6 WATER

6.1 INTRODUCTION

This chapter describes the existing hydrological and hydrogeological characteristics at the development lands associated with the proposed development of the Kilcumber Bridge 110kV substation. The surface water features and characteristics are described, as well as the site drainage and groundwater. An impact assessment was carried out to determine whether the project poses a significant impact to the hydrology and hydrogeological aspects of the environment and to propose mitigation measures to reduce any potential negative impact of the proposed development.

6.1.1 Scope of assessment

1. Establish the baseline conditions on site;
2. Identify the impacts on surface and groundwater of the proposed development during construction and operation;
3. Identify and develop mitigation measures to avoid, reduce or eliminate significant impacts;
4. Identify any significant residual impacts, effects and possible cumulative impacts after mitigation measures are implemented.

6.1.2 Methodology

An examination of the existing hydrological regime and an assessment of the potential impact of the proposed substation on the hydrological regime has been undertaken through a combination of a desktop study of hydrological resources and site-specific fieldwork (including a site walkover, water sampling and field measurements).

6.1.2.1 *Desk study*

A desktop study involving a review of all available information, datasets and documentation sources pertaining to the site's natural environment was completed. The study involved the following:

- Examination of maps and aerial photography to identify any hydro features, and site topography and slope;
- Determination of the catchments and drainage regime on the site and downstream from the site;
- Review of legislation including the Water Framework Directive and all previous water quality legislation along with the River Basin Management Plan for Ireland 2018 - 2021;
- Review of existing water quality data, chemical and biological, available from the EPA;
- Review of rainfall data for the area and at the site;
- Review of Water Framework Directive datasets, reports and maps;
- Examination of the Geological Survey of Ireland (GSI) online datasets pertaining to hydro-geology features such as aquifers, wells, groundwater bodies and groundwater protection schemes;
- Examination of National Parks and Wildlife Service (NPWS) nature conservation designations; and
- Preparation of catchment and other site maps.

6.1.2.2 *Site Walkover and Investigations*

A site walkover was undertaken in the summer of 2020 on the proposed development site. Field work also involved site walkovers followed by water sampling and analysis during the Environmental

Impact Assessment (EIA) for the Cushaling Wind Farm which included the area of the Kilcumber Bridge 110kV substation. The water sampling and analysis was undertaken during the Cushaling Wind Farm EIA during 2019 and is reported in this assessment. Field work includes:

- A walkover survey of the site to identify hydrological features on site, wet ground, drainage patterns and distribution, exposures, and drains;
- Measurement of slope inclination and mapping of significant features;
- Confirmation of the site catchments and drainage regime, and any hydrological buffers to be implemented;
- Field hydrochemistry measurements in-situ, using the YSI multi-parameter probe, to determine pH, Total Dissolved Solids, Electrical Conductivity, Dissolved Oxygen, Temperature; and
- The collection of water samples for laboratory analysis for select quality parameters (Suspended Solids, Nitrate as NO_3-N, Nitrite as NO_2-N, MRP, Phosphorous)

6.1.3 Assessment Criteria

The results of water sampling and analysis are compared to Environmental Water Quality Standards as set out in the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations 1989. It must be noted that these standards are used for comparative purposes only as the surface water is not for human consumption. The results have also been assessed against the surface water limits as outlined in S.I No. 293/1988 European Communities (Quality of Salmonid Waters) Regulations, 1988. All water quality analysis must be considered in the wider context of the Water Framework Directive.

In addition to the methodology outlined in Section 6.1.2, the sensitivity of water environment receptors was assessed upon completion of the desk and baseline study. **Table 6-1** outlines the levels of sensitivity that are used to assess any potential effects of the proposed development.

Table 6-1 Receptor sensitivity criteria as outlined by EPA

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

6.1.3.1 *Legislative Context*

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

Regard has also been taken of the requirements of the following legislation:

- Planning and Development Acts 2000-2017;
- Planning and Development Regulations, 2001 (as amended);
- S.I. No 296 of 2018: S.I. No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (transposes the provisions of Directive 2014/52/EU into Irish Law);
- S.I. No. 94 of 1997: European Communities (Natural Habitats) Regulations, resulting from EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293 of 1988: Quality of Salmon Water Regulations, resulting from EU Directive 78/659/EEC on the Quality of Fresh Waters Needing Protection or Improvement in order to Support Fish Life;
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 and S.I. No. 722 of 2003 European Communities (Water Policy) Regulations which implement EU Water Framework Directive (2000/60/EC) and provide for implementation of 'daughter' Groundwater Directive (2006/118/EC). Since 2000, water management in the EU has been directed by the Water Framework Directive (WFD). The key objectives of the WFD are that all water bodies in member states achieve (or retain) at least 'good' status by 2015. Water bodies comprise both surface and groundwater bodies, and the achievement of 'Good' status for these depends also on the achievement of 'good' status by dependent ecosystems. Phases of characterisation, risk assessment, monitoring and the design of programmes of measures to achieve the objectives of the WFD have either been completed or are ongoing. In 2015 it will fully replace a number of existing water related directives, which are successively being repealed, while implementation of other Directives (such as the Habitats Directive 92/43/EEC) will form part of the achievement of implementation of the objectives of the WFD;
- S.I. No. 41 of 1999: Protection of Groundwater Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 249 of 1989: Quality of Surface Water Intended for Abstraction (Drinking Water), resulting from EU Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States (repealed by 2000/60/EC in 2007);
- S.I. No. 439 of 2000: Quality of Water intended for Human Consumption Regulations and S.I. No. 278 of 2007 European Communities (Drinking Water No. 2) Regulations, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009;
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010; and,

- S.I. No. 296 of 2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009.

6.1.3.2 *Evaluation and impact assessment categorisation*

The method of impact assessment and prediction follow the EPA (2017) Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports, as amended with a view towards facilitating compliance with EIA Directive 2014/52/EU.

6.1.3.3 *Key guidance*

The assessment was prepared with regard to the NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydro-geology for National Road Schemes (NRA, 2005) and the EPA (2002) Guidelines on the information to be contained in Environmental Impact Assessment Reports, as well as the latest draft guidelines (2017).

