies

WS POL 25 To protect, maintain and improve the natural character of the watercourses and rivers in the county Meath

WS POL 26 To seek the continued improvement of water quality, bathing facilities and other recreational opportunities in the coastal, estuarine and surface waters in the County

WS POL 27 To ensure that proposed septic tanks and proprietary treatment systems, or other waste water treatment and storage systems, and associated percolation areas where required as part of a development, comply with the recommendations of the Environmental Protection Agency and that they are employed only where site conditions are appropriate

NH POL 21 To protect the recreational, educational and amenity potential of navigational and non-navigational waterways within the County, towpaths and adjacent wetlands.

The Meath County Development Plan 2013-2019 lays down specific objectives in relation to surface water run-off as follows:

WS SOBJ 9 To promote compliance with environmental standards and objectives established for bodies of surface water, by the European Communities (Surface Waters) Regulations 2009

WS OBJ 10 To develop groundwater protection schemes in line with the recommendations contained within the DoEHLG/GSI/EPA publication 'Groundwater Protection Schemes, 1999' or any revised or replacement publication

WS OBJ 16 To incorporate and promote the use of Sustainable Urban Drainage Systems within County Council Developments and other infrastructural projects as required in the Greater Dublin Regional Code of Practice for Drainage Works

WS OBJ 17 To require the use of Sustainable Urban Drainage Systems in accordance with the Greater Dublin Regional Code of Practice for Drainage Works for new developments (including extensions)

WS OBJ 18 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.

10.2.2.3 Consultation Responses

This chapter considers the responses, with particular regard to concerns relating to water quality, which were received following consultations with the prescribed bodies and other interested parties, as summarised in Chapter 4 of Volume 2 of the EIS.

The comments expressed in particular by Kildare County Council (KCC), the Health Service Executive (HSE), the Department of Agriculture, Fisheries and Food, and Inland Fisheries Ireland (IFI) in written consultations received from them as part of the EIA process were considered in the preparation of this chapter.

10.2.2.4 Other Sources

Reference is also made to Chapter 7 Ecology and Chapter 9 Hydrology of this EIS in the preparation of this chapter.

10.2.3 Desk Study

The desk top study involved an examination of the water quality aspects of the following sources of information:

- Study of existing surface water/drainage features in the vicinity
- Review of the Water Framework Directive online mapping and data (http://watermaps.wfdireland.ie/NsShare_Web/Viewer.aspx?Site=NsShare&ReloadKey=True).
- Review of the EPA online mapping (http://gis.epa.ie/Envision)
- Current and historic Ordnance Survey Ireland mapping
- River chemistry and quality monitoring results from the EPA, KCC and MCC
- Groundwater quality monitoring results for Meath and Kildare from the EPA
- Study of the proposed layout of the development
- Liaison with geotechnical specialists for details on soil conditions on the site
- Review of designated areas within 15km of the site
- Study of planning documents for adjacent developments
- Review of consultation with statutory and interested bodies and relevant Local Authorities
- Study of development plans.

10.2.4 Field Assessment

Site walkover surveys took place from May to July 2013 (31 May, 10 & 18 June, 2, 8 & 18 July) and again on 11 and 12 November 2014 to establish the pattern of existing drainage on the site and to record any significant hydrological features. During the site visit the GPS coordinates, descriptions, and photographs of the hydrological features were recorded. Streams to be crossed by the proposed wind farm were identified and the river crossing structures downstream of the site were recorded where relevant.

Water samples were taken from various locations around the site during stormflow and baseflow conditions to determine the baseline water quality conditions. A number of parameters were measured and the samples were analysed in Emerald Environmental Services accredited laboratory now called 'The Water Lab'.

The monitoring results were compared to the relevant Environmental Water Quality Standards set out in the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).

10.3 Existing Environment

This section gives an overview of the existing water quality environment with to surface water and groundwater bodies.

10.3.1 Surface Water

The proposed wind farm, including the turbine delivery route (TDR) and MV and HV cable routes lie within the Eastern River Basin District (ERBD) and the South Eastern River Basin District (SERBD).

The wind farm clusters drain into the following 11 surface water body catchments, as defined by the Water Framework Directive (WFD), and as shown in Figure 10.1. The information in this figure is available to view in more detail in the sub maps, which are included in Volume 2a (Figure 10.1.1-10.1.5).

Ballynakill
- EA_Boyne159BlackwaterLongwood_Blackwater1_Lower
- EA_Boyne159Main_BoyneTRIB_Glash1_Lower
- EA_Boyne159Main_Boyne2

Windmill
- EA_Boyne159Main_BoyneTRIB_Glash3_Upper Drehid-Hortland
- EA_Boyne159BlackwaterLongwood_Blackwater2_Upper
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Deryvarroge
- SE_BarrowFigile_Cushaling
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish

Drehid-Hortland
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish
- EA_Boyne159BlackwaterLongwood_Blackwater2_Upper
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Deryvarroge
- SE_BarrowFigile_Cushaling

Derrybrennan
- SE_BarrowFigile_Figile_Upper
- SE_BarrowFigile_Cushaling
- SE_BarrowSlate_Slate

Cloncumber
- SE_BarrowSlate_Cloncumber
- SE_BarrowSlate_Slate

The TDR will cross a number of the above waterbody catchments in addition to the following waterbodies:

- EA_Liffey168Rye_RyeWater3_Upper
- EA_Boyne159Main_Boyne4_Upper

The MV cable route will cross a number of the above waterbody catchments in addition to the following waterbodies:

- EA_Boyne159Main_BoyneTRIB_Glash2_Mid
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Aleckafin
- EA_Boyne159Main_Boyne4_Upper

The TDR and the MV cable route will be located along the route of existing roads within the additional catchments noted above and will cross a number of streams along the route with the exact location of these crossings outlined in further detail in Chapter 9 - Hydrology.

There are two potential HV cable routes, to connect Maighne Wind Farm to one of two proposed substation locations in either Woodland, Co. Meath or Maynooth, Co. Kildare. The two routes are included in this assessment of the impacts on water quality while only one route will be constructed.

The proposed HV cable route from the proposed substation at Drehid to the existing substation at Woodland will cross 12 no. waterbody catchments. These are:

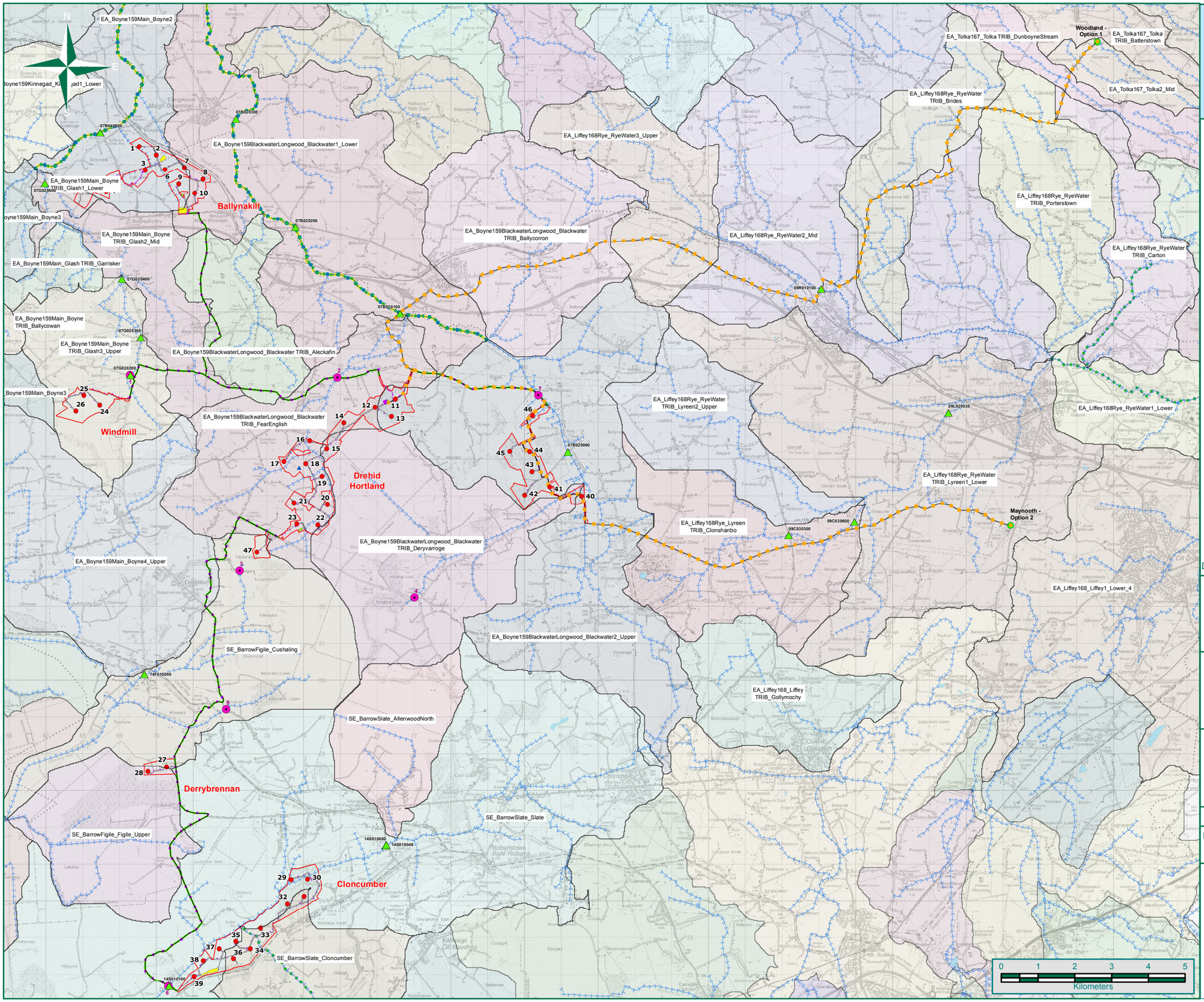
- EA_Boyne159BlackwaterLongwood_Blackwater2_Upper
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish
- EA_Boyne159BlackwaterLongwood_Blackwater1_Lower
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Ballycorron
- EA_Liffey168Rye_RyeWater3_Upper
- EA_Liffey168Rye_RyeWater2_Mid
- EA_Liffey168Rye_RyeWateTRIB_Brides
- EA_Liffey168Rye_RyeWateTRIB_Porterstown
- EA_Liffey168Rye_RyeWateTRIB_Carton
- EA_Tolka167_TolkaTRIB_DunboyneStream
- EA_Tolka167_Tolka2_Mid
- EA_Tolka167_TolkaTRIB_Batterstown

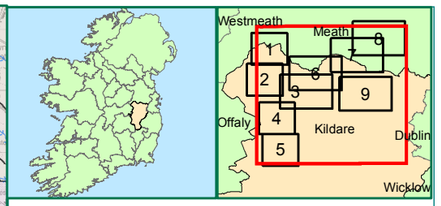
The proposed HV cable route from the proposed substation at Drehid to the substation at Maynooth will cross 4 no. waterbody catchments. This cable route traverses the:

- EA_Boyne159BlackwaterLongwood_Blackwater2_Upper (IE_EA_07_981)
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish
- EA_Liffey168Rye_LyreenTRIB_Clonshanbo
- EA_Liffey168Rye_RyewaterTRIB_Lyreen1_Lower

The two proposed HV routes and their respective waterbody catchments are shown in Figure 10.1. The information in this figure is available to view in more detail in the sub maps, which are included in Volume 2a of this EIS (10.1.6 – 10.1.9).

R:\Map Production\2014\LE14\731\04\Workspace\EIS MAPS\Chapter 10 Water Quality\LE1473104_Fig 10.1 Water Quality Monitoring Locations Map.mxd





Legend

- Turbine Locations
- Wind Farm Cluster Boundary
- Proposed Borrow Pit Location
- Proposed Compound Location
- Proposed Substation Location
- Proposed Met Mast Location
- Indicative Access Tracks
- MV Cable Routes
- Cable Routes (Internal to Windfarm Cluster)
- HV Cable Route
- Irish Grid Connection Points

WFD Register of Protected Areas (RPA)

- Drinking Water Rivers
- Salmonid Rivers
- SAC
- SPA
- WFD River Sub-basin
- Water Sampling Locations
- EPA Monitoring Stations

Date 26/03/2015

Name Of Client

Element Power Ireland

Name Of Job

Maighne Wind Farm

Title Of Figure

Water Quality Monitoring Locations Map
Maighne Overview

Scale Used 1:100,000 @ A3

Figure No. 10.1.

Rev B

FEHILY TIMONEY & COMPANY
CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
Core House, Pouladuff Rd, Cork, Ireland.
T:+353-21-4964133, F:+353-21-4464
Unit 16 J5 Plaza, North Park Business Park, Dublin 11, Ireland.
T:+353-1-6583500, F:+353-1-6583501
W:www.fehilytimoney.ie, E: info@ftco.ie

10.3.2.1 Description of the Surface Water Environment

The surface water environment is described for the proposed development hereunder.

Surface Water at Ballynakill Cluster

The proposed Ballynakill cluster, including the TDR and MV cable route lies within the Eastern River Basin District (ERBD) and in Hydrometric Area HA 07 - Boyne of the Irish River Network. This cluster drains into the following three surface water body catchments, as defined by the WFD.

- EA_Boyne159BlackwaterLongwood_Blackwater1_Lower (IE_EA_07_954)
- EA_Boyne159Main_BoyneTRIB_Glash1_Lower (IE_EA_07_863)
- EA_Boyne159Main_Boyne2 (IE_EA_07_1517)

In addition to the above waterbodies, the MV cable route will cross the following waterbodies near to the cluster at Ballynakill:

- EA_Boyne159Main_BoyneTRIB_Glash2_Mid
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Aleckafin

The waterbodies associated with the turbine locations, TDR and MV cable route are described in more detail in Chapter 9 Hydrology of Volume 2 of the EIS.

The area proposed for the Ballynakill cluster predominantly drains into the main river channel of the River Boyne via a short tributary, the Ballynadrummy Stream. It also drains into a tributary of the River Boyne, the Glash River.

The Royal Canal runs along the eastern boundary of the site. It is a pNHA. There are no hydrological links between the proposed development area and the Royal Canal.

The River Blackwater runs from south to north approximately 700m from the eastern boundary of the site. It is a tributary of the River Boyne. Surface water run-off from the site does not however drain into the main channel of the River Blackwater due to the canal and artificial drainage patterns. It is instead drained overland towards the neighbouring *Boyne159Main_Boyne2* catchment.

The River Boyne runs in a north easterly direction approximately 600m north east of the site boundary towards Longwood. The Glash River flows north towards the site and joins the main channel of the River Boyne at Leinster Bridge 1.3km to the west of the cluster boundary.

The River Boyne and River Blackwater candidate cSAC (site code: 002299) and SPA (site code: 0004232) is approximately 660m by hydrological links from the nearest point of the proposed boundary. The River Boyne and the River Blackwater are salmonid.

There are no other surface waterbodies listed on the WFD Register of Protected Areas within 10km downstream of the Ballynakill Cluster.

The area along the MV cable route from Cadamstown north to the Ballynakill cluster drains primarily to the Aleckafin River which is a tributary of the River Blackwater. It flows in a northerly direction parallel to the proposed cable route, and joins the River Blackwater upstream of the proposed cluster. A small length of the proposed cable route lies in the catchment of the Clonuff Stream, a tributary of the Glash River. It joins the River Glash upstream of the proposed Ballynakill cluster. The MV cable route also lies in the catchment of the River Blackwater, to which some of the cluster turbines will also drain.

The hydrological features of the site are described in more detail in Chapter 9 Hydrology of this EIS.

Surface Water at Windmill Cluster

The Windmill cluster is located in the ERBD. The proposed area for the cluster, drains into one surface water body catchment, as defined by the Water Framework Directive (WFD):

- EA_Boyne159Main_BoyneTRIB_Glash3_Upper (IE_EA_07_1483)

There are 3 no. turbines in the Windmill cluster. The area proposed for the Windmill cluster drains into a tributary of the Glash River, itself a tributary of the River Boyne. The Glash River rises to the east of the cluster at Mylerstown and continues in a northerly direction to join the main river channel of the River Boyne at Leinster Bridge approximately 7.5km from the site.

The River Boyne and River Blackwater cSAC (site code: 002299) and SPA (site code: 0004232) is approximately 660m by hydrological links from the nearest point of the proposed boundary. The River Boyne and the River Blackwater are salmonid.

There are no other surface waterbodies listed on the WFD Register of Protected Areas within 10km downstream of the site.

The area proposed for the MV cable route connecting the Windmill cluster (with Ballynakill to the north and with the proposed substation at Drehid) lies in 5 catchments including that of the cluster. The additional catchments include:

- EA_Boyne159Main_BoyneTRIB_Glash2_Mid
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Aleckafin
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish
- EA_Boyne159Main_Boyne4_Upper

As discussed above (Ballynakill cluster), the cable route drains to the catchments of the Aleckafin River and to the Calfstown and Clonuff Streams, tributaries of the Glash River. Both of these rivers flow north.

Upstream of the Windmill cluster, the cable route lies in the catchment of the River Boyne, flowing south and tributaries of the Fear English River which flows north into the River Blackwater. The Fear English River is also in the catchment of the Drehid-Hortland cluster.

The hydrological features of this cluster are described in more detail in Chapter 9 Hydrology.

Surface Water at Drehid-Hortland Cluster

The proposed Drehid-Hortland Cluster is located in the ERBD. The cluster and the proposed MV cable route drain into four surface water body catchments, as defined by the WFD:

- EA_Boyne159BlackwaterLongwood_Blackwater2_Upper (IE_EA_07_981)
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Deryvarroge (IE_EA_07_1720)
- EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish (IE_EA_07_317)
- SE_BarrowFigile_Cushaling (IE_SE_14_987)

There are 21 no. turbines, a substation, a met mast and a temporary site compound in the Drehid-Hortland cluster. The area predominantly drains to the north to the Fear English River and the River Blackwater, both tributaries of the River Boyne.

The eastern area of the proposed site drains north into the River Blackwater and into the Mulgeeth Stream, a tributary of the River Blackwater. This tributary meets the River Blackwater to the south east of the Cluster at Newtownhortland.