Guidance highlighting good practice applicable to the project is as follows:

- The Code of Best Forest Practice and the Forestry and Water Quality guidelines[1]
- Control of water pollution from linear construction projects. Technical guidance (C648) 234pp. CIRIA, UK (Murnane *et al.* 2006)
- '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes'* (NRA, 2008)
- '*Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters'* (IFI, 2016)
- *'CIRIA B14 Design of Flood Storage Reservoirs'* (Hall *et al*. 1993)
- '*River Crossings and Migratory Fish: Design Guidance'* (Scottish Executive, 2012)

6.1.3.4 *Surface water quality*

The Quality Rating (Q) System is the standard biotic index which is used by the EPA. The Q-index is a quality measurement ranging from Q1 to Q5 with Q1 being of the poorest quality and Q5 being pristine/unpolluted. The Quality Rating System has been shown to be a robust and sensitive measure of riverine water quality and has been linked with both chemical status and land-use pressures in catchments. The system facilitates rapid and effective assessment of the water quality of rivers and streams. There are nine Q-value scores, ranging from 1 to 5 (intermediate scores such as Q4–5 are also possible). High ecological quality is indicated by Q5, Q4–5 while Q1 indicates bad quality.

[1] The Code of Best Forest Practice is a listing of all forestry operations and the manner in which they should be carried out to ensure the implementation of sustainable forest management in Ireland, as agreed at the Third Ministerial Conference on the Protection of Forests in Europe, Lisbon, 1998.

https://www.agriculture.gov.ie/media/migration/forestry/publications/codeofbestforestpractice/Code%20of%20Best%20Forest%20Prac%20Part%201.pdf

6.1.3.5 *Groundwater vulnerability*

Groundwater Vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability maps are based on the type and thicknesses of subsoils (sands, gravels, glacial tills (or boulder clays), peat, lake and alluvial silts and clays), and the presence of karst features. Groundwater is most at risk where the subsoils are absent or thin and, in areas of karstic limestone, where surface streams sink underground at swallow holes. All land area is assigned one of the following groundwater vulnerability categories, as presented in the GSI vulnerability mapping guidelines and shown in **Table 6-2** below.

Table 6-2 Vulnerability Mapping Guidelines (Adapted from GSI)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High Permeability (sand/gravel)	Moderate Permeability (e.g. Sandy subsoil)	Low Permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	
Extreme (E)	0-3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	30m radius
High (H)	>3.0m	3.0 – 10.0m	3.0 – 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 – 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes:

(1) N/A = not applicable

(2) Precise permeability values cannot be given at present

(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

6.1.3.6 *Sensitivity, Impact Assessment and Significance*

An impact rating has been developed with reference to ‘Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2005). This document deals with major infrastructure developments and the assessment guidance is therefore deemed appropriate to the current project. The sensitivity of the receiving hydrological environment was identified. The sensitivity of an environmental receptor is based on its ability to absorb an impact without perceptible change. Then the magnitude of the potential hydrological impact was estimated. The sensitivity rating, together with the magnitude of the potential impact, provides an overall rating of the significance of the impact prior to application of mitigation measures.

The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the potential impact. The magnitude criteria for hydrological impacts are defined as set out in **Table 6-3**.

Table 6-3 Assessment of Magnitude of Hydrological Impact (Adapted from NRA, 2005)

Magnitude	Criterion	Description and Example
Major	Loss of attribute	Long term changes to the geology, hydrology, water quality and hydrogeology, e.g., loss of EU-designated salmonid fishery: change in water quality status of river reach loss of flood storage/increased flood risk, pollution of potable source of abstraction
Moderate	Impact on integrity of attribute or loss of part of attribute	Short to medium term changes to the geology, hydrology, water quality and hydrogeology: loss in productivity of a fishery contribution of significant sediment and nutrient quantities in the receiving water, but insufficient to change its water quality status
Minor	Minor impact on attribute	Detectable but non-material and transitory changes to the geology, hydrology, water quality and hydrogeology - measurable change in attribute, but of limited size and/or proportion
Negligible	Impact on attribute but of insufficient magnitude to affect the use/integrity	Do perceptible changes to the geology, hydrology, water quality and hydrogeology: discharges to watercourse but no loss in quality, fishery productivity or biodiversity, no increase in flood risk

Potential impacts are assessed as being of major, moderate, minor or negligible significance as shown in **Table 6-4.**

Table 6-4 Significance of Criteria

Magnitude	Sensitivity			
	Very High	**High**	**Medium**	**Low**
Major	major	major	moderate	minor
Moderate	moderate	moderate	moderate	minor
Minor	minor	minor	minor	negligible
Negligible	negligible	negligible	negligible	negligible

6.1.4 Statement on Limitations and Difficulties Encountered

There were no limitations or difficulties encountered with this assessment.

6.1.5 Competency of Assessor

This Water Chapter has been prepared by Graeme Thornton. Graeme is an environmental scientist with over seventeen years' experience in environmental assessment. He has particular experience in acting as environmental lead on several greenfield, construction and operational phase projects.

6.2 EXISTING RECEIVING ENVIRONMENT

6.2.1 Site and project context

The site is currently an agricultural field and is in a rural location. It is accessed via the R401 which is adjacent to the site. To the northeast of the site there is the R401 and the Edenderry power station, which is 80m to the north east of the site. The land to the south, west and north of the site is made up of agricultural fields and cutaway peatland. The topography of the site is relatively flat and is at an elevation of approximately 67 metres above Ordnance Datum (mOD).

The Figile River is approximately 70 meters to the east of the substation. The grid connection route crosses over agricultural fields as well as the River Figile. The site generally drains towards the River Figile, which is within the Barrow River Basin District (RBD). The field boundaries consist of hedgerows with land drains that direct drainage towards the River Figile.

The entire development is within the catchment of the Figile River which is a tributary of the River Barrow (**Figure 6-1**).

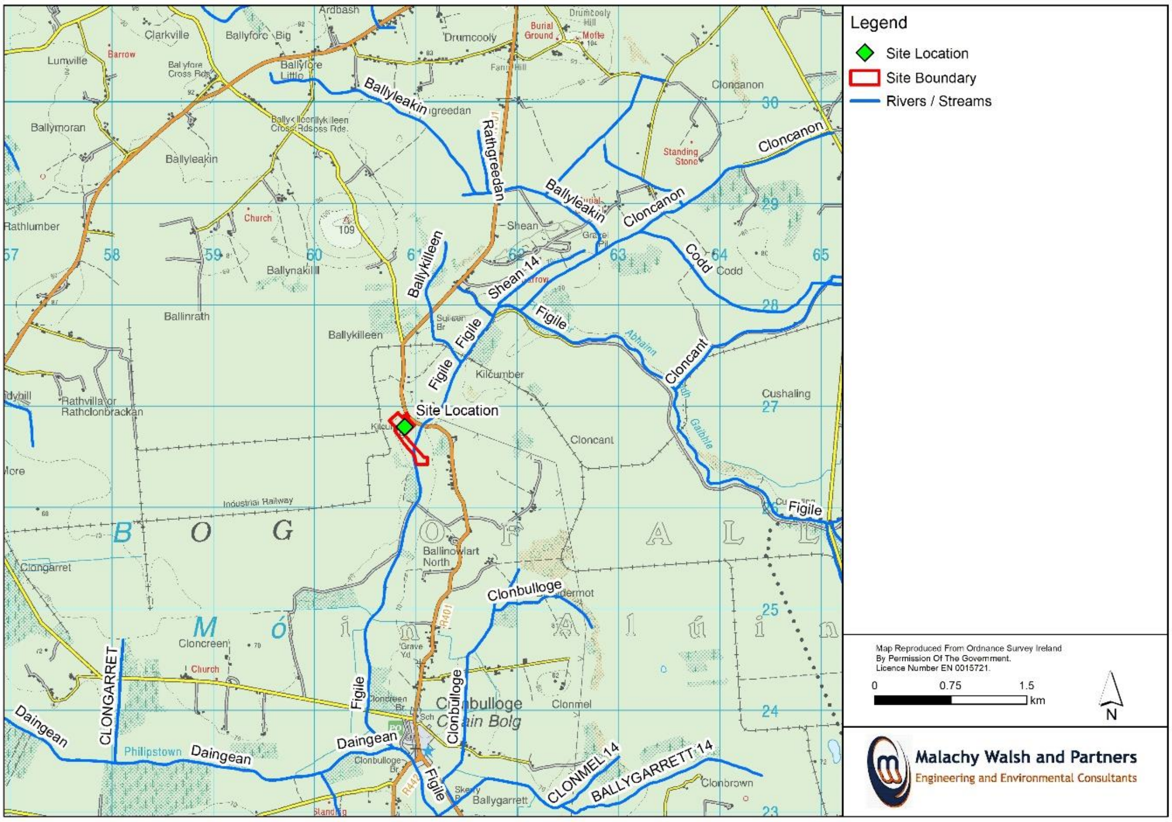

Figure 6-1 – Watercourses

6.2.2 Surface Hydrology

6.2.2.1 *Surface water features*

The proposed development site is located within the South Eastern River Basin District and WFD River Sub Basin FIGILE_040. The WFD sub-catchment is FIGILE_SC_020. The main river at the site is the River Figile which drains to the River Barrow and has a catchment area of 73.30 km^2 upstream of the western site boundary (**Figure 6-2**).

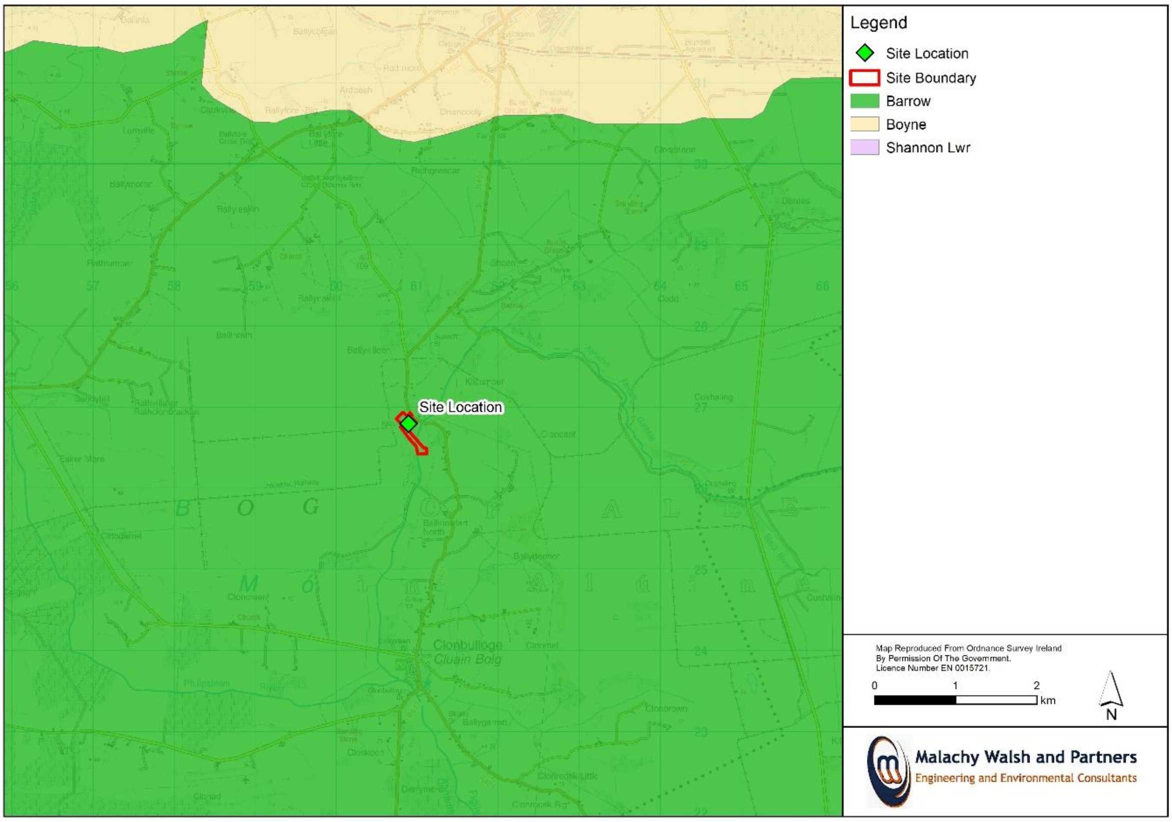

Figure 6-2 – River Basin Catchments

6.2.2.2 *Drainage*

The fields at the proposed development site are wet most likely due to peaty soils that are not free draining. The drainage at the site consists of land drains within the hedge rows. These land drains can fill up in wet weather and then dry out in dry weather. **Figure 6-3** below shows the land drains as they follow the hedgerows. All the land drains direct the flow in a south easterly direction to the River Figile.