The western area of the proposed site drains north into the Kilcooney River and the Fear English River. A small proportion of the south western area of the site drains south into the Cushaling River. The central area of the site drains to the River Blackwater via the Mulgeeth Stream.

The Kilcooney River generally drains the western extent of the site and flows in a north easterly direction along parts of the western site boundary. It joins the Fear English River south of Ballynamullagh within the site boundary. The Fear English River flows in a north easterly direction through the site.

Upon exiting the site at Ballynamullagh, it flows north east for 3km to Johnstown Bridge, where it meets the River Blackwater.

The Mulgeeth tributary of the River Blackwater draining the central extent of the site, and one proposed turbine T15, rises in the west of the site in bogland and flows south for approximately 3km, where it turns to the east before joining the Clogheraun Stream that runs into the main channel of the River Blackwater at Newtownhortland. A section of the north eastern tip of the site drains directly into the Blackwater.

The Cushaling River rises in Parsonstown at the south western corner of the cluster and flows south for approximately 2km and then southwest for approximately 11km where it meets the Figile River.

The River Boyne and River Blackwater cSAC (site code: 002299) and SPA (site code: 0004232) is approximately 2km by hydrological links from the nearest point of the proposed boundary. The River Boyne and the River Blackwater are salmonid.

It was noted in the aquatic ecological assessment, that the Figile River is a designated salmon spawning watercourse.

There are no other surface waterbodies listed on the WFD Register of Protected Areas within 10km downstream of the site.

The hydrological features of this cluster are described in more detail in Chapter 9 Hydrology of this EIS.

Surface Water at Derrybrennan Cluster

The Derrybrennan Cluster is located in the South Eastern River Basin District (SERBD). The wind farm drains into three surface water body catchments, as defined by the WFD:

- SE_BarrowFigile_Figile_Upper (IE_SE_14_23)
- SE_BarrowFigile_Cushaling (IE_SE_14_987)
- SE_BarrowSlate_Slate (IE_SE_14_999)

There are 2 no. turbines in the cluster. The area proposed for the Derrybrennan Cluster drains to three catchments. It drains south to the Lugherra River which flows in a north westerly direction where it joins the Figile at Cushaling Bridge. From Cushaling Bridge the Figile continues northwest to Kilcumber then turns south, passing through the town of Clonbulloge and on towards Monasterevin from where it continues as the Black River before entering the River Barrow.

Turbine T27 and a section of the access track located to the north of the site in Derrybrennan townland drain east to the Cushaling River, which joins the Lugherra 1km upstream of Cushaling Bridge. Turbine T28 and a short section of access track are also located in the Slate catchment, draining southwest to the River Slate, a tributary of the Barrow. The Slate then continues on a south westerly course through Rathangan before flowing into the Figile at Pollaghnagraigue.

The Grand Canal is located north of the cluster, 1.6km from the nearest turbine. The Grand Canal is a pNHA (site code 002104). There are no hydrological links to the Grand Canal from the area proposed for the Derrybrennan Cluster. There are no other surface waterbodies listed on the WFD Register of Protected Areas within 10km downstream of the site.

It was noted in the aquatic ecological assessment, that the Figile River is a designated salmon spawning watercourse.

The proposed cable route connecting the Cloncumber cluster to the south with the Derrybrennan cluster, and connecting the Drehid-Hortland and Windmill clusters to the North and North East, is situated in 3 of the same catchments as the cluster, and also in a fourth catchment (EA_Boyne159Main_Boyne4_Upper), draining to the River Boyne to the East.

The hydrological features of this cluster are described in more detail in Chapter 9 Hydrology of Volume 2 of the EIS.

Surface Water at Cloncumber Cluster

The proposed Cloncumber Cluster is located in the SERBD. It drains into two surface water body catchments, as defined by the WFD:

- SE_BarrowSlate_Cloncumber (IE_SE_14_1870)
- SE_BarrowSlate_Slate (IE_SE_14_999)

There are 11 no. turbines and 2 no. borrow pits in the cluster. The area proposed for the Cloncumber cluster drains into the Cloncumber Stream (a tributary of the Slate River) and the main channel of the Slate River. The Cloncumber Stream runs in a north westerly direction before joining the main channel of the Slate River. The Slate River runs south west through the proposed site and continues in a south westerly direction joining the Figile River which is a tributary of the River Barrow.

A feeder line of the Grand Canal from Athy and the River Barrow called the Grand Canal (Barrow Line) is located to the east of the proposed cluster. There is no hydrological connection between the Grand Canal (Barrow Line) and the Cloncumber cluster.

The Cloncumber Stream is listed as an SAC on the WFD Register of Protected Areas (7). It rises in Pollardsown Fen which is a cSAC (site code000396) and which is located 6.7km from the proposed development.

It was noted in the aquatic ecological assessment, that the Figile River is a designated salmon spawning watercourse.

The Grand Canal is a pNHA (site code 002104).

There are no other surface waterbodies listed on the WFD Register of Protected Areas within 10 km downstream of the site.

The proposed MV cable route connecting the cluster at Cloncumber to the cluster at Derrybrennan to the north east lies in the same two catchments as discussed above and also lies in the SE_BarrowFigile_Figile_Upper. A short length of the proposed cable route will drain to Lullymore East Stream, a tributary of the River Figile. The cluster at Derrybrennan also drains to this stream.

The hydrological features of this cluster are described in more detail in Chapter 9 Hydrology of this EIS.

Surface Water Crossings on TDR and MV Cable Route

The TDR as shown on Figure 2.9 of Volume 2a of the EIS, was examined along with the Delivery Route Selection and Assessment Report, which is included in Appendix K of Volume 3 EIS Appendices. A number of stream crossings are included in the route and these are discussed in detail in Chapter 9 - Hydrology of Volume 2 of the EIS.

The descriptions of the waterbody catchments draining the MV cable route were included in the cluster descriptions above. The MV cable route will cross watercourses at 19 no. locations and these are detailed in Chapter 9 – Hydrology of Volume 2 of the EIS.

Surface Water along the HV Cable Routes

Descriptions of the waterbody catchments along the HV route options, are provided below.

Surface water along the HV Cable Route from Drehid to Woodland

This proposed HV cable route option crosses 12 no. waterbody catchments which drain to three river systems, namely the River Blackwater, the River Rye Water and the River Tolka.

There are 20 no. proposed watercourse crossings on this route, which are listed in Chapter 9 - Hydrology of Volume 2 of the EIS. The crossing points of major rivers are described here.

The proposed HV cable route will cross the River Boyne and River Blackwater candidate cSAC (site code: 002299) and SPA (site code: 0004232) at Johnstown Bridge on the River Blackwater, just South of Enfield. The River Boyne and the River Blackwater are salmonid. As listed above the proposed HV cable route will cross tributaries of the River Blackwater at six other locations.

The River Rye Water is a tributary of the River Liffey, joining it in Leixlip Demesne. The Rye Water Valley/Carton cSAC and pNHA (site code: 001398) starts just north of Maynooth town.

The proposed HV cable route will cross the River Rye Water at Balfeaghan Bridge, north of Kilcock. It will cross the following tributaries of the River Rye Water; Paddinstown Stream, Brides Stream, Jenkinstown Stream and Blackhall Little. Chapter 9 - Hydrology of Volume 2 of the EIS contains more detailed information on the proposed crossings.

The proposed HV cable route will cross Dunboyne Stream and Lustown Stream which are tributaries of the River Tolka. The River Tolka is salmonid and it flows into the environmentally designated South Dublin Bay and River Tolka Estuary SPA (code: 004024). The River Tolka rises in Culmullin Co. Meath in the same waterbody catchment as the existing substation at Woodland and flows 33km to the Tolka Estuary. The Dunboyne Stream, also referred to as Castle Stream, joins the River Tolka after Dunboyne.

The Royal Canal runs parallel and within 1km of the proposed HV cable route from the proposed substation at Drehid to the existing substation at Woodland, from Enfield to Kilkock. The proposed HV cable route will cross the Royal Canal at Allen Bridge in Kilcock.

Surface Water along the HV cable route from Drehid to Maynooth

The proposed HV cable route option from Drehid to Maynooth crosses four waterbody catchments, the two most westerly of which drain to the River Blackwater. The other two waterbody catchments all drain to the Lyreen River which is a tributary of the River Rye Water which is itself a tributary of the River Liffey. The waterbody catchments drain to the Clonshanbo River and Lyreen River Lower. There are 20 no. proposed watercourse crossings on this route which are listed in Chapter 9 – Hydrology of Volume 2 of the EIS.

The Clonshanbo River is a tributary of the Baltracey River, itself a tributary of the Lyreen River. The source of the Clonshanbo River system is at Donadea Forest Park, flowing eastwards towards Baltracey townland and onward where it joins the Lyreen River after Frayne's Bridge (Derrinstown Stud).

The Lyreen River has its source at Rathcoffey and flows north towards Maynooth, after which it joins the River Rye Water near Kildare Bridge.

There are 5 no. proposed crossing points of tributaries of the River Blackwater. The River Boyne and River Blackwater candidate cSAC (site code: 002299) and SPA (site code: 0004232) begins approximately 2.7 km upstream of a proposed crossing point at New Bridge.

The Lyreen River is a tributary of the River Rye Water which supports a significant portion of Brown trout and provides spawning habitat for a population of Atlantic salmon (listed under Annex II and V of the EU Habitats Directive). There are nine proposed crossing points on tributaries of the Lyreen River and two proposed crossing points on the Lyreen River Upper.

10.3.2.2 WFD Status and Risk Assessment

As discussed in Section 10.2.2 a risk assessment was carried out in 2005 on each waterbody catchment, as defined under the WFD. Some of the assessments were updated in 2008. The results of the assessments are available on the WFD website (watermaps.wfdireland.ie) and are included in more detail in Chapter 9, Hydrology. The results of the assessments carried out on the waterbodies draining the development are summarised below for each of the proposed cluster areas and associated MV cable route, and for the two HV cable route options. Fourteen waterbodies drain the proposed area of the Maighne Wind Farm and associated MV cable route. The status of these catchments ranges from 'Poor' to 'Good.'

The WFD website defines 'Status' as the condition of the water in the waterbody. It is defined by its chemical status and its ecological status, whichever is worse. Waters are ranked in one of five status classes: High, Good, Moderate, Poor, and Bad. However, not all waterbodies have been monitored, and in such cases the status of a similar nearby waterbody has been used (extrapolated) to assign status.

Table 10.2: WFD Status of Waterbody Catchments Draining the Wind Farm and MV Cable Route

Waterbody Catchments draining the:	River / Stream	Status	Objective
Ballynakill Cluster			
EA_Boyne159BlackwaterLongwood_Blackwater1_Lower (reference IE_EA_07_954)	River Blackwater	Moderate	Restore 2021
EA_Boyne159Main_BoyneTRIB_Glash1_Lower (reference IE_ EA_07_863)	River Glash	Poor	Restore 2021
EA_Boyne159Main_Boyne2 (reference IE_ EA_07_1517)	River Boyne	Moderate	Restore 2021
MV cable route EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Aleckafin (reference IE_EA_07_985)	Aleckafin River	Moderate	Restore 2021
EA_Boyne159Main_BoyneTRIB_Glash2_Mid (reference IE_ EA_07_599)	River Glash	Poor	Restore 2027
Windmill Cluster			
EA_Boyne159Main_BoyneTRIB_Glash3_Upper	River Glash	Poor	Restore 2021
MV cable route EA_Boyne159Main_Boyne4_Upper	River Boyne	Moderate	Restore 2015
EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Aleckafin EA_Boyne159Main_BoyneTRIB_Glash2_Mid EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish	Refer above		
Drehid-Hortland Cluster			
SE_BarrowFigile_Cushaling	Cushaling River	Bad	Restore 2021
EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish	Fear English River	Good	Protect
EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Deryvarroge	Derryvarrogue Stream and Mulgeeth Stream	Good	Protect
EA_Boyne159BlackwaterLongwood_Blackwater2_Upper	River Blackwater	Good	Protect
Derrybrennan Cluster			
SE_BarrowFigile_Cushaling	Refer above		
SE_BarrowSlate_Slate	Killinagh Upper Stream	Poor	Restore 2021
SE_BarrowFigile_Figile_Upper	Lullymore East Stream	Poor	Restore 2021
MV cable route EA_Boyne159Main_Boyne4_Upper	Refer above		
Cloncumber Cluster			
SE_BarrowSlate_Cloncumber	Cloncumber Stream	Poor	Restore 2021

Waterbody Catchments draining the:	River / Stream	Status	Objective
SE_BarrowSlate_Slate	Refer above		
MV cable route SE_BarrowFigile_Figile_Upper	Refer above		

HV cable route

A descriptive detail of each of the waterbody catchments along the proposed HV cable route options is included in Chapter 9 – Hydrology of Volume 2 of the EIS, while the status of each of the waterbody catchments is tabulated below. The proposed HV cable route option from Drehid to Woodland (Option 1) crosses 12 waterbody catchments. Monitoring of the catchments is carried out in accordance with the WFD. There are 4 waterbody catchments draining to the Blackwater River and their status ranges from 'Moderate' to 'Good.' There are 5 waterbody catchments draining to the River Rye Water and their status ranges from 'Bad' to 'Poor.' There are 3 waterbody catchments draining to the River Tolka and their status ranges from 'Poor' to 'Moderate.'

The proposed HV cable route from Drehid to Maynooth (Option 2) crosses 4 waterbody catchments. Monitoring of the catchments is carried out in accordance with the WFD. There are 2 waterbody catchments draining to the Blackwater River and their status is 'Good.' There are 2 waterbody catchments draining to the River Rye Water and the Clonshanbo River, and their status is 'Bad' to 'Poor.'

Table 10.3: WFD Status of Waterbody Catchments Draining the HV Cable Route Options

Waterbody Catchments Drehid to Woodland	River / Stream	Status	Objective
EA_Boyne159BlackwaterLongwood_Blackwater2_Upper*	Blackwater River	Good	Protect
EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish*	Fear English River	Good	Protect
EA_Boyne159BlackwaterLongwood_Blackwater1_Lower*	Blackwater River	Moderate	Restore 2021
EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_Ballycorron	Ballycorron River	Good	Protect
EA_Liffey168Rye_RyeWater3_Upper	River Rye Water	Bad	Restore 2027
EA_Liffey168Rye_RyeWater2_Mid	River Rye Water	Poor	Restore 2027
EA_Liffey168Rye_RyeWateTRIB_Brides	Brides Stream	Poor	Restore 2021
EA_Liffey168Rye_RyeWaterTRIB_Porterstown	Pagestown, Kilcone and Blackwood Little tributaries	Bad	Restore 2027
EA_Liffey168Rye_RyeWateTRIB_Carton	Stafffordstown Stream	Bad	Restore 2027
EA_Tolka167_TolkaTRIB_DunboyneStream	Dunboyne Stream	Moderate	Restore 2027
EA_Tolka167_Tolka2_Mid	Lustown and Cookstown Streams	Moderate	Restore 2027
EA_Tolka167_TolkaTRIB_Batterstown	Moyleggan Stream	Poor	Restore 2027
Waterbody Catchments Drehid to Maynooth	**River / Stream**	**Status**	**Objective**
EA_Boyne159BlackwaterLongwood_Blackwater2_Upper	As above		
EA_Boyne159BlackwaterLongwood_BlackwaterTRIB_FearEnglish	As above		
EA_Liffey168Rye_LyreenTRIB_Clonshanbo	Clonshanbo River	Bad	Restore 2021

Waterbody Catchments Drehid to Woodland	River / Stream	Status	Objective
EA_Liffey168Rye_RyewaterTRIB_Lyreen1_Lower	Lyreen River Lower and tributaries	Bad	Restore 2021

*This waterbody catchment also drains an area of the wind farm.

10.3.2.3 Water Framework Directive Monitoring Data

A water quality monitoring programme was established by the EPA under the WFD to determine the status of the waterbodies, as discussed above. Chemical and biological/ecological quality of surface waters is monitored at numerous locations throughout the country. The monitoring stations in the vicinity of the site are shown on Figure 10.1. The information in this figure is available to view in more detail in the sub maps, which are included in Volume 2a of the EIS. The results of the monitoring at these locations are discussed below.

Biological Water Quality

The EPA scheme of Biotic Indices or Quality (Q) Values was developed to determine the status of organic pollution in Irish rivers by assessing the occurrence of macroinvertebrate taxa of varying sensitivity to pollution. The relationship between Q Values and WFD status is included in Table 10.1. The Q values for the waterbodies draining the proposed development range from 2 to 4 for the period 2006-2012, however the more recent Q values range from 3 to 4:

- a Q value of 3 or 2-3 represents 'Poor' water quality status under the WFD. It also indicates that the waterbody is "moderately polluted" and in an "unsatisfactory condition[1]"
- a Q value rating of 3-4 represents 'Moderate' water quality status under the WFD. It also indicates that the waterbody is "slightly polluted" and in an "unsatisfactory condition"
- a Q value rating of 4 represents 'Good' water quality status under the WFD. It also indicates that the waterbody is "unpolluted" and in a "satisfactory condition[2]"

The Q values measured at these monitoring stations in the vicinity of the site are outlined in Table 10.4. Nineteen monitoring locations were identified. Biological monitoring was not carried out at any of the monitoring stations in 2013. The locations of theses monitoring locations with respect to the proposed development are shown in Figure 10.1. Note that the distances are measured along the watercourses to the nearest proposed turbine in the case of each cluster or to the cable route.

Table 10.4: EPA Measured Q Values in Proposed Area of Maighne Wind Farm

Ballynakill Cluster						
Station No.	Station Name	Waterbody	Distance from development* (km)	2006	2009	2012
07B020300	Br ESE of Longwood	Blackwater	n/a	-	-	3-4
07B020200	Blackwater Br	Blackwater	n/a	4	3	-
07B040600	Ashfield Br	Boyne River	1.2 d/s	-	3-4	3-4

[1] "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses. EPA website.
[2] "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses. EPA website.