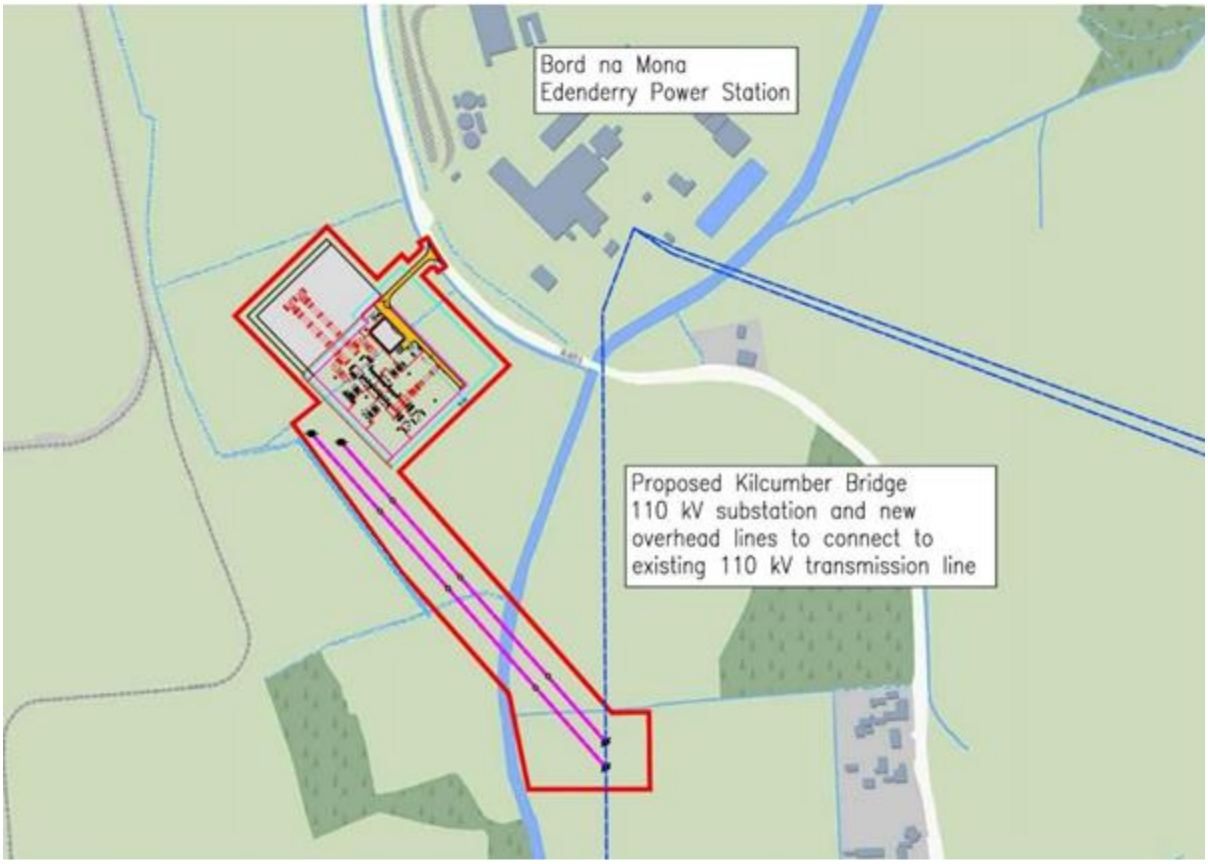

Figure 6-3 Site drainage layout

6.2.2.3 *Biological Water Quality*

The River Figile is monitored by the EPA at five locations upstream of the proposed development site. The river contains a further two monitoring stations along the reach that runs east to west, adjacent to the permitted Cushaling Wind Farm, with three more monitoring stations downstream as the River Figile meets the Cushina River at Clonbulloge. The River Figile received a status of Q3-4[2] Moderate in a 2017 survey. The EPA monitoring stations, for which accompanying Q-Values are known, have been included in **Table 6-5** below.

There are currently two water monitoring stations on the River Figile near to the proposal site. These are the Cushaling Bridge (RS14F010100) about 6km upriver and the adjacent Kilcumber Bridge (RI14F010180), both which were rated Q3-4 in 2017. There is one station further upstream (NE) of the proposed development site at the bridge South of Ticknevin Bridge (RS14F010070), where biological water quality was rated Q3 in 2017. There are three active monitoring stations located downstream (SW) of the proposed development site: Bridge in Clonbulloge (RS14F010300); Derrygarran Bridge (RS14F010400) and Ardra Bridge (RS14F010500). Biological water quality at these locations was rated Q4 in 2017.

The following is the most recent EPA assessment of the Figile River based on the 2017 results: Unsatisfactory ecological conditions persisted in the upper reaches (0050, 0100, 0200) of the Figile River in August 2017. The downstream stations at Clonbulloge Br. (0300), Andra Br. (0500) and Derrygarran Br. (0400) remained in satisfactory condition.

[2] http://gis.epa.ie/Envision [Accessed 11/06/2019]

Table 6-5 River water quality at EPA stations at the River Figile when most recently surveyed in 2017

Station Name/Location	Station ID	Q-rating	Corresponding WFD status
BR south of Ticknevin Bridge	RS14F010050	Q3	Poor
Cushaling Bridge	RS14F010100	Q3-4	Moderate
Kilcumber Bridge	RS14F010200	Q3-4	Moderate
Figile – Bridge in Clonbulloge	RS14F010300	Q4	Good
Derrygarran Bridge	RS14F010400	Q4	Good
Ardra Bridge	RS14F010500	Q4	Good
1 km upstream Barrow River confluence	RS14F010600	-	-

A biological water quality assessment was carried out at five locations on the River Figile as part of the Cushaling Wind Farm environmental impact assessment in 2019. The assessment sites (1 to 5) are shown in **Figure 6-4** below. The Kilcumber Bridge 110kV substation as it is located adjacent to Site 1. The biotic indices based on this assessment are provided in Table 6-6 below.

Table 6-6 Biological water quality at the aquatic sites on the Figile River (BMWP site specific scores applied).

	Site 1	Site 2	Site 3	Site 4	Site 5
Q-Value	3	3-4	3	3-4	3
EPT	3	6	3	9	5
WFD status	Poor	Moderate	Poor	Moderate	Poor
BMWP category	Good	Very good	Moderate	Very good	Good
BMWP interpretation	'Clean but slightly impacted'	Unpolluted, unimpacted	Moderately impacted	Unpolluted, unimpacted	'Clean but slightly impacted'

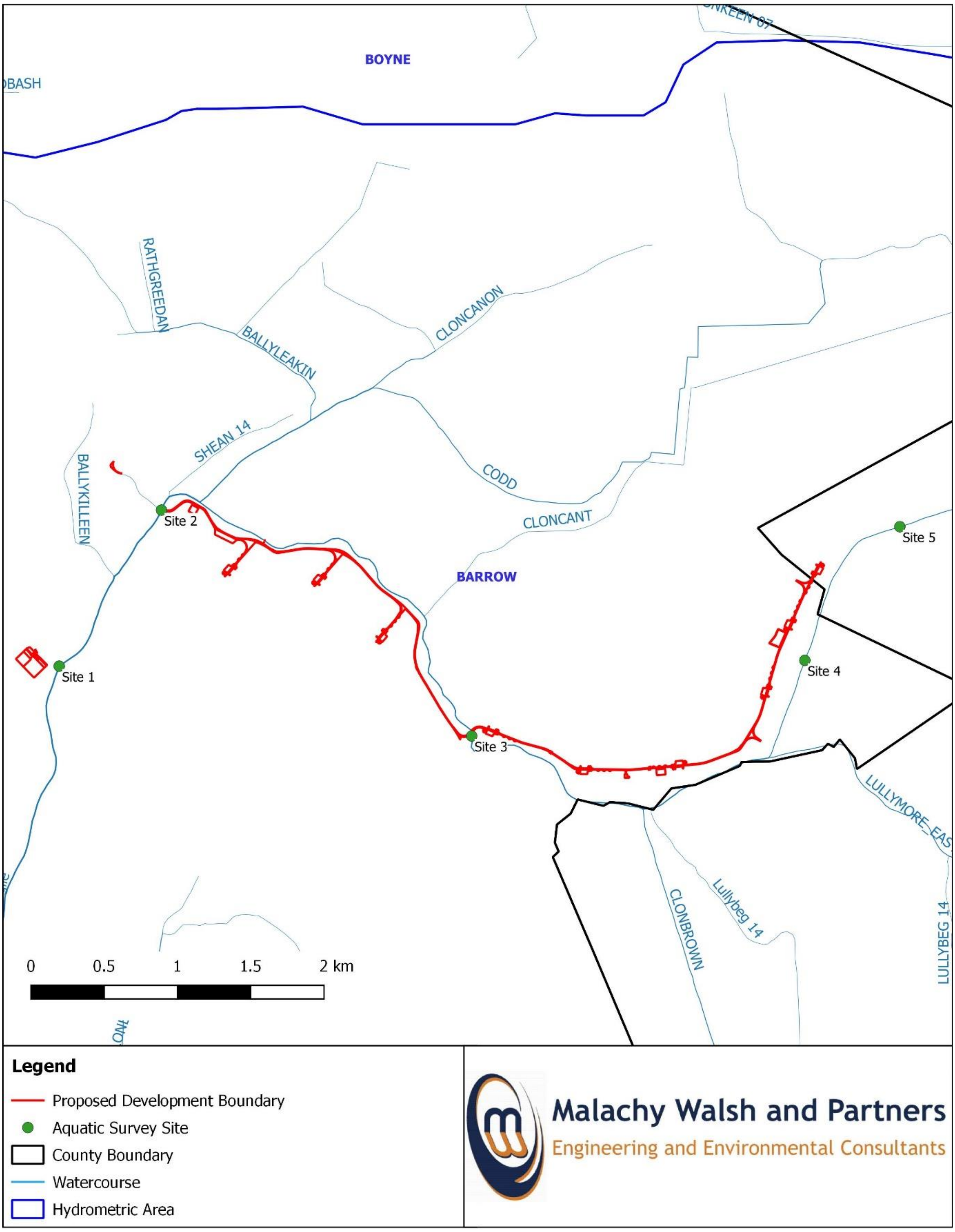

Figure 6-4 – Aquatic Survey Sites for the Cushaling Wind Farm with site 1 adjacent to the Kilcumber Bridge 110kV substation

6.2.2.4 *Physico-chemical water quality*

Table 6-7 below shows the results obtained for the physio-chemical characteristics of each site (1-5). No site achieved 'high' status in relation to the Water Framework Directive's requirements for BOD, Total Ammonia and Orthophosphate. Site 4 achieved 'good' status for its BOD reading as it met the required mean value. Conversely, no other site met the desired mean values for any of the chemical parameters specified. All sites did however qualify as 'good' status using 95%ile criteria.

BOD serves as an indicator of the presence of organic matter in a watercourse (eutrophication) and is a useful measure of water quality. BOD results were relatively consistent in all sites with the exception of site 2 which was slightly more elevated at 2.4mg/L which was just under the 95%ile margin of ≤2.6mg/L. Ammonium and total ammonia both showed an exact consistency across all sites. Orthophosphate is the most readily available form of nutrient for plant uptake. Elevated levels of this chemical can have a detrimental effect on aquatic life. The orthophosphate levels for the surveyed sites were higher than desirable and did not meet the 'good' quality status requirements in relation to the mean value but did so using the 95%ile value. Nitrate and nitrite values were higher than the guiding values given by the EPA.