Ballynakill Cluster						
Station No.	Station Name	Waterbody	Distance from development* (km)	2006	2009	2012
07G020600	Br u/s Boyne R. confluence	River Glash	1 d/s	3	3	3

* Distance is measured u/s – upstream or d/s – downstream by hydrological links to nearest turbine
Note: There are no hydrological links between the Ballynakill cluster and the River Blackwater east of the Ballynakill cluster as the canal creates an artificial drainage pattern in the area. The monitoring location at Bridge ESE of Longwood is located 1.8 km downstream and the location at Blackwater Bridge is 2.9 km upstream as the crow flies.

Enriched conditions were evident with enhanced macrophyte growth noted downstream of Johnstown at Longwood (07B02-0300).

Windmill Cluster						
Station No.	Station Name	Waterbody	Distance from development* (km)	2006	2009	2012
07G020200	Br NW of Calfstown	Glash River	0	-	-	3
07G020300	Br at Tanderagee crossroads	Glash River	2 d/s	-	-	3
07G020400	Clonuff Br	Glash River	3.2 d/s	-	-	3

* u/s – upstream, d/s – downstream
Note: The monitoring point at the Bridge NW of Calfstown is located 0.75 km downstream of the cluster boundary, and it is located on the proposed MV cable route, hence 0 km from the development.

The EPA's assessment noted that "*the dominance of pollution tolerant macroinvertebrate taxa, complete lack of pollution sensitive taxa and excessive instream siltation continues to indicate unsatisfactory poor ecological conditions at all stations surveyed on the Glash River in 2012*."

Drehid-Hortland Cluster						
Station No.	Station Name	Waterbody	Distance from development* (km)	2006	2009	2012
07B020100	Br at Johnstown	River Blackwater	2.2 d/s	4	3-4	3-4
07B020060	Br S of Hortland	River Blackwater	1.1 d/s	4	4	3

* u/s – upstream, d/s – downstream

Derrybrennan Cluster						
Station No.	Station Name	Waterbody	Distance from development* (km)	2006	2009	2011
14F010050	Br. S of Ticknevin Br	Cushaling River trib. of Figile River	2.5 d/s	2-3	-	3
14F010100	Cushaling Br	Figile River	5 d/s	3-4	-	3-4

* u/s – upstream, d/s – downstream

The dominance of pollution tolerant macroinvertebrate species, enhanced in stream plant and algal growth and excessive siltation indicated continued unsatisfactory ecological conditions in the upper reaches (14F01-0050 and 14F01-0100) of the Figile River in May 2011.

Cloncumber Cluster						
Station No.	Station Name	Waterbody	Distance from development* (km)	2006	2009	2011
14S010050	Ford Bridge	Slate River	2.3 u/s	-	3	3
14C170200	Old River Br	Cloncumber Stream	2.6 u/s	-	3-4	3-4
14S010100	Agar Br	Slate River	0.7 d/s	-	-	3-4
14S010150	E Br Rathangan	Slate River	5 d/s	-	-	3-4

* u/s – upstream, d/s – downstream

HV Cable Route Option from Drehid to Woodlands				
Station No.	Station Name	Waterbody	Distance from development* (km)	2010
09R010100	Balfeaghan Br	River Rye Water	0	3-4
09D040500	Rusk Br	Dunboyne Stream	73.5 km u/s	3

* u/s – upstream, d/s – downstream
Note: The monitoring point at Balfeaghan Bridge on the River Rye Water is at the proposed crossing point, hence a distance of 0 km from the proposed development.

HV Cable Route Option from Drehid to Maynooth				
Station No.	Station Name	Waterbody	Distance from development* (km)	2010
09C030300	Baltracey Br	Clonshanbo River	0	3
09C030600	Br u/s Lyreen R confl	Clonshanbo River	<0.5 d/s	3
09L020035	Br NE of Treadstown	Lyreen River Lower	3.3 d/s	3

* u/s – upstream, d/s – downstream
Note: The monitoring point at Baltracey Bridge on the Clonshabo River (tributary of Baltracey River) is at the proposed crossing point, hence a distance of 0 km from the proposed development.

The EPA refer to the Clonshanbo River as the location for two of the above monitoring points. On the mapping, the Clonshanbo River flows into the Baltracey River just upstream of Baltracey Bridge.

Chemical Water Quality

Various parameters are analysed from the water samples taken as part of the WFD monitoring programme. 13 monitoring points were identified in the vicinity of the development. They are listed below.

The tables show the mean values recorded during a monitoring programme (2009-2013) for the following locations. (Note that the distances are measured along the watercourses to the nearest proposed turbine unless noted otherwise).

Ballynakill

1. Blackwater Bridge, on the River Blackwater, located approximately 2.9km downstream of the proposed development[3]
2. Bridge south east of Longwood[4], on the River Blackwater, located approximately 1.8km upstream of the proposed development. The River Blackwater flows in a northerly direction to the East of the proposed Ballynakill Cluster and is separated from the area by the Royal Canal
3. Ashfield Bridge, located on the River Boyne, approximately 1.3km upstream of the proposed development and downstream of the confluence of the River Glash and the River Boyne. The River Boyne flows in a northerly direction west of the proposed Ballynakill Cluster. The River Glash joins the River Blackwater near the western boundary of the proposed area

Windmill

4. Clonuff Bridge, located on the River Glash, is approximately 2.2km downstream of the Windmill Cluster and approximately 4 km upstream of the Ballynakill Cluster. The River Glash flows in a northerly direction to the east of the proposed area for development

Drehid-Hortland

5. Bridge at Johnstown, on the River Blackwater, located approximately 4 km downstream of the Drehid-Hortland Cluster at turbine T12. The Fear English River flows in a north easterly direction adjacent to the western boundary of the proposed area and the River Blackwater flows in a north westerly direction along the eastern boundary of the proposed area.

   The monitoring point is located north of the Drehid-Hortland Cluster, immediately after the confluence of the Fear English River with the River Blackwater

Derrybrennan

6. Bridge south of Ticknevin Bridge, on a tributary (Cushaling River) of the River Figile approximately 3.5km upstream of the Derrybrennan Cluster and approximately 4.5km downstream of the Drehid-Hortland Cluster. The Cushaling River flows in a south westerly direction, west of the proposed Derrybrennan Cluster

Cloncumber

7. Allenwood, located on the River Slate, approximately 2.3km upstream of the Cloncumber Cluster. The River Slate flows adjacent to the western boundary of the Cloncumber Cluster
8. East Bridge in Rathangan, opposite the church, on the River Slate, located approximately 5 km downstream of the Cloncumber Cluster.

9. Old River Bridge, on the Cloncumber Stream which bisects the cluster and joins the River Slate. The monitoring point is approximately 2.6km upstream of Cloncumber Cluster

HV Cable Routes from Proposed Substation at Drehid to Substations at Woodland or Maynooth

10. Balfeaghan Bridge on the River Rye is located just north of the town of Kilcock at the proposed watercourse crossing on the proposed HV cable route to the substation at Woodland
11. Rusk Bridge on the Dunboyne Stream is located in Dunboyne.
12. Bridge Upstream of Lyreen River Confluence, is located on Clonshanbo River at Frayne's Bridge. It is adjacent to the proposed HV cable route to Maynooth
13. Bridge north east of Treadstown, is located on the Lyreen River. It is located approximately 3.3 km downstream by hydrological links of the proposed HV cable route to the substation at Maynooth.

[3] The proposed area for the cluster and MV cable route is not hydraulically connected to the River Blackwater at these locations due to the location of the Royal Canal between the cluster and the river. However these monitoring points are downstream of the Drehid-Hortland cluster and upstream of the confluence with the River Boyne.

The parameters measured at the monitoring stations in the vicinity of the site are outlined in Appendix I with the location of monitoring points illustrated on Figure 10.1. The tables in Appendix I the mean values recorded during the monitoring programme (2009-2013). The monitoring results are compared to the environmental quality standards as set out in the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012) and the European Communities (Quality of Salmonid Waters) Regulations 1988, (S.I. No. 293 of 1988), where applicable. The results indicate that all of the parameters measured are below the thresholds of the environmental quality standards for waters of 'Good' status with the exception of particular results at five locations which are set out below.

The average results for Ammonia (2009-2013) at Clonuff Bridge on the River Glash did not achieve 'Good Status' in accordance with the limits set by the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).

The average results for Ammonia and Ortho-phosphate (2009-2013) at the Bridge South of Ticknevin Bridge did not achieve 'Good Status' in accordance with the limits set by the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).

The average results for Ammonia and Ortho- phosphate at Allenwood on the River Slate did not achieve 'Good Status' in accordance with the limits set by the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012). Monitoring at this location was carried out six times during 2012.

The average results for Ortho- phosphate at Rusk Bridge on the Dunboyne Stream did not achieve 'Good Status' in accordance with the limits set by the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).

The average results for Ortho- phosphate at the Bridge northeast of Treadstown on the Lyreen River did not achieve 'Good Status' in accordance with the limits set by the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).

Potential sources of Ammonia and Ortho-phosphate/Reactive Phosphorous include peat soils which occur in the area and/or anthropogenic activities such as fertiliser application or sewerage effluent.

10.3.2.4 Supplementary Monitoring Data

Additional water quality monitoring was undertaken as part of this assessment in various locations to supplement the WFD data and establish the baseline water quality at the site. The results of chemical monitoring are shown below. The results of biological monitoring are included in Chapter 7 – Ecology of Volume 2 of the EIS.

The locations for the additional chemical monitoring are shown on Figure 10.1 and detailed below. (Note that the distances are measured along the watercourses to the nearest proposed turbine).

- PML1 –On River Glash, approximately 14.14km downstream of turbine T24 (Windmill cluster)
- PML2 – On the Fear English River, approximately 1.3 km downstream of turbine T12 (Drehid-Hortland cluster)
- PML3 – On the Cushaling River, a tributary of the Figile River, approximately 650m downstream of turbine T47 (Drehid-Hortland cluster)
- PML4* – On the Mulgeeth Tributary/Derryvarogue Tributary, approximately 5.5 km upstream of the River Blackwater on the eastern boundary of the Drehid-Hortland cluster. Turbine T40 is located just upstream of the confluence of the Mulgeeth Tributary and the River Blackwater (Drehid-Hortland cluster)
- PML5 – On Abbeylough River, approximately 2.8 km upstream of turbine T27 in the Derrybrennan cluster and 1.2 km upstream of Iron Bridge at the MV cable route crossing point

- PML6 – On River Slate, downstream of the Cloncumber cluster and approximately 900m downstream of turbine T39. There are 3 borrow pits immediately east of T39
- PML7 – On River Blackwater, approximately 900m downstream of turbine T46. It is located at a crossing point on the proposed HV cable route from Drehid to Maynooth, on one of the tributaries of the River Blackwater. (Drehid –Hortland cluster).

**Sample point 4 was originally selected close to a proposed turbine that was subsequently removed from the proposed development.*

Samples were taken by Water Technology Ltd. during stormflow and baseflow conditions. The baseflow samples were taken on 13 November 2014 at locations 1 to 7. The stormflow samples were taken on 18 November 2014 at locations 1 to 7. Samples were analysed in The Water Lab accredited laboratory. The results of the monitoring in the vicinity of the site are summarised in the tables overleaf. The test reports are included in Appendix I of Volume 3 EIS Appendices.

The monitoring results are compared to the environmental quality standards as set out in the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012) and the European Communities (Quality of Salmonid Waters) Regulations 1988, (S.I. No. 293 of 1988), where applied.

Table 10.5: Baseflow Surface Water Monitoring Results

Parameter	Units	PML1	PML2	PML3	PML4	PML5	PML6	PML7	Environmental Quality Standard
Alkalinity-total (as CaCO3)	mg/l	162	303	292	177	162	238	236	
Ammonia-Total (as N)	mg/l	0.3	0.05	0.13	0.17	0.06	0.05	0.28	0.14 (95%ile good status) [a]
BOD	mg/l	<2	<2	<2	2.11	2.03	<2	<2	2.6 (95%ile good status) [a]
Chloride	mg/l	20.3	21.1	17.3	27.5	31	23.3	22.9	
Conductivity @20°C	µS/cm	353	579	584	366	308	500	563	
Diesel Range Organics	µg/l	<50	<50	<50	<50	<50	<50	<50	
Dissolved Inorganic Nitrogen	mg/l	1.4	0.954	1.842	1.968	0.46	1.361	2.097	
Dissolved Oxygen	mg/l	10.1	9.82	8	9.96	9.03	8.82	6.95	>6 [b]
Nitrate (as N)	mg/l	1.1	1.7	2.5	2	1.3	1.8	2.1	
Nitrite (as N)	mg/l	0.004	0.01	0.01	<0.004	<0.004	0.008	0.017	<0.05 [b]
Petrol Range Organics	µg/l	<1	<1	<1	<1	<1	<1	<1	
pH	pH Units	8.43	8.5	8.22	8.32	8.32	8.42	8.06	6.0 < pH < 9.0 [b]
Reactive Phosphorous	mg/l	0.35	0.27	0.35	0.44	0.43	0.2	0.22	0.075 (95%ile good status) [a]
Sulphate	mg/l	<2	<2	10	<2	<2	57	100	
Total Oxidised Nitrogen (as N)	mg/l	1.104	1.71	2.51	2	1.3	1.808	2.117	
Total Phosphorous	mg/l	0.46	0.49	0.44	0.42	0.58	0.32	0.34	
Total Suspended Solids	mg/l	10	8	2	5	8	6	2	<25 [b]
Turbidity	NTU	14.28	6.62	4.85	7.84	7.71	7.36	6.16	

a) European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).
b) European Communities (Quality of Salmonid Waters) Regulations, 1988. SI No. 293 of 1988.

Table 10.6: Stormflow Surface Water Monitoring Results

Parameter	Units	PML1	PML2	PML3	PML4	PML5	PML6	PML7	Environmental Quality Standard
Alkalinity-total (as CaCO3)	mg/l	297	363	400	213	165	244	275	
Ammonia-Total (as N)	mg/l	0.21	0.08	0.08	0.28	0.11	0.08	0.37	0.14 (95%ile good status) [a]
BOD - 5 days (Total)	mg/l	<2	<2	<2	<2	<2	<2	2.71	2.6 (95%ile good status) [a]
Chloride	mg/l	21.9	22.9	17.6	15.4	19	16.2	22.8	
Conductivity @20Â°C	ÂµS/cm	492	604	633	397	313	493	608	
Diesel Range Organics	µg/l	<50	<50	<50	<50	<50	<50	<50	
Dissolved Inorganic Nitrogen	mg/l	1.578	0.444	1.716	1.385	1.939	2.114	2.529	
Dissolved Oxygen	mg/l	8.22	7.39	5.64	7.44	7.43	7.1	5.5	>6 [b]
Nitrate (as N)	mg/l	1.6	0.4	1.8	1.2	2.7	2.2	2.1	
Nitrite (as N)	mg/l	0.004	0.011	0.016	<0.004	<0.004	0.009	0.024	<0.05 [b]
Petrol Range Organics	µg/l	<1	<1	<1	<1	<1	<1	<1	
pH	pH Units	7.75	7.69	7.52	7.47	7.44	7.48	7.2	6.0 < pH < 9.0 [b]
Reactive Phosphorous	mg/l	0.42	0.26	0.38	0.3	0.33	0.37	0.31	0.075 (95%ile good status) [a]
Sulphate	mg/l	<2	20	19	<2	<2	56	108	
Total Oxidised Nitrogen (as N)	mg/l	1.604	0.411	1.816	1.2	2.703	2.209	2.124	
Total Phosphorous	mg/l	0.45	0.55	0.44	0.34	0.35	0.56	0.37	
Total Suspended Solids	mg/l	8	4	<2	4	5	2	5	<25 [b]
Turbidity	NTU	5.52	4.78	2.51	3.24	4.42	4.71	4.7	

a) European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).
b) European Communities (Quality of Salmonid Waters) Regulations, 1988. SI No. 293 of 1988.

The results for Ammonia at PML4 (Mulgeeth Tributary) and PML7 (River Blackwater) during baseflow conditions and at PML1 (River Glash), PML4 and PML7 during stormflow conditions did not achieve 'Good Status' in accordance with the limits set by the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).

The results for Reactive Phosphorous at every location during both baseflow and stormflow conditions did not achieve 'Good Status' in accordance with the limits set by the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).

Similarly, the results for Dissolved Oxygen at PML3 (Cushaling River) and PML7 during stormflow conditions did not achieve 'Good Status' in accordance with the limits set by the European Communities (Quality of Salmonid Waters) Regulations, 1988. SI No. 293 of 1988.

Overall the results for ammonia were within the same range as recorded by the EPA at the monitoring locations used to determine the status of the waterbody in accordance with the WFD. The Reactive Phosphorous levels recorded during baseflow and stormflow monitoring are higher than the range of results recorded by the EPA. All of the monitoring points PML1 - PML7 are located in areas draining peat soils and the elevated Ammonia and Reactive Phosphorous levels are likely to be derived from the peat soils.

10.3.2.5 Summary of Existing Surface Water Quality

Chemical analysis from both the WFD dataset and the supplementary monitoring carried out for this assessment identified elevated levels of Ammoniacal Nitrogen, Reactive Phosphorous and Dissolved Oxygen at some of the monitoring locations. Elevated ammonia and phosphorous in surface water may be derived from peat soils or anthropogenic sources. There are peat soils in the waterbody catchments draining the development.

The WFD monitoring dataset was used to examine Q values in the vicinity of the development. The Q values recorded at each of those sites in the period 2006 – 2012 ranged from 2 to 4, however the most recent values range from 3 to 4. In accordance with the WFD, a Q value of 3 or 2-3 indicates 'Poor' status, "moderately polluted" and in an "unsatisfactory condition". A Q value rating of 3-4 indicates 'Moderate' status, "slightly polluted" and in an "unsatisfactory condition". A Q value rating of 4 indicates 'Good' status, "unpolluted" and in a "satisfactory condition".

The WFD monitoring dataset was used to examine chemical analysis data at locations on the River Blackwater, River Boyne, River Glash, Figile River, Slate River, Cloncumber Stream, River Rye Water, Dunboyne Stream, Clonshanbo River and the Lyreen River.

The water quality in the vicinity of the proposed Maighne wind farm development is generally within the environmental quality standards as set out in the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012) and the European Communities (Quality of Salmonid Waters) Regulations 1988, (S.I. No. 293 of 1988), where applicable.