Table 6-7: Physico-chemical characteristics for each location sampled at the River Figile

Parameter	Unit	Site				
		1	2	3	4	5
Ammonium	mg/L NH_4	<0.129	<0.129	<0.129	<0.129	<0.129
BOD	mg/L	1.6	2.4	1.7	1.5	1.7
COD	mg/L	42	44	47	41	39
Ortho-Phosphate (as P)	mg/L P	<0.065	<0.065	<0.065	<0.065	<0.065
Total Ammonia	mg/L N	<0.1	<0.1	<0.1	<0.1	<0.1
Total Hardness	mg/L $CaCO_3$	305	295	309	322	330
Total Organic Carbon	mg/L	21	23	23	21	20
Total Phosphorous (as P)	mg/L P	<0.075	<0.075	<0.075	0.08	<0.075
Total Suspended Solids	mg/L	<10	<10	<10	<10	<10
Total Dissolved Solids	mg/L	440	364	399	448	438
Nitrate (as NO_3)	mg/L NO_3	6.1	6.0	6.3	9.2	9.4
Nitrite (as NO_2)	mg/L NO_2	0.051	0.060	<0.05	<0.05	0.054

6.2.2.5 *Surface water sensitivity*

Watercourse sensitivity has been derived from the biological ratings attained during the on-site investigations and EPA biological water quality results. It is considered that all surface waters within and near the site are of low to moderate sensitivity as indicated by the Biotic Indices of Q3 and Q3-4 at the surveyed sites.

6.2.3 Groundwater

6.2.3.1 *Groundwater body*

According to the Geological Society of Ireland (GSI), the proposed substation site is underlain by both the Cushina Groundwater Body and the Rhode Ground Water Body (See **Figure 6-5**).

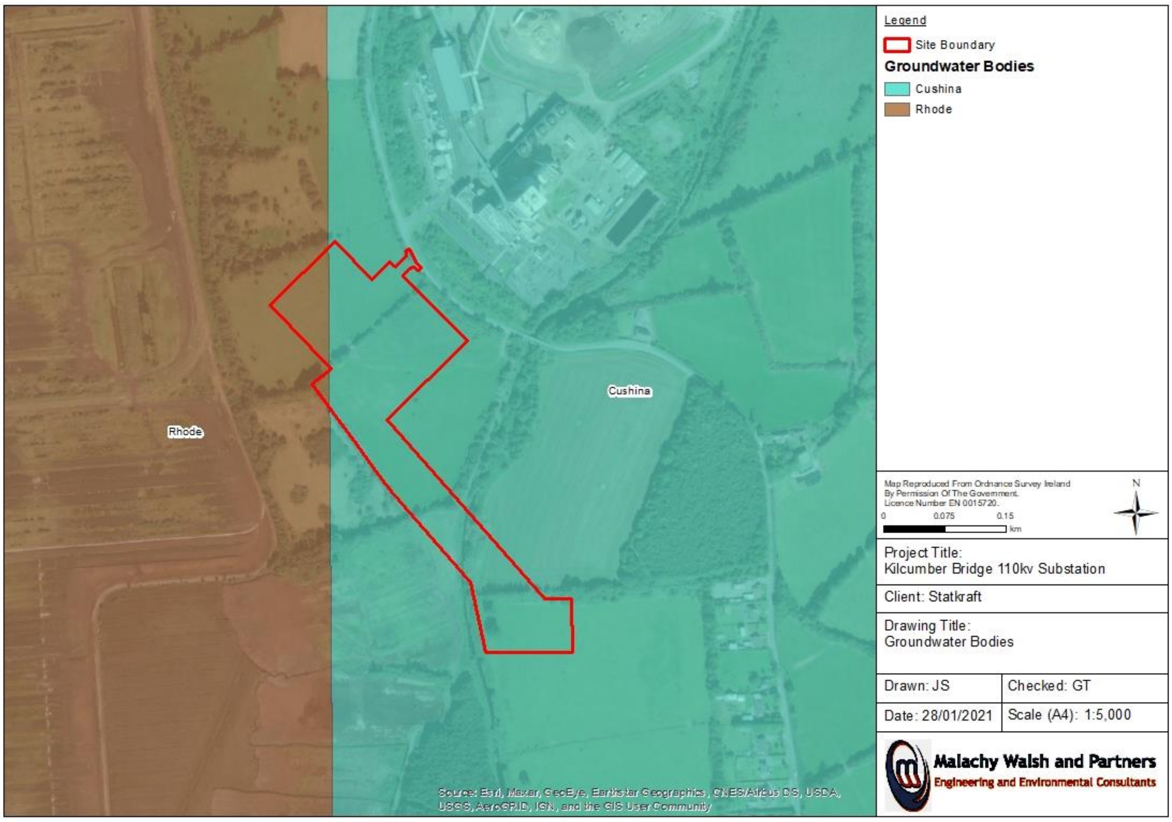

Figure 6-5 Groundwater bodies (From GSI data)

6.2.3.2 *Aquifer classification*

An aquifer is defined as a geological formation that is capable of yielding quantities of water. While most rock types are aquifers, their supply varies. Geological strata are categorised for hydrogeological purposes as Major Aquifers (Regionally Important), Minor Aquifers (Locally Important) or Unproductive Rocks (Poor Aquifers/Aquitards).

The aquifers under the substation are classified by the GSI as a *Locally Important Aquifer – Bedrock which is Moderately Productive Only in Local Zones* (Cushina) and *Locally Important Aquifer – Bedrock which is General Moderately Productive* (Rhode). Refer to **Figure 6-6** for aquifer classification.