Ammonia and Ortho-Phosphate/Reactive Phosphorous levels in the River Glash were elevated above the EQS for 'Good Status' in both sets of monitoring results. Ortho-Phosphate/Reactive Phosphorous levels in the Cushaling River were elevated above the EQS for 'Good Status' in both sets of monitoring results. Supplementary monitoring also detected elevated Dissolved Oxygen above the EQS for 'Good Status' in the Cushaling River.

The EPA detected Ammonia and Ortho-Phosphate/Reactive Phosphorous levels in the River Slate which were elevated above the EQS for 'Good Status'

Supplementary monitoring for the purposes of defining existing water quality in the area, shows that Ammonia and Reactive Phosphorous levels are elevated above the EQS for 'Good Status' in the Mulgeeth Tributary and in the River Blackwater.

Ammonia and Ortho-phosphate/Reactive Phosphorous levels detected that exceed the EQS for Good Status are most likely derived from the peat soils in the area. However both are also indicative of anthropogenic pollution, for example from fertiliser application or sewage.

The EPA monitoring results for the period 2009-2012 in the Dunboyne Stream recorded Ortho-Phosphate/Reactive Phosphorous above the EQS for 'Good Status.'

The EPA monitoring results for the period 2009-2013 on the Lyreen River Lower also recorded Ortho-Phosphate/Reactive Phosphorous above the EQS for 'Good Status.'

Supplementary monitoring was carried out at seven monitoring locations in the vicinity of the clusters. The locations were chosen to provide a baseline representation of surface water quality in those areas where there were no WFD monitoring locations.

The results for Ammonia in the Mulgeeth Tributary, River Blackwater in the River Glash did not achieve 'Good Status' in accordance with the limits set by the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).

The results for Reactive Phosphorous at every location during both baseflow and stormflow conditions did not achieve 'Good Status' in accordance with the limits set by the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012 (S.I. No. 272 of 2009, S.I. No. 327 of 2012).

The results for Dissolved Oxygen in the Cushaling River and the River Blackwater during stormflow conditions did not achieve 'Good Status' in accordance with the limits set by the European Communities (Quality of Salmonid Waters) Regulations, 1988 (SI No. 293 of 1988).

The supplementary monitoring points were all located in areas draining peat soils and this is the likely reason for elevated Ammoniacal Nitrogen and Reactive Phosphorous levels.

10.3.3 Groundwater

The proposed Maighne Wind Farm and MV cable route lies within three groundwater bodies shown as listed below and as shown on Figure 10.2 Groundwater Bodies Overview:

- Trim (IE_EA_G_002)
- Kildare (IE_SE_G_077)
- Bagnelstown_1 (IE_SE_G_002)

The proposed HV cable route from the proposed substation at Drehid to the substation at Woodland, Co. Meath lies within the following groundwater catchments:

- Trim (IE_EA_G_002)
- Dublin (IE_EA_G_008)
- Dunsaughlin (IE_EA_G_03)

The proposed HV cable route from the proposed substation at Drehid to the substation at Maynooth, Co. Kildare lies within the following groundwater catchments:

- Trim (IE_EA_G_002)
- Dublin (IE_EA_G_008)
- Dublin Urban (IE_EA_G_005)

The Ballynakill and Windmill clusters and associated MV cable route are located within one groundwater waterbody catchment, as defined by the WFD. This is:

- Trim (IE_EA_G_002)

The Trim groundwater body is shown as an SAC and an SPA waterbody on the WFD Register of Protected Areas (7). It is also identified as groundwater used for abstraction for drinking water on the WFD Register of Protected Areas (7). Its overall status is 'Good.'

The majority of the land area for the Drehid-Hortland cluster and associated MV and HV cable routes is also located within the Trim groundwater waterbody.

The Drehid-Hortland cluster and associated MV cable routes also lies partly within a second groundwater waterbody catchment, as defined by the WFD:

- Kildare (IE_SE_G_077)

The Kildare groundwater body is classified as an SAC waterbody on the WFD Register of Protected Areas (7) available. It is also identified as groundwater used for abstraction for drinking water on the WFD Register of Protected Areas (7). Its overall status is 'Good.'

The Derrybrennan and Cloncumber clusters and associated MV cable route are within two groundwater waterbody catchments, as defined by the WFD. These are:

- Kildare (IE_SE_G_077)
- Bagnelstown_1 (IE_SE_G_002)

The northern portion of the Derrybrennan cluster lies within the Kildare groundwater body.

The southern portion of the Derrybrennan cluster lies within the Bagnelstown_1 groundwater body which is classified as an SAC waterbody on the WFD Register of Protected Areas (7). It is also identified as groundwater used for abstraction for drinking water on the WFD Register of Protected Areas (7). Its overall status is 'Good.'

The majority of the proposed land area for the Cloncumber cluster lies within the Kildare groundwater body. The south eastern tip of the proposed area for the Cloncumber cluster, south of turbine T39 lies in the Bagenalstown_1 groundwater body.

Along the HV cable route from Drehid to Woodland, there are 3 groundwater bodies. The first section of the route traverses the Trim groundwater body, from Drehid to Kilteighter. The middle and longest section of the route lies in the Dublin groundwater body. The last section (approximately 1km) of the cable route is in the Dunshaughlin groundwater body.

The Dublin groundwater body is classified as an SAC and SPA waterbody on the WFD Register of Protected Areas (7). It is also identified as groundwater used for abstraction for drinking water on the WFD Register of Protected Areas (7). The overall status is 'Good.'

The Dunshaughlin groundwater body is identified as groundwater used for abstraction for drinking water on the WFD Register of Protected Areas (7). The overall status is 'Good.'

Along the HV cable route from Drehid to Maynooth, there are three groundwater bodies. The first section of the route sits within the Trim groundwater body, from Drehid to just north of Donadea Forest Park. The second section lies in the Dublin groundwater body. The last section of the route (approximately 2km) from Donaghstown, south of Maynooth town sits within the Dublin Urban groundwater body.

The Dublin Urban groundwater body is classified as an SAC and SPA waterbody on the WFD Register of Protected Areas (7). It is also identified as groundwater used for abstraction for drinking water on the WFD Register of Protected Areas (7). The overall status is 'Good.'

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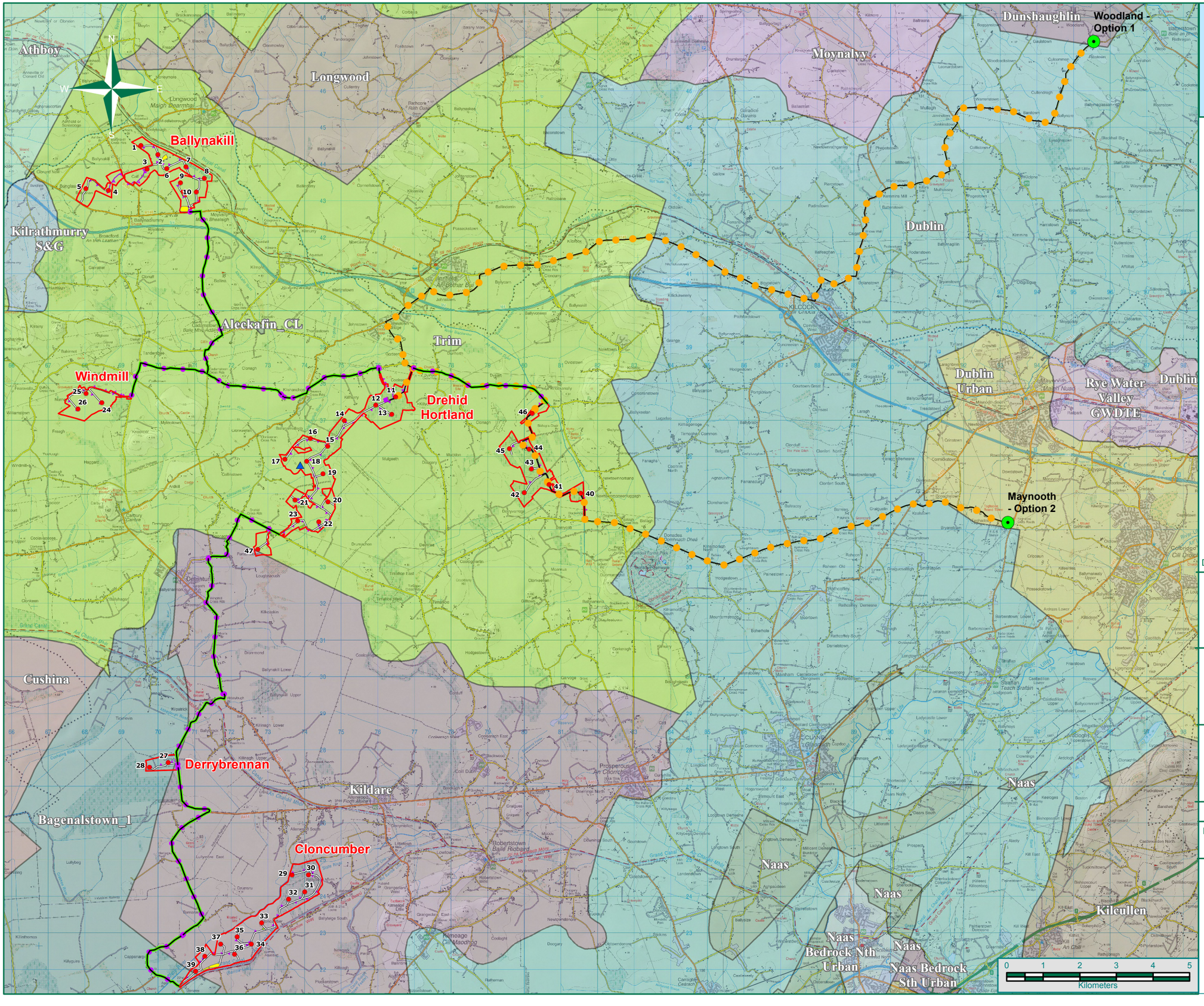


Legend

- Turbine Location
- Wind Farm Cluster Boundary
- Proposed Borrow Pit Location
- Proposed Compound Location
- Proposed Substation Location
- Proposed Met Mast Location
- MV Cable Route (External to Cluster)
- MV Cable Routes (Internal to Cluster)
- Irish Grid Connection Point
- HV Cable Route
- Indicative Access Track

Groundwater Body

- Aleckafin_CL
- Athboy
- Bagenalstown_1
- Cushina
- Dublin
- Dublin Urban
- Dunshaughlin
- Kilcullen
- Kildare
- Kilrathmurry S&G
- Longwood
- Moynalvy
- Naas
- Naas Bedrock Nth Urban
- Naas Bedrock Sth Urban
- Naas_CL
- Rye Water Valley GWDTE
- Trim

Date 26/03/2015

Name Of Client

Element Power Ireland

Name Of Job

Maighne Wind Farm

Title Of Figure

Groundwater Bodies Map Overview (Maighne)

Scale Used 1:100,000 @ A3

Figure No. 10.2.

Rev A

FEHILY TIMONEY & COMPANY
CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
Core House, Pouladuff Rd, Cork, Ireland.
T:+353-21-4964133, F:+353-21-4464
Unit 16 J5 Plaza, North Park Business Park, Dublin 11, Ireland.
T:+353-1-6583500, F:+353-1-6583501
W:www.fehilytimoney.ie, E: info@ftco.ie

10.3.3.1 Aquifer Classification

The aquifer classifications for the proposed Maighne Wind Farm development are shown in Figure 10.3.0 Aquifer Classification Map Overview, with the bedrock geology shown in Figure 8.1.0 Bedrock Geology Overview in Chapter 8 – Soils and Geology. The information in this figure is available to view in more detail in the sub maps, which are included in Volume 2a of the EIS. A summary of the desk study findings for groundwater in each cluster are presented in Table 10.7.

Table 10.7: Groundwater Desk Study Summary

Cluster Name	Turbine ID	Bedrock Formation	Aquifer Classification	Soil Type	Vulnerability	Estimated Depth to Bedrock (m)
Ballynakill	T1	Lucan Formation	Locally Important - Moderately Productive	Lake Sediment / Till	High	3-5
	T2					
	T3					
	T4				Moderate	5-10
	T5			Lake Sediment / Till / Gravel	High	3-10
	T6			Glacial Till	Moderate	5-10
	T7					
	T8					
	T9			Gravel	High	>3
	T10			Glacial Till	Moderate	5-10
Drehid-Hortland	T11	Lucan Formation	Locally Important - Moderately Productive	Peat	Low	>10
	T12					
	T13					
	T14				High	3-5
	T15					
	T16			Glacial Till		
	T17					
	T18			Peat / Till		
	T19			Glacial Till		
	T20			Peat		
	T21			Glacial Till		
	T22			Peat / Till		
	T23			Glacial Till		
	T40			Peat		
	T41				Low	>10
	T42					
	T43					
	T44					
	T45				High	3-5
	T46					
	T47			Glacial Till		

Cluster Name	Turbine ID	Bedrock Formation	Aquifer Classification	Soil Type	Vulnerability	Estimated Depth to Bedrock (m)
Windmill	T24	Lucan Formation	Locally Important - Moderately Productive	Cutover Peat	Moderate	5-10
	T25					
	T26					
Derrybrennan	T27	Allenwood Formation	Rkd*	Peat	High	3-5
	T28				Moderate	5-10
Cloncumber	T29	Ballysteen Formation	Locally Important – Locally Productive	Alluvium	Moderate	5-10
	T30			Peat		
	T31					
	T32					
	T33			Glacial Till		
	T34			Peat		
	T35			Peat/Till/ Gravel	Moderate/ High	3-10
	T36			Peat/ Alluvium	Moderate	5-10
	T37			Alluvium		
	T38					
	T39					

*Regionally important Regionally Important Aquifer (Rkd) – karstified (diffuse)

The Ballynakill and Windmill Clusters are underlain by the Lucan ("Calp") Formation which comprises varied dark grey to black basinal limestones and shales. Small parts of the south of the site are underlain by the Waulsortian Formation which comprises pale grey limestones which are commonly dolomitised.

The groundwater section of the GSI website classifies the Lucan Formation underlying the site as a "Locally Important Aquifer (Lm) with bedrock which is generally moderately productive".

No karst features have been identified close to the clusters either on the GSI website or during the site walkover survey.

The MV cable route running between the Windmill and Ballynakill clusters is in the Lucan Formation. The section of the MV cable route connecting between the Drehid-Hortland cluster and Windmill cluster is in the Lucan Formation, the Waulstortian Formation and the Allenwood Formation.

The Drehid-Hortland cluster is also underlain by the Lucan ("Calp") Formation. Small parts of MV cable route are underlain by the Waulsortian Formation which comprises pale grey limestones which are commonly dolomitised.

The groundwater section of the GSI website classifies the Waulsortian formation as a "Locally Important Aquifer (Ll) with bedrock which is moderately productive locally".

No karst features have been identified close to the cluster either on the GSI website or during the site walkover survey.

The two turbines of the Derrybrennan cluster are underlain by the Allenwood Formation. A small section in the south east of the area within the cluster boundary is underlain by the Waulsortian formation.

The Allenwood Formation comprises mainly pale grey, clean, massive shelf limestones which are commonly dolomitised. The Waulsortian Formation comprises pale grey limestones which are also commonly dolomitised.

The groundwater section of the GSI website classifies the majority of the site as a "Regionally Important Aquifer (Rkd) – karstified (diffuse)". The Waulsortian Formation underlying the extreme east of the site is classed as a "Locally Important Aquifer (Ll) with bedrock moderately productive locally".

The Allenwood Formation is classed as a "Regionally Important Aquifer (Rkd) – karstified (diffuse)." No karst features have been identified close to the cluster either on the GSI website or during the site walkover survey.

The MV cable route connecting the Derrybrennan cluster north towards the Drehid-Hortland cluster is also underlain by the Boston Hill Formation and the Waulsortian Formation. The Boston Hill Formation comprises nodular and irregularly bedded dolomitised limestones with subordinate shale. The groundwater section of the GSI website classifies the Boston Hill Formation as a "Locally Important Aquifer (Ll) with bedrock moderately productive locally."

The vast majority of the area proposed for the Cloncumber cluster is also underlain by the Boston Hill Formation. The extreme southwest of the site is underlain by the Allenwood Formation (mainly limestone), while the extreme northeast is underlain by the Waulsortian Limestone Formation.

The groundwater section of the GSI website classifies the Boston Hill Formation as a "Locally Important Aquifer (Ll) with bedrock moderately productive locally."

No karst features have been identified close to the cluster either on the GSI website or during the site walkover survey.

The MV cable route between the Cloncumber and Derrybrennan clusters is predominately underlain by the Waulsortian Formation. Short sections are underlain by the Allenwood and Boston Hill Formations.

The groundwater section of the GSI website shows that there are four aquifer types underlying the proposed HV cable route from Drehid to Woodland. The eastern section from Drehid to Kilbrook is underlain by the Lucan Formation, a "Locally Important Aquifer (Lm) with bedrock which is generally moderately productive." This section of the route is approximately 10km. From Kilbrook to Killeighter, the route (approximately 2.5k) is underlain by the Namurian Formation, a "Poor aquifer (PI) with bedrock that is generally unproductive except locally." The western portion of the route from Killeighter to Cappagh is approximately 19.5km. It is underlain by the Lucan Formation and small sections of the Waulsortian, Ballysteen and Boston Hill Formations. It is a "Locally important aquifer (LI) with bedrock that is moderately productive locally." The final 1km of the route from Cappagh to the existing electrical substation at Woodland is underlain by a "Locally Important Aquifer (Lm) with bedrock which is generally moderately productive."

There are three aquifer types underlying the proposed HV cable route from Drehid to Maynooth. The western section of the route from Drehid to Ballagh Cross Roads, approximately 11km is underlain by the Lucan Formation. The classification is a "Locally Important Aquifer (Lm) with bedrock which is generally moderately productive."

The eastern section of the route, from Balllagh Cross to the existing substation at Maynooth is predominantly (approximately 11km) underlain by a "Locally Important Aquifer (Ll) with bedrock that is moderately productive locally." This length of the route is underlain by the Waulsortian, Tober Colleen and Boston Hill Formations.

No karst features have been identified close to the HV cable routes on the GSI website.

10.3.3.2 Groundwater Source Protection Areas and Groundwater Wells

There is one Groundwater Source Protection Zone (SPZ), at Johnstown, within the proposed Maighne Wind Farm development as shown in Figure 10.3 Aquifer Classification Map Overview. The information in this figure is available to view in more detail in the sub maps, which are included in Volume 2a of the EIS. The well field at Johnstown Bridge was installed by Kildare County Council in the early 2000's for the abstraction of groundwater as a potable water supply. However, abstraction has never occurred and the well field remains undeveloped. The Source Protection Plan (12) for this well field and the GSI mapping shows 3 no. Inner SPZs and an Outer SPZ. The source protection plan states that the planned abstraction was from 7 no. production wells, with a combined output of 3.75 M l/day. There are 2 no. production wells in each of the eastern and western Inner SPZs and 3 production wells in the central Inner SPZ.

While a site walkover of the area resulted in identification of 4 no. wells, the grid coordinates of the identified wells do not match those for the source protection wells. Plate 10.1 shows the 3 wells in the vicinity of T11. These are not labelled, covered or fenced off.



Plate 10.1: Existing Groundwater Wells within Johnstown SPZ

A number of elements of the proposed development are located within the Johnstown SPZ. These include:

- The Drehid electrical substation, 5 no. turbines (T11, T12, T13, T43 and T44) along with sections of access track, MV cables and HV cable are in the Outer SPZ
- A section of the proposed MV and HV cable route between Drehid and Hortland which runs along the local road (L-1004) is in the Inner and Outer SPZ at Dysart
- Section of the HV cable route through the Hortland portion of the Drehid-Hortland cluster, along with Turbine T45, its associated MV cable and access track are in the Inner SPZ.

It is possible that the development could have an impact on these areas without suitable mitigation measures being implemented. Details regarding the design and construction of the cable route, electrical substation and the foundations and hardstanding for turbines T44 and T45 are included in Section 10.4.1.

The GSI lists approximately 64 no. groundwater wells within 2km of the Drehid-Hortland site boundary. It is possible that further groundwater wells also exist in addition to those listed on the GSI database.

There are no known SPZs in the proposed area of the Ballynakill or Windmill clusters. The nearest SPZs are the Longwood Groundwater SPZ which is located approximately 2km east of the Ballynakill cluster, and the Edenderry SPZ which is located approximately 4km southwest of the Windmill cluster.

The GSI lists approximately 50 groundwater wells within 2km of the Ballynakill cluster and approximately 30 groundwater wells within 2km of the Windmill cluster. It is possible that further groundwater wells also exist in addition to those listed on the GSI database.

There are no known Groundwater SPZs close to the Derrybrennan cluster. The nearest Groundwater SPZs are Robertstown Groundwater SPZ located approximately 7km southeast of the proposed area and Rathangan Groundwater SPZ located approximately 6km south of the proposed area.

The GSI lists approximately 15 no. groundwater wells within 2km of the site boundary. It is possible that further groundwater wells also exist in addition to those listed on the GSI database.

There are no groundwater SPZs close to the Cloncumber cluster. The Robertsown groundwater SPZ lies approximately 4.5km east of the development boundary. The Rathangan Well Field is 4km southwest of the Cloncumber development boundary. The GSI lists approximately 30 groundwater wells within 2km of the site boundary. It is possible that further groundwater wells also exist in addition to those listed on the GSI database.

The GSI lists approximately 210 no. groundwater wells within 2km of the HV cable route from Drehid to Woodland and approximately 53 no. groundwater wells within 2km of the HV cable route from Drehid to Woodland. It is possible that further groundwater wells also exist in addition to those listed on the GSI database. It should be noted that the well count along the HV cable route includes wells previously counted within 2km of the clusters boundary.

10.3.3.3 Groundwater Vulnerability

Groundwater vulnerability, as defined by the GSI, is the term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater could be contaminated by human activities.

The vulnerability of an aquifer to contamination is influenced by the leaching characteristics of the topsoil, the permeability and thickness of the subsoil, the presence of an unsaturated zone, the type of aquifer, and the amount and form of recharge (the hydrologic process where water moves downward from surface water to groundwater). Groundwater vulnerability is determined mainly according to the thickness and permeability of the subsoil that underlies the topsoil, as these properties strongly influence the travel times and attenuation processes of contaminants that could be released into the subsurface from below the topsoil (as in the case of contaminants from landfills, septic tank systems and underground storage tanks). The type of recharge is also considered where indirect recharge (termed 'point recharge' in Ireland) can occur through swallow holes or sinking streams.

The published groundwater vulnerability data for the proposed area of the Maighne Wind Farm, MV and HV cable routes is shown in Figure 10.4 Groundwater Vulnerability Map Overview. The information in this figure is available to view in more detail in the sub maps, which are included in Volume 2a of the EIS.

Ballynakill Cluster

The GSI distribution of vulnerability for the site area is 'Moderate' to 'High' because it has a variable thickness of glacial till, lake sediments and sand and gravel over bedrock.

The published vulnerability for the site is shown in Table 10.8. The table illustrates the standard ratings of vulnerability used by the GSI, with the dominant site conditions highlighted.

Table 10.8: Groundwater Vulnerability at Ballynakill Cluster

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand / gravel)	Moderate Permeability (e.g., Sandy soil)	Low Permeability (e.g., Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	**> 3.0 m**	**3.0 -10.0 m**	**3.0 - 5.0 m**
Moderate (M)	Not applicable	**>10.0 m**	**5.0 - 10.0 m**
Low (L)	Not applicable	Not applicable	>10 m

Based on the desk study, the sub-soil thickness on the site is thought to be generally between 3m and greater than 10m in thickness. This suggests that if any contamination were to occur it will encounter a variable degree of attenuation prior to reaching bedrock.

The overburden deposits of glacial till (where present) have generally low permeability and may therefore act as a confining layer, preventing the free movement of surface water to the underlying aquifer within the bedrock. By contrast, the sand and gravel will have a higher permeability and therefore have a high vulnerability to sources of contamination. The topography of the site is flat or gently sloping. Groundwater at the site is expected to flow in the general direction of the topography and surface water courses.

Windmill Cluster

The GSI distribution of vulnerability for the southern site area is predominantly 'Moderate' for the site due to having a variable thickness of peat and glacial till. This is where the turbines are located. The extreme north of the site where the MV cable route travels toward the cluster is rated as 'High' vulnerability due to the thinner peat/glacial till in these areas.

The published vulnerability for the site is shown in the accompanying maps included in Volume 2a of the EIS. The table illustrates the standard ratings of vulnerability used by the GSI, with the dominant site conditions highlighted.

Table 10.9: Groundwater Vulnerability at Windmill Cluster

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand/gravel)	Moderate Permeability (e.g., Sandy soil)	Low Permeability (e.g. Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	**> 3.0 m**	**3.0 -10.0 m**	3.0 - 5.0 m
Moderate (M)	Not applicable	**>10.0 m**	**5.0 - 10.0 m**
Low (L)	Not applicable	Not applicable	>10 m

Based on the desk study, the sub-soil thickness on the site is thought to be predominantly between 3m and 10m in thickness. This suggests that any contamination will encounter a variable degree of attenuation prior to reaching bedrock.

The overburden deposits of peat and glacial till have generally low permeability and may therefore act as a confining layer, preventing the free movement of surface water to the underlying aquifer within the bedrock. The topography of the site is flat or gently sloping. Groundwater at the site is expected to flow in the general direction of the topography and surface water courses.

Drehid-Hortland Cluster

The GSI distribution of vulnerability for the Drehid-Hortland cluster is predominantly 'High' due to a variable thickness of peat and/or glacial till over bedrock. The eastern part of Drehid and the southern part of Hortland (turbine nos. 11, 12, 13, 41, 42, 43 and 44) however, is rated as 'Low' vulnerability due to the thicker peat deposits in these areas. Small parts of the cluster are rated as 'Moderate' vulnerability.

The published vulnerability for the site is shown in Table 10.10. This illustrates the standard ratings of vulnerability used by the GSI, with the dominant site conditions highlighted.

Table 10.10: Groundwater Vulnerability at Drehid-Hortland Cluster

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand / gravel)	Moderate Permeability (e.g., Sandy soil)	Low Permeability (e.g., Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	> 3.0 m	3.0 -10.0 m	**3.0 - 5.0 m**
Moderate (M)	Not applicable	>10.0 m	**5.0 - 10.0 m**
Low (L)	Not applicable	Not applicable	**>10 m**

Based on the desk study, the sub-soil thickness on the site is thought to be predominantly between 3 m and greater than 10 m in thickness. This suggests that any contamination will encounter a reasonable degree of attenuation prior to reaching bedrock.

The overburden deposits of peat and glacial till have generally low permeability and may therefore act as a confining layer, preventing the free movement of surface water to the underlying aquifer within the bedrock. Groundwater at the site is expected to flow in the general direction of the topography and surface water courses, flowing in different directions in different parts of the site.

The GSI classification of vulnerability at the proposed electricity substation site is 'Low'. This is due to the depth of peat and boulder clay overlying the bedrock (14).

Elements of this proposed cluster occur within the inner and outer zones of the SPZ. In particular, Turbine T45, its associated cable route and access track as well as a section of the proposed HV cable route are located within the inner zone. The GIS distribution of vulnerability at T45 is 'High'. Borehole logs (14) for the area show that the bedrock is at a depth of approximately 8-11 m in this area and is overlain by mainly gravels and some clay.

Derrybrennan Cluster

The GSI distribution of vulnerability for the cluster area is 'Moderate' to 'High' for the site due a variable thickness of peat. The published vulnerability for the site is shown in Table 10.11. This illustrates the standard ratings of vulnerability used by the GSI, with the dominant site conditions highlighted.

Table 10.11: Groundwater Vulnerability at Derrybrennan Cluster

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand / gravel)	Moderate Permeability (e.g., Sandy soil)	Low Permeability (e.g., Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	> 3.0 m	3.0 -10.0 m	**3.0 - 5.0 m**
Moderate (M)	Not applicable	>10.0 m	**5.0 - 10.0 m**
Low (L)	Not applicable	Not applicable	**>10 m**

Based on the desk study, the sub-soil thickness on the site is thought to be predominantly between 3m and 10m. This suggests that any contamination will encounter a variable degree of attenuation prior to reaching bedrock.

The overburden deposits of peat and glacial till have generally low permeability and may therefore act as a confining layer, preventing the free movement of surface water to the underlying aquifer within the bedrock. The topography of the site is flat or gently sloping. Groundwater at the site is expected to flow in the general direction of the topography and surface water courses.

Cloncumber Cluster

The GSI distribution of vulnerability for the area of the Cloncumber cluster is predominantly 'Moderate' for the site due to a variable thickness of peat and/or glacial till/alluvium over bedrock. Small parts of the southern end of the site are rated as 'High' vulnerability due to the shallow bedrock in these areas. The published vulnerability for the site is shown in Table 10.12. The table illustrates the standard ratings of vulnerability used by the GSI, with existing site conditions highlighted.

Table 10.12: Groundwater Vulnerability at Cloncumber Cluster

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand / gravel)	Moderate Permeability (e.g., Sandy soil)	Low Permeability (e.g., Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	> 3.0 m	**3.0 -10.0 m**	**3.0 - 5.0 m**
Moderate (M)	Not applicable	**>10.0 m**	**5.0 - 10.0 m**
Low (L)	Not applicable	Not applicable	>10 m

Based on the desk study, the sub-soil thickness on the site is thought to be predominantly between 3m and 10m. This suggests that any contamination will encounter a variable degree of attenuation prior to reaching bedrock.

The overburden deposits of peat and glacial till have generally low permeability and (where present) may therefore act as a confining layer, preventing the free movement of surface water to the underlying aquifer within the bedrock, while the permeability of alluvium will tend to be higher resulting in less attenuation.

The topography of the site is flat or gently sloping. Groundwater at the site is expected to flow in the general direction of the topography and surface water courses.

MV Cable Route

The MV cable route is located predominantly in areas of 'Low', 'Moderate' and 'High' vulnerability. The geology is predominantly glacial till overlying limestone with some areas of cut peat between Derrybrennan and Cloncumber. In Coonagh, to the west of Turbine T47, on a short section of cable from Drehid-Hortland to Derrybrennan, there is an area of extreme vulnerability. There is also rock near the surface between Calfstown and Mylerstown for a short section of the MV cable route between Windmill and Drehid-Hortland. Just east of that location, on a short section of cable route from Drehid-Hortland to Ballynakill, there is a small area of 'Extreme' vulnerability due to the presence of shallow rock, south of Cadamstown.

Table 10.13: Typical Groundwater Vulnerability along the MV Cable Route

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand / gravel)	Moderate Permeability (e.g., Sandy soil)	Low Permeability (e.g., Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	**0 - 3.0 m**
High (H)	> 3.0 m	3.0 -10.0 m	**3.0 - 5.0 m**
Moderate (M)	Not applicable	>10.0 m	**5.0 - 10.0 m**
Low (L)	Not applicable	Not applicable	**>10 m**

Based on the GSI vulnerability rating, the subsoil thickness along the cable route is variable, typically ranging from 3m, to greater than 10m, although small areas may also be present with less than 3m of subsoil cover.

HV Cable Route Options

Drehid to the existing substation at Woodland

The GSI distribution of vulnerability along the first section of the proposed route from Drehid to Kilkcock ranges from 'High' to 'Medium' to 'Low' (from west to east). The soil types are predominantly glacial till which have low permeability. There are some sections of the route near Johnstown Bridge and Johnstown where the GSI vulnerability is classified as 'High. ' Soils in these two areas comprise alluvium, sands and gravels.

The GSI distribution of vulnerability along the final section of the route from Kilcock to the existing electrical substation at Woodland is 'Low' and the soil type is predominantly glacial till overlying Calp bedrock. There are two rock outcrops near Jenkinstown, adjacent to the road and proposed cable route where the vulnerability is 'Extreme'.

The overburden deposits of glacial till (where present) have a generally low permeability and may therefore act as a confining layer, preventing the free movement of surface water to the underlying aquifer within the bedrock. Where the glacial till is thin or absent, or where granular alluvium is present (at river crossings) the bedrock has a higher vulnerability to sources of contamination. Based on the vulnerability, the subsoil thickness is variable, from 3m, to more than 10m, although small areas also exist where subsoil thickness is less than 3m.

Table 10.14: Typical Groundwater Vulnerability along the HV Cable Route Drehid to Woodland

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand / gravel)	Moderate Permeability (e.g., Sandy soil)	Low Permeability (e.g., Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	**0 - 3.0 m**
High (H)	> 3.0 m	3.0 -10.0 m	**3.0 - 5.0 m**
Moderate (M)	Not applicable	>10.0 m	**5.0 - 10.0 m**
Low (L)	Not applicable	Not applicable	**>10 m**

Drehid to the existing substation at Maynooth

From Drehid to east of Dysart, the GSI distribution of vulnerability is predominantly 'High'. The soil type is predominantly glacial till overlying Calp or Carboniferous limestone. The remainder of the proposed HV cable route is in limestone till and the GSI distribution of vulnerability is predominately 'Moderate' or 'Low'. There are also some short lengths of the route that are of 'High' and 'Extreme' vulnerability as shown in Figure 10.4.

The proposed HV cable route passes through the Inner and Outer SPZ at Johnstown Well Field at Drehid, at Dysart on the existing road from Dunfierth to Knockanally and within the eastern area of the Drehid-Hortland cluster in Hortland.

The GSI distribution of vulnerability along the road is 'High'. The overburden deposits of glacial till and a small area of peat have a low permeability.

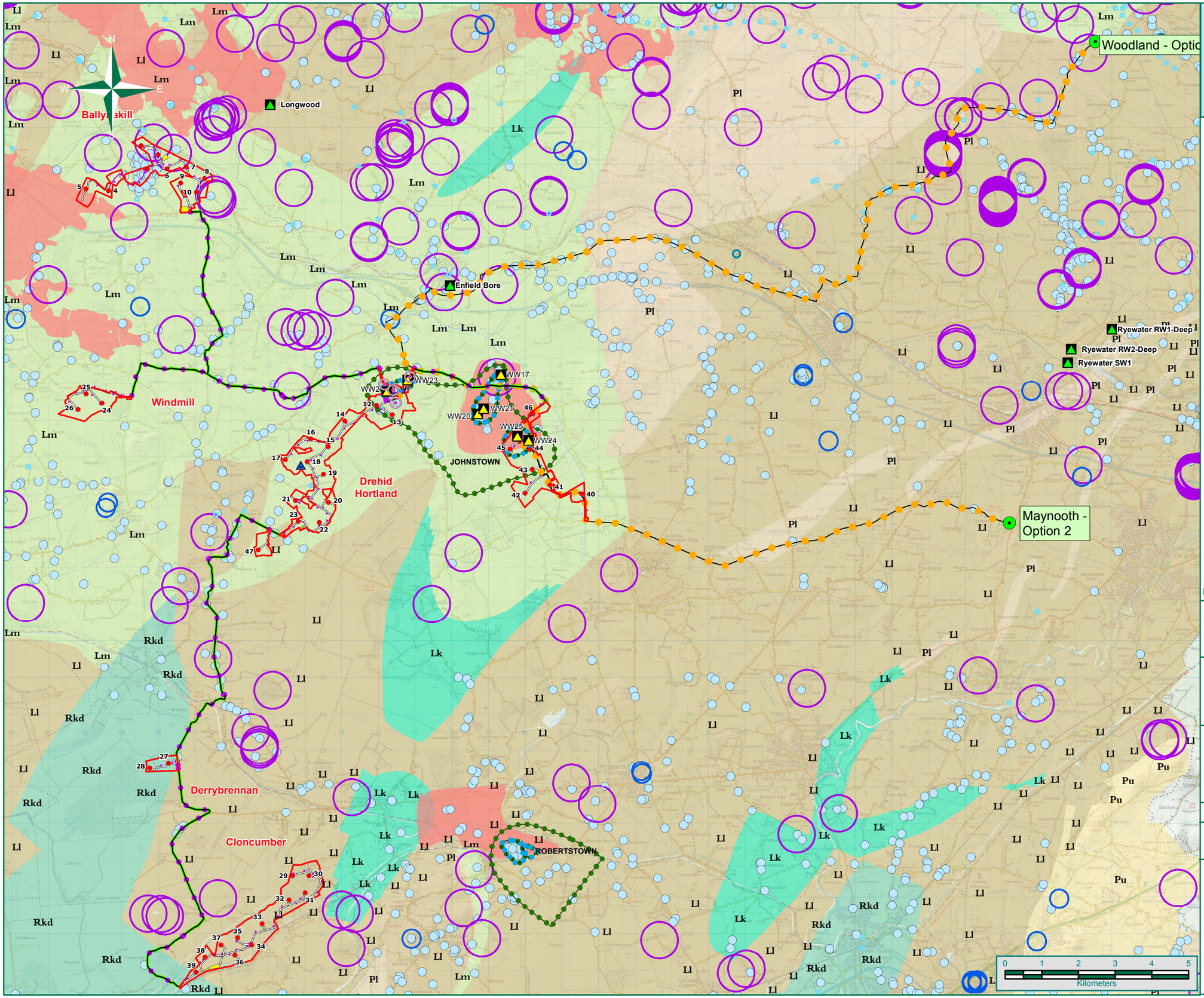
The GSI distribution of vulnerability at Hortland is 'High' at the north of the cluster and 'Low' to 'Moderate' for the remainder. The overburden deposits of peat have a low permeability.