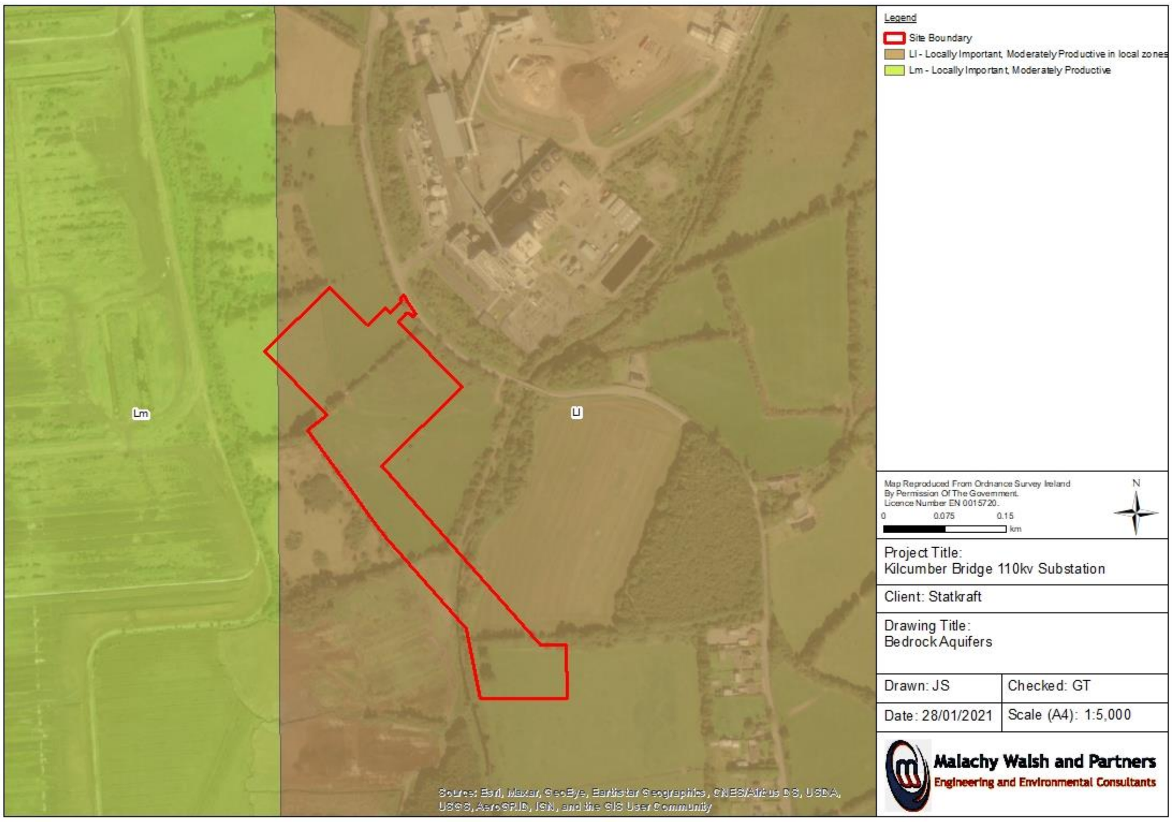

Figure 6-6 Groundwater aquifers (From GSI data)

6.2.3.3 *Abstraction*

The Clonbulloge Public Supply Source Protection Area (SO) is located two kilometres due south of the proposed development. Within this area there is a public supply abstraction well located adjacent to the east bank of the Figile River on the western outskirts of Clonbulloge Village. This has an abstraction rate of 300 to 320 m^3/day. There are two borehole wells in the townland of Cloncant about 0.5 kilometre to the east of the proposed development. Both of these wells have a GSI yield class of 'Poor'. There may be other unmapped local wells for domestic or farming use.

6.2.3.4 *Groundwater sensitivity*

The peaty soil in the study area has a generally low permeability and therefore acts as a confining layer, preventing the free movement of surface water to the underlying aquifer within the bedrock. The groundwater recharge is 18 mm/year which is within the lowest category of National Groundwater Recharge Ireland values (1-50 mm/year).

The vulnerability of the groundwater is described by the GSI as *Low* in the area west of the site within the cut peat area, *Moderate* in the area under the substation, and *High* under the eastern area of the substation and the eastern bank of the River Figile. The ground water vulnerability of the site is illustrated in **Figure 6-7**.

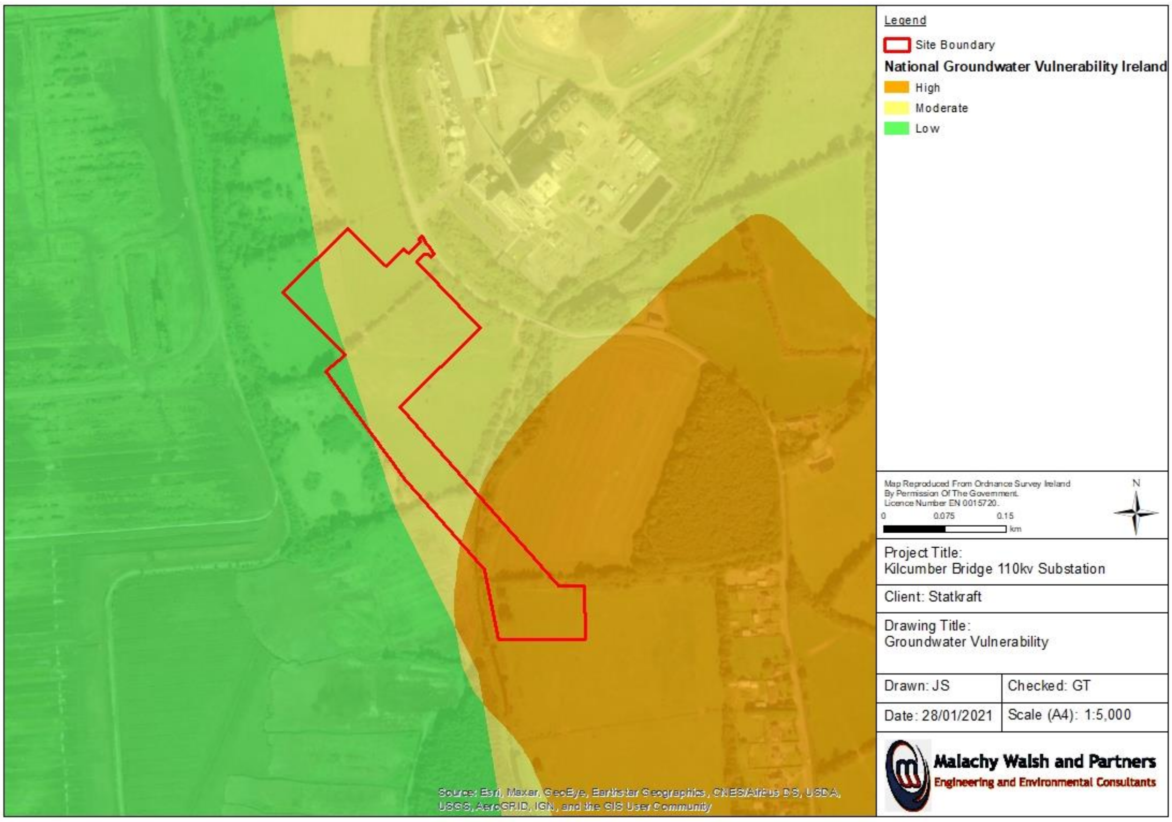

Figure 6-7 Groundwater vulnerability (From GSI data)

6.2.4 Do-Nothing Scenario

The land in study area comprises of agricultural grassland with land drains. It would remain as low intensity agricultural land with low impact on the water in the area.