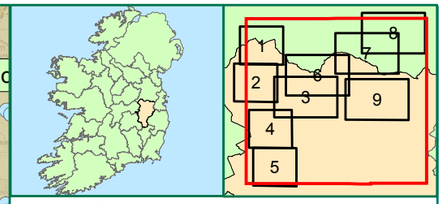
Table 10.15: Typical Groundwater Vulnerability along the HV cable route Drehid to Maynooth

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand / gravel)	Moderate Permeability (e.g., Sandy soil)	Low Permeability (e.g., Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	**0 - 3.0 m**
High (H)	> 3.0 m	3.0 -10.0 m	**3.0 - 5.0 m**
Moderate (M)	Not applicable	>10.0 m	**5.0 - 10.0 m**
Low (L)	Not applicable	Not applicable	**>10 m**

Based on the GSI vulnerability rating, the subsoil thickness along the cable route is variable, ranging typically from 3m, to greater than 10m, although small areas are also present where the subsoil may be less than 3m thick.

R:\Map Production\2014\LE14\731\01\Workspace\EIS Maps\Chapter 10\LE14 731 01 _ Figure 10.X. Aquifer Classification Map





Legend

- Turbine Location
- Wind Farm Cluster Boundary
- Proposed Met Mast Location
- Proposed Compound Location
- Proposed Borrow Pit Location
- Proposed Substation Location
- Proposed Access Track
- MV Cable Route (Internal to Clusters)
- MV Cable Route (External to Cluster)
- HV Cable Route
- Irish Grid Connection Point

Aquifer Classification

- Lk: Locally Important Aquifer - Karstified
- Ll: Locally Important Aquifer - Bedrock Mod Productive Locally
- Lm: Locally Important Aquifer - Bedrock Generally Mod Productive
- Pl: Poor Aquifer Bedrock Generally Unproductive Except Locally
- Pu: Poor Aquifer Bedrock Generally Unproductive
- Rkd: Regionally Important Aquifer - Karstified (diffuse)
- Sand and Gravel Aquifers
- Source Protection Zone (Inner)
- Source Protection Zone (Outer)
- GW Well (50m-100m Accuracy)
- GW Well (100m-200m Accuracy)
- GW Well (200m-500 Accuracy)
- GW Well (500m-1km Accuracy)
- GW Well (10m-50m Accuracy)
- Well from K.T. Cullen Report 2003
- Bore Hole
- Well From EP Site Walk-over

Date 26/03/2015

Name Of Client

Element Power Ireland

Name Of Job

Maighne Wind Farm

Title Of Figure

Aquifer Classification Map Overview (Maighne)

Scale Used 1:100,000 @ A3

Figure No. 10.3.

Rev A

FEHILY TIMONEY & COMPANY
CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
Core House, Pouladuff Rd, Cork, Ireland.
T:+353-21-4964133, F:+353-21-4464
Unit 16 JS Plaza, North Park Business Park, Dublin 11, Ireland.
T:+353-1-6583500, F:+353-1-6583501
W:www.fehilytimoney.ie, E: info@ftco.ie

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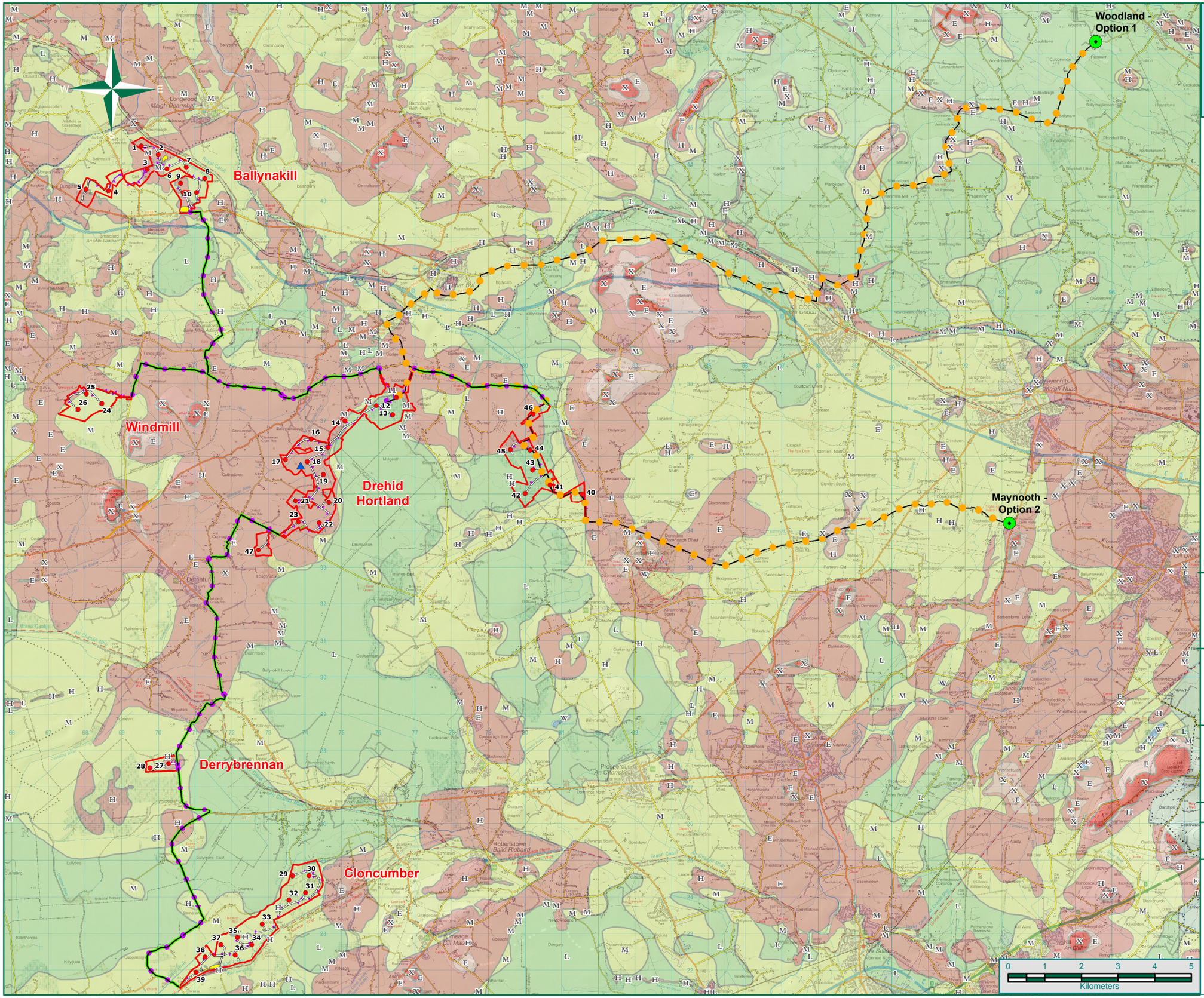

Legend

- Turbine Location
- Wind Farm Cluster Boundary
- Proposed Borrow Pit Location
- Proposed Compound Location
- Proposed Substation Location
- Proposed Met Mast Location
- Indicative Access Track
- MV Cable Route
- MV Cable Routes (Internal to Windfarm Cluster)
- Irish Grid Connection Point
- HV Cable Route

Groundwater Vulnerability

- E - Extreme
- H - High
- L - Low
- M - Moderate
- Water
- X (Rock near Surface or Karst)

Date 19/03/2015

Name Of Client

Element Power Ireland

Name Of Job

Maighne Wind Farm

Title Of Figure

Groundwater Vulnerability Map Overview (Maighne)

Scale Used 1:100,000 @ A3

Figure No. 10.4.

Rev A

FEHILY TIMONEY & COMPANY
CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
Core House, Pouladuff Rd, Cork, Ireland.
T:+353-21-4964133, F:+353-21-4464
Unit 16 J5 Plaza, North Park Business Park, Dublin 11, Ireland.
T:+353-1-6583500, F:+353-1-6583501
W:www.fehilytimoney.ie, E: info@ftco.ie

10.3.3.4 WFD Status and Risk Assessment

A risk assessment was carried out in 2005 on groundwater bodies, as defined under the WFD. Some of the assessments were updated in 2008. The results of the assessments are available on the WFD website (watermaps.wfdireland.ie). The results of the assessments carried out on the groundwater bodies at the site are discussed below.

Trim
The groundwater body Trim (reference IE_ EA_G_002) is currently of 'Good' status. The waterbody is at risk of not achieving 'Good' status due to 'contaminated land risk (CLR)', 'risk associated with exceedances of water quality above specific standards (DWR)' and 'general groundwater quality risk (GWR)'. It is an objective to protect the status of this waterbody.

Kildare
The groundwater body Kildare (reference IE_SE_G_077) is currently of 'Good' status. The waterbody is probably at risk of not achieving 'Good' status due to the 'risk associated with exceedances of water quality above specific standards (DWR)'. It is an objective to protect the status of this waterbody.

Bagnelstown_1
The groundwater body Bagnelstown_1 (reference IE_SE_G_002) is currently of 'Good' status. The waterbody is at risk of not achieving 'Good' status due to the 'risk of groundwater due to pressure from diffuse sources of pollution (DR)', 'general groundwater quality risk (GWR)', 'overall risk associated with nutrient loadings to rivers and transitional and coastal waters (SWR)' and 'risk associated with nitrate loading to transitional and coastal waters (TNR)'. It is an objective to protect the status of this waterbody.

Dublin
The groundwater body Dublin (reference IE_ EA_G_008) is currently of 'Good' status. The waterbody is probably not at risk of not achieving 'Good' status. It is an objective to protect the status of this waterbody.

Dunshaughlin
The groundwater body Dunshaughlin (reference IE_EA_G_031) is currently of 'Good' status. The waterbody is not at risk of not achieving 'Good' status. It is an objective to protect the status of this waterbody.

Dublin Urban
The groundwater body, Dublin Urban (reference IE_EA_G_005) is currently of 'Good' status. The waterbody is at risk of not achieving 'Good' status due to 'contaminated land risk (CLR)','general groundwater quality risk (GWR)', revised groundwater risk assessment (RA)' and risk of groundwater due to pressures from urban areas (UAR)'.

10.3.3.5 Groundwater Quality

Two groundwater monitoring locations are located within a 5km radius of the cluster boundaries and HV cable route. These wells are in Kildare (Enfield) and Meath (Longwood). Monitoring data collected by the EPA from these wells have been compared to the standards set by the Environmental Objectives (Groundwater) Regulations 2010, (S.I. No. 9 of 2010). A summary of the test results closest to the development at Enfield and Longwood are provided in Appendix I along with the overall threshold value (OTV) set by the legislation. The location of the two wells is shown on Figure 10.3 with submaps included in Volume 2a of the EIS.

All of the results are within the OTV with the exception of Total Ammonium in the Enfield Bore. The OTV for Ammonium is 175ug/l for groundwater intended for human consumption or human use. The potential sources of ammonia include anthropogenic pollution, e.g. sewage or industrial sources along with some naturally occurring ammonia within peat soils.

10.4 Potential Impacts

The potential impacts on water quality are assessed in the following sections for the construction, operation and decommissioning of the proposed Maighne Wind Farm development.

10.4.1 Do Nothing Impact

If the proposed wind farm development does not proceed, the site will remain as generally poor draining agricultural and bog land for the foreseeable future including grazing, arable, peat milling and forestry uses. In areas where conifer forestry plantations are present, deforestation and reforestation will continue to occur into the future. The impact on water quality would remain largely unaltered.

10.4.2 Potential Impacts during Clearfelling

Clearfelling has the potential to impact adversely upon the environment if undertaken in an uncontrolled manner; however the adoption of sound planning procedures, operating techniques and control measures will considerably reduce any potential adverse environmental effects.

The tree species to be felled includes Douglas Fir, Western Hemlock, Lodgepole pine, Stika spruce, Norway Spruce and Western Red Cedar, Birch, Oak, Alder and Ash. The yield class varies between 4 and 24, with planting years also varying from c. 1963 to 2013. Much of the forestry is Coillte forestry, with some being in private ownership. It would appear, from the information available, that only 7.2ha of the Coillte plantations in Hortland, have been fertilised in recent years.

The potential risk of phosphorus and suspended solids losses (arising from the proposed felling) to surface waters is related to the size of the area to be felled to facilitate construction, the amount of phosphorus remaining in the soil and vegetation as well as the number of intervening years since the fertiliser application.

Attention has been given to the drainage design of the wind farm development, including the drainage of hard standing areas associated with turbine construction, proposed site access tracks, and associated infrastructure, such that potential impacts to the hydrological regime, water quality and aquatic habitats are minimised.

10.4.3 Potential Impacts during Construction

10.4.3.1 Potential Direct and Indirect Impacts

The main potential impact of the proposed development on water quality in the absence of mitigation measures is an increase in sediment concentration in watercourses during the construction phase. Sedimentation is the deposition of fine sediment either within the gravel or directly on the substrate surface of an aquatic system. Problems arise when high sedimentation rates smother coarser particles with fine ones. This can reduce oxygen levels either through a decline in flow rates or in the case of organic particulates, by their own use of oxygen (29).

The main sources of potential increase in sediment to surface water are:

- Run-off to surface water during the construction of new access tracks
- Excavation of peat could lead to an increase in suspended solids in surface water run-off from these areas and from minor quantities of exposed mineral soils
- Inappropriate site management of excavations could lead to loss of suspended solids to surface waters
- Spoil heaps from the excavations for the turbine bases will be stored temporarily; if left exposed, this could lead to an increase in silt-laden run-off draining off site
- Uncontrolled run-off from the borrow pit areas at Ballynakill and Cloncumber clusters have the potential to be silt laden, with the risk of draining into adjacent streams at Ballynakill cluster or into the Grand Canal Barrow Line at the Cloncumber cluster

- Blockages in the roadside drains could result in silt-laden runoff from the road entering adjacent watercourses
- Standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils
- Tree felling could lead to an increase in nutrients in the surface water run-off, if the brash is left in place in the riparian buffer zones
- Sediment carried on the wheels of vehicles leaving the site could be carried onto the public road and subsequently into the existing roadside drainage network.

During construction the transport of both dissolved and sediment-bound nutrients from soil to water could deleteriously affect water quality downstream, in the absence of mitigation measures. Nutrient transport from soil to water, may lead to eutrophication in waters receiving drainage from the site.

Potential impacts to groundwater in the absence of mitigation measures are:

- Removal of subsoils in the Hortland area may result in the exposure of the underlying rock to sources of contamination and may increase the vulnerability of the aquifer whether or not the rock is exposed. This potential impact will be temporary, during construction, for approximately 3 to 5 weeks
- Chemical pollutants such as hydrocarbons may enter the aquifer in the event of accidental release and have implications for groundwater wells in the area, particularly those located down-gradient of any infrastructure location
- Existing disused groundwater wells (e.g. within the Johnstown wellfield) have the potential to act as receptors for contamination sources which could result in contamination of local or regional groundwater supplies
- Dewatering of excavations close to the peat bog or groundwater wells could potentially result in lowering of the water table and dewatering of the bog, resulting in loss of ground and possible ecological damage or possible disruption to nearby groundwater supplies.

Further potential impacts on the water quality (both surface water and groundwater) in the absence of mitigation measures are outlined below:

- Wet concrete operations could lead to contamination of receiving waters
- Refuelling activities could result in fuel spillages
- Unbunded fuel storage tanks within the temporary site compounds could result in spills/leaks
- Sanitary waste could lead to contamination of receiving waters
- Uncontrolled runoff from wheel washing facilities.

10.4.3.2 Potential Impacts from the cable route and temporary alterations to the Turbine Delivery Route

The potential hydrological impacts associated with the TDR and cable routes are described in more detail in Chapter 9 Hydrology of Volume 2 of the EIS.

The excavations for cable route trenches and the temporary alterations to accommodate the turbine delivery route can have a direct impact on the exposed soils and rock in the form of increased erosion and sediment release that, without mitigation, could also have additional impacts on water quality (due to sedimentation of water courses). Works will be required to upgrade two bridges; Kilpatrick Bridge, over the Grand Canal for access to the Derrybrennan cluster and a bridge over the River Slate in Ballyteige North for access to the Cloncumber cluster. Any works adjacent to the canal could have potential impacts on water quality if mitigation measures are not incorporated into the design.

In the absence of mitigation measures, there are potential impacts to water quality from watercourse crossings along the cable routes. Where possible, the preferred method for river/stream crossings is trenchless techniques as it minimises the potential impact on hydrology and water quality. Where trenchless techniques are not feasible, open-cut methods will be used whereby the cables will be laid by excavating a trench and laying the cable ducts in the bed of the watercourse. Open-cut methods associated with the cable routes will be subject to the time of year and a pre-construction survey.

In some instances, the cable-ducts will be laid in the bridge or culvert structure, which carries the road across the watercourse, where there is sufficient depth within the structure. There are also situations where the water course passes through a culvert when it will be feasible to excavate for the cables to cross underneath or lie on top of the culvert.

In the absence of appropriate mitigation measures, the potential impacts on water quality from these construction methods are:

- During trenchless techniques, there may be the possibility of surface disturbance if an inadvertent release of drilling fluid or a release of sediment laden groundwater) occurs into a watercourse. There is also the potential for sediment laden water or other deleterious substances to enter a surface water or groundwater feature as the result of grading, drilling excavations, equipment washing, or other construction related activities during directional boring. It should be noted however that the drilling fluid itself (CLEARBORE or equivalent) will not give rise to any environmental impacts and will be the same as those used for drilling domestic groundwater wells
- With other trenchless techniques, there is the potential for sediment laden surface water run-off to enter groundwater from the excavation of the launch and reception pits if the pits were not set back an appropriate distance from watercourses
- During in-stream works, there is the potential for the generation of and discharge of suspended solids to surface water or groundwater in the absence of appropriate SPCs and construction method statement
- During in-stream works, there is the potential for harmful discharges from site machinery.

10.4.4 Potential Impacts during Operation and Maintenance

The main potential impact in the absence of mitigation of the development on water quality during operation is a minor increase in run-off, due to the change in land use and an increase in impermeable ground conditions. Construction of access tracks, hardstanding areas, turbine bases and a substation will lead to an increase in hard standing area on the site resulting in additional flows being discharged to the roadside drains during rainfall events. An estimate of the changes in the volume of run-off has been made in Chapter 9 - Hydrology. An overall increase in run-off of 0.17% could be expected in the River Boyne catchment and an overall increase in run-off of 0.03% could be expected in the Barrow River catchment. These estimated increases in run-off will reduce over time as vegetation is re-established on the site. It is not expected therefore that the estimated increases will give rise to any significant impacts.

There is a potential risk of some hydrocarbons polluting the watercourses in the event of an uncontrolled spill on a trafficked area.

During the operation phase, small quantities of oil will be used in cooling the transformers. There is potential for contamination in the event of an uncontrolled release.

10.4.4.1 Potential Cumulative Impacts during Construction, Operation and Maintenance

There are currently no other significant developments planned in the area.

The following neighbouring wind farms were examined for potential cumulative impacts on water quality with the proposed development:

- Crowinstown Wind Farm, a 3 turbine permitted wind farm at Delvin, Co. Westmeath, approximately 19.7km north-north-west of the proposed development
- Dryderstown Wind Farm, a 1 turbine wind permitted farm at Delvin, Co. Westmeath, approximately 20.8km north west of the proposed development
- Mountlucas Wind Farm, a 28 turbine existing wind farm at Derrylesk, Co. Offaly, approximately 17km west of the proposed development
- Yellow River Wind Farm, a 32 turbine permitted wind farm at Rhode, Co. Offaly, approximately 10.5km west of the proposed development

The existing neighbouring wind farms outlined above are not located within any of the same waterbody catchments as the proposed development for Maighne Wind Farm. They are also not located within any of the same waterbody catchments within which the TDR and the cable route are located. The potential cumulative impact on water quality is therefore considered to be negligible as there is no cumulative risk of an increase in sediment to waterbodies.

There are a number of commercial businesses and industries in the vicinity of the proposed Maighne Wind Farm, namely Carbury Compost Ltd, Bord na Móna Drehid Waste Management Facility, Allenwood Business Park, Monaghan Mushrooms, Clairstone Ltd, Moyvalley Meats, Brady's Family Ham, Doran Nurseries, Irish Industrial Explosives Ltd. and peat extraction. These were examined for potential cumulative impacts on water quality.

Carbury Compost Ltd is located south of Derrinturn, off the R403 and is approximately 3.1km from the nearest turbine T27, in the Derrybrennan cluster. Carbury Compost Ltd produces mushroom substrate (compost) at its facility. This facility is registered and licensed by the Environment Protection Agency (EPA) under Waste Licence Registration No. W0124-01. It is located in the same waterbody catchment as turbine T27 in the Derrybrennan cluster, as turbine T47 in the Drehid-Hortland cluster, a section of the MV cable route and as the Drehid Waste Management Facility. Carbury Compost Ltd. is 3.3km downstream of turbine T47. The MV cable will be installed in the roadway outside the facility. The drainage from the mushroom compost facility drains to a different tributary of the Cushaling River and therefore there is no cumulative impact.

Drehid Waste Management Facility is located within the townlands of Parsonstown, Loughnacush, Kilkeaskin, Drumond, Timahoe West, Coolcarrigan, Killinagh Lower and Killnagh Upper and Carbury in County Kildare. It is owned and operated by Bord na Móna Public Limited Company. This facility is registered and licensed by the EPA under an Industrial Emissions Licence Register No. W0201-03.

This facility is located between the Drehid-Hortland cluster and the Derrybrennan cluster. It is in the same waterbody catchment as turbine T27 in the Derrybrennan cluster and as turbine T47 in the Drehid-Hortland cluster and as Carbury Compost Ltd. It is approximately 1km as the crow flies from turbine no. T47 and both the turbine and the waste management facility are located upstream of the two streams in the catchment feeding the Figile River. It is approximately 5.8km upstream of turbine T27. The MV cable route also runs through this catchment approximately 3km west of Drehid Waste Management Facility.

The discharges from these licenced facilities are regulated in addition to the requirement for licensees to carry out water quality monitoring up and down stream of their facilities and in addition the waste management facility has attenuation facilities to mitigate the potential impact of sediment on nearby watercourses. The potential cumulative impact on water quality is therefore considered to be negligible.

Allenwood Business Park is situated northeast of Allenwood village and is north of the Cloncumber cluster. Allenwood Business Park is located approximately 2.5km from the nearest turbine (T30). It is located in the same waterbody catchment and upstream of turbines T30, T29 and T31. Given the nature of business park it is unlikely that normal activities would give rise to any impacts on water quality, therefore a potential cumulative impact with Maighne Wind Farm on water quality is considered negligible to low.

Monaghan Mushrooms, Moyvalley Meats and Clairstone Ltd. are all located in the vicinity of the Windmill cluster. Monaghan Mushrooms merged with Carbury Mushrooms in 2004[4]. Its facility is located in Carbury village at Carbury Farm. There are no turbines in this catchment but two short sections of the MV Cable route run through it. There will be no significant changes in run-off volume due to the MV cable. Therefore, there will no cumulative impacts.

Moyvalley Meats is located off the L5005, in Taneragee, and is approximately 2.1km north of the nearest turbine T24 in the Windmill cluster. Moyvalley Meats is licensed by the EPA under an Industrial Emissions Licence Register No. P0192-02. Clairstone Ltd. gravel pit is located to the north of the Windmill cluster and is approximately 1 km to turbine T25. Both Moyvalley Meats and Clairstone Ltd. are located in the same waterbody catchment as the turbines in the Windmill cluster. The turbines are upstream of the two industrial sites. Moyvalley Meats operates its own WWTP under an IPC licence which will be subject to discharge limits, the potential cumulative impact on water quality is therefore considered to be negligible.

Brady's Family Ham, together with Doran's Nurseries next door, are located approximately 1.2km north of the Timahoe Cross Roads between the townlands of Coologmartin, Derryvarroge and Timahoe. They are located approximately 2.2km from the nearest turbine (no. 40 in the Drehid-Hortland cluster). Neither of these facilities are located in the same waterbody catchment as any turbines or the MV cable route. Therefore there is no potential cumulative impact on water quality.

[4] https://www.monaghan-mushrooms.com

Irish Industrial Explosives Ltd is located in the townland of Clonagh, Co. Kildare and has an IPC Licence issued by the EPA, Licence Register No. P0055-01. It is located approximately 0.9km west of turbine T46 in the Drehid-Hortland cluster. It is in the same waterbody catchment as 9 of the turbines in this cluster along with a short section of the MV and HV cable routes. It is located in the central Inner and Outer SPZ of the well field at Johnstown and was licensed prior to the installation of the well field. The turbines are all located upstream of the facility. As an IPC licence holder, the licensee is required to carry out regular monitoring of surface water and groundwater in the surrounding environment. The most recent annual environmental report (AER 2013) for the facility indicates some contamination of on-site surface water and groundwater. There is no evidence to date of this contamination migrating off site. The contamination is predominantly from an old unregulated landfill on site which was used up until the 1980s for the disposal of some site wastes. Site investigations were ongoing in 2014. Information in the license files onsite indicate that the hydraulic gradient on the site is eastwards towards the River Blackwater.

There is no potential for an uncontrolled release from Maighne Wind Farm during the operational phase. Therefore in the event of an uncontrolled release from Irish Industrial Explosives Ltd., there will be no cumulative impacts on water quality.

There are a number of quarries and gravel pits in the area, which are discussed in Section 8.4 of this EIS.

Bord na Móna commercially harvests peat in the vicinity of the Derrybrennan cluster, the Drehid-Hortland cluster and the Cloncumber cluster. Bord na Móna turf extraction works traverse access points into the Derrybrennan and Cloncumber clusters.

Whereas a small portion of the bogs owned by Bord na Móna traverse the study area of the Drehid-Hortland cluster. In the absence of silt protection controls and drainage systems, there is a potential cumulative impact on water quality from the release of sediment to surface water. During construction and operation of the wind farm, there will be measures in place to mitigate any impact. The drainage of the excavated material is discussed in detail in Section 9.6.7 of the hydrology chapter and in the section on mitigation measures during construction in this chapter.

The HV cable routes were assessed for facilities that lie in the same waterbody catchments for cumulative impact. No EPA licensed facilities or quarries were noted along the route. There is a distribution centre (Musgraves) at Boycetown, on the western outskirts of Kilkcock. There is a commercial park at Barstown near Woodland. The installation of the cable route will not result in any potential cumulative impacts with these facilities.

The potential cumulative impact on water quality overall, therefore, is considered to be negligible. Potential cumulative hydrological impacts have been assessed in Chapter 9 Hydrology of Volume 2 of the EIS.

10.4.5 Potential Impacts during Decommissioning

In the event of decommissioning of the wind farm, activities would take place in a similar fashion to the construction phase. Potential impacts would be similar to the construction phase but to a lesser degree.

Following decommissioning of the wind farm, turbine foundations, hardstanding areas and site tracks will be rehabilitated, i.e. left in place, covered over with local soil/topsoil and allowed to re-vegetate naturally, if required. The internal site access tracks may be left in place, subject to agreement with Kildare and Meath County Councils and the landowners. It is considered that leaving these areas in-situ will cause less environmental damage than removing and recovering them.

Removal of this infrastructure would result in considerable disturbance to the local environment in terms of disturbance to underlying soils and an increased sedimentation (if turbine foundations, access tracks and hardstandings are being reinstated there is a risk of silt laden run-off entering the receiving watercourses), erosion, dust, noise, traffic and an increased possibility of contamination of the local water table. However if removal is deemed to be required all infrastructure will be removed with mitigation measures similar to those during construction being employed.

It is proposed that underground cables will be cut back and left in place.

The substation will remain in place as it will be under the ownership of the ESB. There are no impacts associated with this.

10.5 Mitigation Measures

During the iterative design process for the proposed wind farm, cognisance was taken of the locations of existing watercourses in the vicinity of the site. To reduce the potential impacts on these watercourses a minimum buffer of 50m from watercourses has been adopted for all new site tracks where possible that run parallel to a watercourse, and a minimum buffer of 50m will be provided between temporary stockpiles and the nearest watercourse.

The drainage system for the proposed development is described in detail in Section 9.6 of the Hydrology Chapter of Volume 2 of the EIS and shown on Figure 9.4 of Volume 2a of the EIS. The drainage system for the existing tracks and roads will largely be retained. Proposed new access tracks and turbine hard-standing areas will be drained as per the existing drainage system via roadside swales with stilling ponds at the end of the swale run. The stilling ponds will drain diffusely overland, over existing vegetated areas, within the site boundary. The proposed drainage network has been designed to minimise the impact of the proposed development on the drainage network in the area.

10.5.1 Mitigation by Design

10.5.1.1 Design for the Source Protection Zone

As introduced in Section 10.3.3.2, there is one Groundwater SPZ at Johnstown which consists of three Inner SPZs and an Outer SPZ for this well field with elements of the Drehid-Hortland cluster occurring within this zones. Although a well field was installed by Kildare County Council, water abstraction has never taken place. Nonetheless there is a onus to maintain groundwater quality in this area owing to the SPZ designation. This section outlines the specific mitigation measures which have been incorporated into the design of the proposed development to minimise and in place eliminate potential impacts on the SPZ.

Design and Construction of the Substation

A description of the proposed electrical substation is included in Chapter 2 – Description of the Development. During the design process, cognisance was taken of the location of the substation in the Outer SPZ and changes were made to avoid potential impacts to water quality during the construction and operation of the substation. These included:

- The location of the substation on impermeable hardstand to prevent any risks associated with infiltration to groundwater
- The bunding of the transformer, oil storage tanks, diesel generator and any diesel or fuel oils stored at the substation. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity. Where there is more than one tank within the bund, the capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. Design and installation of fuel tanks will be in accordance with best practice guidelines BPGCS005 (Oil Storage Guidelines)
- A sealed drainage system will be provided, extending past the area of significance i.e. concrete dished channels with a kerbed perimeter at the substation hardstanding. The concrete dished channels will drain to a stilling pond, located 200m from the Inner SPZ, which will in turn drain via forestry drains to the receiving watercourse, which is at a distance of 1km from the location of the substation
- A petrol and oil interceptor will be installed to deal with all substation surface water drainage.

To reduce the concentration of the surface water run-off contribution from the substation, tanked permeable paving is a viable alternative to the sealed drainage system and this may be considered at detailed design stage. At the upslope side of the substation overland flows will be intercepted in channels and discharged diffusely over vegetated areas. Further details on the drainage design of the substation is provided in Chapter 9 – Hydrology of Volume 2 of the EIS.

Permanent sanitary facilities will be provided at the substation. Rainwater harvesting will be used for grey water use. Potable water will be imported. It is acknowledged that Kildare County Council requested that wastewater treatment be used in place of a holding tank at the location of the substation, in comments provided by them, in their scoping response. However, given its proximity to a SPZ and the requirement to maintain water quality within this area, a holding tank was deemed to be the most environmentally appropriate solution. This ensures that there are no direct discharges to groundwater. Effluent from the holding tank will be transported off-site for treatment/disposal by a permitted contractor.

Design and Construction of the Foundation and Hardstanding (T44 & T45)

A permanent sheet pile 'cut-off' wall will be installed around the turbine foundations of T45 and T44 (owing to its close proximity to the inner protection zone). It will prevent alkali leakage into the SPZ during gravity reinforced concrete foundation construction. The sheet pile 'cut-off' wall will be toed sufficiently deep into the overburden and will form an enclosed 'cofferdam' to prevent fluid circulation or loss from under the turbine foundation, when subjected to wind pressures from the turbine, to the surrounding aquifer.

If a piled foundation is required at this location, cementitious fluid loss during pile construction will be mitigated by the use of precast piles or with the provision of temporary steel lining or casing over the full length of each pile through granular soils. A perimeter 'cut-off' wall around the turbine foundation site will also be provided, as described above.

Excavation flooding will be prevented by controlled pumping to transportable containers/holding tanks. The water collected in this tank with be tested and following agreement with Kildare County Council, will be discharged under licence or alternatively transported off-site for treatment/disposal.

Groundwater monitoring and testing will be carried out throughout the foundation phase of the works.

10.5.1.2 Installation of the MV and HV Cables

The majority of the cable routes will be installed in existing roadways. Where new site access tracks to turbines are required, the MV cable will be laid in or on the edge of those tracks. There is a potential impact during construction in the absence of mitigation measures of sediment run-off in surface water from the ground surface surrounding the trench. This potential impact is avoided by laying the cable in existing roadways for the majority of the route.

There is a potential impact during the operational phase of the re-instated cable routes by providing a preferential pathway to groundwater for any contaminated run-off in the absence of mitigation measures. To eliminate this potential impact the cable trenches located in the SPZ will be backfilled with a cement bound material. This will mitigate potential preferential pathways.

10.5.2 Mitigation Measures during Tree Felling

As outlined, dispersed around the various clusters comprising the site, approximately 63ha of tree felling will be required for this proposed development across four of the five clusters. The tree felling area proposed for Maighne Wind Farm is shown in Figure 2.8 of Volume 2A of the EIS. This tree felling will be the subject of a Felling Licence from the Forest Service and will be in accordance with the conditions of such a licence. A Limited Felling Licence will be in place prior to any felling works commencing on site.

The licence will include the provision of relevant replant lands to be planted in lieu of the proposed tree felling on the site. The replant lands will be properly certified as suitable for forestry by a certified forester. The replant lands will be certified to be of an appropriate yield class and soil type and recommendations as to types and amount of fertilisation required will also be provided by a certified forester at the time of applying for the felling licence.

To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000)[1] and Forest Harvesting and Environmental Guidelines (2000)[2].

Before any harvesting works commence on site all personnel, particularly machine operators, will be made aware of the following and will have copies of relevant documentation, including:

- the felling plan, surface water management, construction management, emergency plans and any contingency plans
- environmental issues relating to the site
- the outer perimeter of all buffer and exclusion zones
- all health & safety issues relating to the site.

The harvester represents the first point of contact between machinery and the ground and therefore the layout of the extraction racks is critical. The layout of extraction racks or routes are site dependant but will be designed to:

- avoid streams or other watercourses
- be as short as possible
- avoid any areas of poor crop or bare areas
- generally extract to site roads with the extraction racks laid out at right angles to the road to prevent water flowing down wheel ruts.

Dense, fresh brash mats are the most important part of a felling site as they serve to avoid soil damage, erosion and sedimentation. These will be designed and installed to protect the underlying soil from damage and will be maintained throughout the felling operation. Their purpose is to prevent breaking of the ground surface thus preventing silt or nutrient run-off.

Brash mats will be topped up in sections when they become heavily used or worn. Where damage or serious rutting has started to occur extraction will be suspended immediately. Relocation of the extraction rack or additional brashing will be used to remedy the situation.

Harvesting extraction routes will be the shortest possible and will avoid the crossing of watercourses, where possible. Trees will be felled away from aquatic zones, where possible. Branches, logs or debris will not be allowed to accumulate in aquatic zones and will be removed as soon as possible to mitigate against nutrient losses, particularly phosphorus. Additional silt fencing will be erected along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area. To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000)[3] and Forest Harvesting and Environmental Guidelines (2000)[4].

Once felling operations are complete, the bulk of the brash will be bundled and recovered from the site in a process known as forest residue recovery. Double- wheeled machinery and corduroy rafts (close poling) will be used as necessary to maximise the recovery of brash and where the bearing capacity of the ground is poor. If any damage or rutting begins to occur, extraction will be suspended immediately, and will not recommence until either repairs are made or an alternative extraction route is provided. Extraction and cutting will be suspended during and following heavy rainfall periods.

Felling will be conducted to accommodate infrastructure and will be limited to the criteria set out in Chapter 2 – Description of the Development.

The permanent areas not replanted will include a corridor of approximately 33m along all tracks and internal cable routes, an area of approximately 1.3ha at each turbine locations located in forestry, plus an area around substation (approximately 1.9ha). Planting along the well-drained margins of roads will ensure a relatively high level of soil fertility and better drainage which is most conducive to tree growth.

The area of proposed felling is small relative to the overall planted area. Thus, no significant increase in the rate of run-off is anticipated as a result of felling nor is the risk of downstream flooding or sedimentation due to erosion increased.

The amount of felling required to facilitate the wind farm will in some cases be undertaken earlier than programmed, which may intensify forestry operations in some compartments during the construction period. There will in turn be an equivalent reduction in forestry operations in the same compartments in subsequent years, giving a net, neutral result in terms of area felled.

10.5.3 Mitigation Measures during Construction

Proposed mitigation measures to reduce or eliminate the potential impacts during construction and protect surface water and groundwater are outlined below and are also included in the Outline CEMP contained in Appendix D of Volume 3 EIS Appendices.

Mitigation measures for the protection of surface water and groundwater include:

- The proposed three-stage treatment train (swale – stilling pond – diffuse outflow) will retain and treat the discharges from hard surface areas as a result of the development
- Silt Protection Controls (SPCs) are proposed at the location of watercourse crossings and where haul roads pass close to watercourses, silt fencing with an associated buffer strip will be used to protect the streams Silt traps will also be provided at outfalls from roadside swales to existing drains. Silt traps will be kept upstream of outfalls to allow a buffer zone to the outfall. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off
- The stilling ponds, silt traps and silt fencing will be put in place in advance as construction progresses across the site and will be regularly maintained during the construction phase
- During the construction period an emergency facility, e.g. sand bags will be provided to control the discharge from the stilling ponds. This will mitigate the risk of any accidental spillage on site affecting watercourses
- Roads will be capped as soon as practicably possible to cover exposed subsoils and as such reduce the concentration of suspended solids in the run-off
- All stockpile material will be bunded adequately and protected from heavy rainfall to reduce silt run-off, where necessary
- Borrow pit No.3 in the Cloncumber cluster is adjacent to the Barrow Line of the Grand Canal. There will be no opening of or access to these borrow pits from the south (canal side). This borrow pit will be set back a minimum of 50m from watercourses with excavation areas 70m from the canal and they will be drained away from the canal to stilling ponds. At the upslope side of the borrow pit overland flows will be intercepted in channels which will discharge diffusely over vegetated areas. Swales will be used to drain the reinstated sections to the stilling ponds at the borrow pit locations. Silt fencing will be erected to further protect streams, where required. The stilling ponds will remain in place until the reinstated areas have attained satisfactory re-vegetation.
- Wheel washing facilities will be provided at the entrances to the temporary site compounds draining to silt traps
- Cross-drains of 450mm diameter will be provided to prevent a risk of clogging for drainage crossings and conveying flows from bog drains, agricultural drains and forestry drains across the access roads
- Where new cross-drains are proposed on this site to convey surface water from roadside swales to outfalls, these will be sized at a minimum of 225mm diameter to avoid blockages.
- Any standing water from the turbine excavations will be pumped into the site drainage system (including stilling ponds), which will be constructed at site clearance stage, in advance of excavations for the turbine bases. Bio-degradable silt bags (or equivalent approved) will be used during dewatering of excavations
- It is not expected that overland flows will be obstructed to any great extent as a result of the layout of the wind farm, however where required, interceptor channels will collect overland flows on the upslope side of the access tracks, hard standing areas, material storage areas and borrow pits. The interceptor channels will cross the access tracks in cross-drains which will be provided at regular intervals. The overland flow will then discharge diffusely on the downslope side over vegetated areas within the site boundary
- Emergency Silt Control and Spillage Response Procedures contained within the CEMP (included in Appendix D of Volume 3 EIS Appendices) will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt
- A suitably qualified person will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process. Water quality on the site and downstream of the site will be monitored regularly as described in Section 10.5.1.1

- Due to the dispersed nature of the site, there will be a number of designated refuelling stations on site, typically at each temporary site compound or refuelling will take place at least 100m from a watercourse using mobile bowsers. Each station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site. Only emergency breakdown maintenance will be carried out on site and appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site
- Any diesel or fuel oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity
- Portaloos and/ or containerised toilets and welfare units will be used to provide toilet facilities for site personnel during construction. Sanitary waste will be removed from site via a licensed waste disposal contractor. Non-potable water at the site compound will be brought in by tanker and drinking water will also be imported
- Concrete wash out areas will only be allowed in designated areas within the temporary construction compounds and drainage from these areas will be controlled as detailed in Chapter 9 – Hydrology of Volume 2 of the EIS
- Adequate security will be provided to prevent spillage as a result of vandalism
- Where works will be required to modify existing bridges to facilitate the delivery of turbines, pre-cast concrete will be used whenever possible, to eliminate the risk to all forms of aquatic life. Should cast-in-place concrete be required, all work will be done in the dry and effectively isolated from any water that may enter the drainage network for a period sufficient to cure the concrete. Debris containment netting will be used to arrest and contain falling objects. Silt curtains will be used where there is a risk of fine sediment getting into the stream or canal. Partial isolation may be undertaken using caissons or cofferdams. No instream works shall be carried out without the written approval of Waterways Ireland and IFI
- The potential impact of exposed soils during the excavation of the turbine bases and cable trenches will be temporary. Any standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids or as a result of the disturbance to soils. The excavations for turbines will be pumped into the site drainage system (including stilling ponds), which will be constructed at site clearance stage, in advance of excavations for the turbine bases
  As the majority of turbine excavations will be within low permeability peat or glacial till, groundwater inflow is expected to be small. In areas of higher permeability soils (expected within alluvium at Cloncumber and within the gravel aquifers at Johnstown), flows may be higher and exclusion techniques such as sheet piles may be required to control groundwater flow and stabilize excavations, particularly close to the river where a higher water table is expected
- Cable trenches will be backfilled with a cement bound material in the SPZ which will prevent preferential pathways from forming
- Existing groundwater wells will be avoided during construction. If any unused existing wells are encountered during construction (e.g. within the Johnstown wellfield), they will be decommissioned properly with grout seals
- In order to protect the existing raised bog and nearby groundwater wells from the effects of dewatering, if high permeability strata are encountered along with strong groundwater inflow within excavations, groundwater cut-off techniques (such as sheet piling) will be used in preference to lowering of the water table (dewatering). The precise technique to be used will be determined at detailed design stage following a full ground investigation. This will avoid the possibility of significant drainage of the adjacent raised bogs. It should also be noted that the majority of excavations close to peat bogs will not extend much deeper than the existing drainage network. Any dewatering will be temporary, during construction only and will not have time to cause drainage of the peat, which due to the low permeability of the peat would result in very slow drainage.

Prior to any earthworks a site specific construction plan will be put in place for construction activities in the SPZ. Groundwater wells identified in the source protection plan (14) will be located and flagged. Site walkovers determined that fencing is not currently in place at any of the wells as they are not in use. Where wells are located posts will be erected and a 10m x 10m area taped off around them.

A full ground investigation will be carried out at the detailed design stage. This will include trial pit excavation, drilling and geophysical survey, as appropriate, at each turbine location, along the roads, cable routes and substation. These investigations will determine the bearing stratum for each turbine, its depth, the presence of groundwater and inform the turbine foundation type and size.

No materials will be stored adjacent to the wells. Concrete wash out areas will be located outside of the SPZ in the temporary construction compound to the south of the Drehid cluster.

The outline CEMP in Appendix D of Volume 3 EIS Appendices includes an Outline Site Drainage Management Plan. This Plan shall be finalised in accordance with this outline plan following the appointment of the contractor for the main construction works.

10.5.3.1 Monitoring of Water Quality Mitigation Measures

Surface Water

A monitoring programme will be established to ensure that the water quality is maintained. The details of this programme are outlined hereunder. This programme will ensure that designed measures are working to ensure water quality is not affected during construction and operation.

- Daily visual inspections of drains and outfalls from interceptor drains will be performed during the construction period to ensure suspended solids are not entering the streams and rivers of the site, to identify any obstructions to channels, and to allow for appropriate maintenance of the drainage regime. If excessive suspended solids are noted, construction work will be stopped and remediation measures will be put in place immediately.
- Fortnightly visual inspections will be continued during the operation period until satisfactory vegetation is established on site
- Turbidity meters will be installed up and downstream of the construction area to determine any impacts. They will be in place for the duration of the works for each particular phase before being moved to the next phase. Should the turbidity levels measured during construction be greater downstream than upstream, the source of the turbidity will be identified and additional mitigation measures will be implemented
- Grab samples, will be undertaken during the construction phase of the development at representative locations so as to ensure the effective implementation of the proposed mitigation measures. Appropriate locations will be chosen to monitor the water quality of the receiving environment for each construction area. Field measurements will be recorded at each site and will include measurement of the following parameters, electrical conductivity, pH, temperature and dissolved oxygen. The field measurements will be taken on a weekly basis during the site clearance and earthworks stage of the construction period
- Following site clearance and earthworks, the field measurements will be taken on a monthly basis until full re-vegetation has occurred, unless otherwise directed by the planning authority, Inland Fisheries Ireland (IFI) or Waterways Ireland. Grab samples were taken for this EIS from seven locations during a dry weather and storm event to provide a baseline against which samples taken during the construction stage can be measured. Trigger values will be defined for indicator parameters based on the pre-construction monitoring results and results will also be compared to the maximum guideline values specified in the table below.

Table 10.16: Surface Water Quality Monitoring Parameters

Parameter	Maximum Guideline Value
Conductivity (µs/cm)	1,000
Turbidity (NTU)	20
pH	6.0 < pH < 9.0
Dissolved Oxygen (% saturation)	80 – 120 (%ile)
Total Suspended Solids (mg/l)	25
Total Ammonia (mg/l N)	0.14 (95%ile)
Nitrite (NO_2) (mg/l)	0.05
Molybdate Reactive Phosphorus (mg/l P)	0.075 (95%ile)
Total Phosphorus (mg/l P)	0.5
Chloride (mg/l)	250

Groundwater

Groundwater wells will be installed up and downgradient of the construction site in the vicinity of the proposed substation at Drehid and for turbines T44 and T45 which are located in or in close proximity to the inner SPZ at Johnstown. Baseline conditions will be established for each well prior to earthworks or construction. Appropriate trigger levels will be set for monitoring parameters. Monitoring will be carried out at regular intervals during construction. The wells will be purged daily and sampled for pH, electrical conductivity and a visual and odour inspection will be carried out. In the event of significant differences in the results from baseline results or in the downgradient well, works will be immediately stopped, the reason identified and additional mitigation measures will be put in place. In addition, monthly groundwater samples will be sent to a laboratory for analysis of the parameters listed below during the construction period.

Table 10.17: Groundwater Quality Monitoring Parameters

Parameters	
Total Coliforms	Total Phosphorus
Faecal Coliforms	Total Organic Carbon
pH_Laboratory	Chloride
Conductivity_Laboratory	Fluoride
Alkalinity	Sulphate
Total Suspended Solids	Sodium
Colour	Potassium
Turbidity	Calcium
Ammonium	Metals
Nitrite as NO_2	Total Pesticides
Nitrate as NO_3	(Total) PAHs

10.5.3.2 Mitigation Measures for the cable route and temporary alterations to the Turbine Delivery Route

Cables will be installed in trenches adjacent to the site access roads, or laid within the access road line, where required. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows. Clay bunds will be constructed within the cable trench at regular intervals.

Short lengths of MV and HV cable will be laid in the SPZ of Johnstown Well Field at the Drehid-Hortland cluster. Dewatering of the trench will be to the site drainage system (including stiling ponds) or to transportable containers. Road drainage will be installed to convey run-off from the access track.

Silt fencing will be erected at the location of stream crossings along the cable route. For off-line cabling methods, a temporary diversion of the watercourse may be required. Silt curtains and floating booms will be used where deemed to be appropriate, in consultation with IFI and this will be assessed separately at each individual location.

Cognisance will be taken of the NRA "*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*" and the "*Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites*" (Eastern Regional Fisheries Board) in the planning and implementation of the watercourse crossings.

A method statement will be prepared in advance of all proposed watercourse crossings which will include the following mitigation measures:

The use of trenchless techniques is the preferred method for river/stream crossings where possible. An Outline Contingency and Resource Protection Plan is included in the Outline CEMP contained in Appendix D of Volume 3 EIS Appendices and includes the following mitigation measures:

- Drilling operations are to be limited to daytime hours and conditions when low levels of rainfall are forecast
- Drilling fluid materials and their respective data sheets shall be included in the method statement for waterways or stream crossings.
- Any site specific investigation results shall be disclosed including, review of all available data from utility owners, site investigations, trial holes, ground penetrating radar as might be appropriate for the location
- Materials such as suitable biodegradable absorbent material, silt fencing and gravel bags (plastic, gravel filled bags) shall be kept at boring sites in quantities sufficient
- At stream crossings with flowing water, water monitors will be placed upstream and downstream of the crossing point, access permitting
- Onsite training shall be provided for all monitors, and names and phone numbers provided to site supervisors
- Upon completion of each drill rod, the monitoring person/team will be provided with information in relation to position of entry and exit of drilling head, amount of fluid utilised or pumped, equipment breakdowns or repairs, any abnormal drilling pressures recorded and any change of drilling fluid contents
- A field response plan to minimise loss of returns of drilling fluid and actions to restore returns shall be provided
- Equipment required to clean up any accidental release of drilling fluid will be available at the work site or at an offsite location at the temporary construction compounds
- In the event of a release of drilling fluid; the directional boring will stop immediately, the bore stem shall be pulled back to relieve pressure and the site supervisor notified to ensure adequate actions are taken and notifications made. In addition terrestrial releases shall be cleaned up using on site equipment and a terrestrial berm will be constructed around any terrestrial release
- Silt fences will be constructed around proposed work areas prior to commencement of works
- Refueling of equipment will take place at the temporary construction compounds
- Any dewatering of the pits will be pumped to land as far from the watercourse as possible to allow it to infiltrate through the field or to a stilling pond or alternative to a holding tank, tested and appropriately discharged under licence .
- Any in-stream works will:
    - Be undertaken in consultation with the Planning Authority and Inland Fisheries Ireland (IFI). To minimise adverse impacts on the fisheries resource, works in watercourses will be carried out

during the period July-September unless prior agreement has been reached with IFI. The works will be isolated from the water in the stream
    - All construction machinery operating in-stream will be mechanically sound to avoid leaks of oils, hydraulic fluid, etc. Machinery will be steam cleaned and checked prior to commencement of in-stream works
    - All works areas will be reinstated fully
- In the event that a culverts are required, they will be sized in accordance with CIRIA C689 Culvert Design and Operation Guide, the Office of Public Works (OPW) guidance
- A Section 50 Application will be prepared for all new stream crossings to obtain the consent of the OPW at detailed design stage.

10.5.4 Mitigation Measures during Operation and Maintenance

It is not envisaged that the operation of the wind farm will result in significant impacts on the water quality of the area, as there will be no further disturbance of soils post-construction, and only minimal traffic movement.

The preliminary drainage specification has been designed to continue to run efficiently during the operation period. Surface water run-off will discharge to the drainage swales during rain events. During the operation period the swales will have vegetated and will serve to further attenuate flows and reduce the amount of sediment discharging from the site.

The stilling ponds will be a permanent feature, and will continue to be effective in filtering the run-off from the site should any accidental release of silt combine with the surface water run-off during operational activities.

During the operation period the swales will have vegetated and will serve to attenuate flows and remove suspended solids from the run-off.

There is potential for small oil spills during the operation phase and as a result, all equipment with the potential for oil spillage will be bunded.

The water quality monitoring programme is detailed in Section 10.5.2.1. During the operation and maintenance phase fortnightly visual inspections of the drains and outfalls from the interceptor drains will be continued until satisfactory vegetation is established on site. Following this stage, the field measurements will be taken on a monthly basis from appropriate monitoring locations until full re-vegetation has occurred, unless otherwise directed by the planning authority, IFI or Waterways Ireland.

10.5.5 Mitigation Measures during Decommissioning

As in the construction phase silt protection controls would again be put in place. The drainage system will remain operational during the decommissioning phase and will serve to treat any sediment laden surface water run-off due to a renewed disturbance of soils.

10.6 Residual Impacts

The residual impact of the development on the receiving waters is likely to be negligible taking account of the proposed mitigation measures being implemented appropriately. The degree of confidence in mitigation measures preventing a significant release of silt into the receiving watercourses and/or the avoidance of spills/ leaks lies in the developer adopting the responsibilities for the mitigation measures. If these responsibilities are adopted then a high degree of confidence can be assured that any effects on the receiving environment would be negligible.

The amount of felling required to facilitate the wind farm will in some cases be undertaken earlier than programmed, to facilitate the wind farm construction. This will intensify forestry operations in some compartments during the construction period, but there will in turn be an equivalent reduction in forestry operations in the same compartments in subsequent years, giving a net, neutral result in terms of area felled.

All mitigation systems will be put in place in advance, as construction progresses across the site. It will be the responsibility of the developer to ensure that these facilities are put in place and a suitably qualified person will be appointed by the developer to ensure their efficient operation and maintenance.

The activities that take place during the operation phase will not have a significant effect on the receiving watercourses.

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