6.3 LIKELY SIGNIFICANT EFFECTS

6.3.1 Construction Phase

During the construction period, the development has the potential to lead to temporary impacts on hydrology and water quality unless appropriate mitigation is applied. The site has already been drained by manmade drainage channels created as part of the agricultural improvement of the fields.

The depth of groundwater table drawdown will generally be insignificant at the substation area as no major excavations are planned, instead the ground level will be raised by about 1-1.6m through the importation of rock onto the site.

Localised drawdown of the water table may occur as a result of excavation for the pylon foundations. This localised drawdown will only be the same depth of the foundation excavations which would be about 1 meter.

The subsoil has low permeability and the groundwater vulnerability is low to high, resulting in a moderate risk of groundwater contamination. Mitigation measures will be put in place to create a low level of contamination risk to groundwater.

The following are the potential impacts on hydrology due to the construction of the substation and associated infrastructure:

- Excavation of topsoil and subsoils could lead to an increase in suspended solids in the surface water run-off and from minor quantities of exposed mineral soils. The removal of the vegetated material will also lead to an increase in the rate of run-off at the substation. This increase in the rate of run-off could lead to a very minor increase in flooding downstream.
- The increase in the rate of surface water run-off due to the increase in hard surface areas as a result of the development could lead to a very minor cumulative risk of flooding downstream.
- Inappropriate site management of excavations could lead to loss of suspended solids to surface waters.
- The construction of new infrastructure has the potential to obstruct existing overland flow.
- Inappropriate management of spoil heaps could result in accidental break outs of silt on site leading to the loss of suspended solids to surface waters.
- Use of machinery during construction could result in spillages of fuel, oils, lubricants and other hydrocarbons to surface waters, with potentially adverse impacts on local groundwater quality and surface water quality in downstream areas. A film of oil on a waterbody can prevent gaseous exchange and prevent re-oxygenation, with deleterious effects on aquatic ecology.

6.3.2 Operational Phase

The main potential hydrological impact of the development is a slight increase in run-off from a storm event to the River Figile due to the change in land use resulting in an increase in impermeable ground conditions. The substation building and entrance road contain impermeable ground. The time of concentration of surface water flows will decrease as a result of the additional hard-surfaced areas resulting in additional flows being discharged to the drains adjacent to the substation during rainfall events. However, the potential increase in runoff rate may be negligible because of the low permeability of the existing surface. Also the large amount of hardcore rock that will make up the majority of the substation compound will be permeable and will have a small effect of slowing rainwater and holding water on its surface area thought the depth of rock.

It is not envisaged that the maintenance activities taking place at the substation will give rise to any significant impacts on the hydrological regime of the area.

The flood risk assessment (**Appendix 3**) shows a 1 in a 100 year flood event level below the footprint of the substation so there is no impact on downstream flooding during this event.

6.3.3 Decommissioning Phase

Decommissioning is not relevant as the Kilcumber Bridge 110kV substation will become a permanent node on the Irish electrical grid.

6.3.4 Summary of unmitigated impacts on sensitive receptors

A summary of unmitigated potential impacts on surface waters due to the proposed development is provided below in **Table 6-8**. It can be observed that some activities during construction if unmitigated, could have a significant effect on receiving watercourses, particularly the risk of sedimentation of sensitive catchments. Operation and maintenance activities are not expected to have a significant effect on the receiving watercourses.

Table 6-8 Summary of potential hydrological impact significance on sensitive receptors

Activity		Potential Impact	Receptor	Sensitivity	Prior to mitigation	
					Magnitude	**Significance**
Site Preparations	Excavation of topsoils and subsoils for substation and grid connection	Erosion and sedimentation	River Figile	Moderate	Moderate	Minor
Construction	Site access road and substation construction	Increase in rate of run-off from hard surfaces	River Figile	Moderate	Minor	Minor
Construction	Site access road, substation and grid connection construction	Erosion and sedimentation	River Figile	Moderate	Moderate	Minor
Construction	Spillages of fuels, oils and other hydrocarbons during construction	Hydrocarbon pollution	River Figile	High	Minor	Moderate
O & M	Access tracks and substation	Increase in rate of run-off	River Figile	Moderate	Minor	Minor

6.3.5 Risk of major accidents and disasters

No risk of major accidents or disasters has been identified as part of the preparation of this chapter. The catchment contributing to the river system is very flat and not subject to sudden increases in flow rate or in flood levels. The flood levels were established in the Flood Risk Assessment (**Appendix 3 of this EIAR**) and show the proposed development will not be affected by flood. The development proposals, during both the construction and operational phases will not incur an increased risk of accidents or disasters.

6.3.6 Cumulative effects

A cumulative impact arises from incremental changes caused by other past, present or reasonably foreseeable actions together with the proposed development. The projects considered in relation to the potential for cumulative effects include those listed below:

- Cushaling Wind Farm - Permitted
- Mount Lucas Wind Farm – Operational
- Yellow River Wind Farm - Permitted
- Cloncreen Wind Farm - Permitted
- Edenderry Power Plant - Operational
- Peat Extraction - Ongoing

Evaluation of the cumulative impacts must also assess the potential linkage pathways with nearby permitted/operational developments and activities relative to their shared receptors. There are potential cumulative hydrological impacts within the Figile River catchment from the drainage systems in neighbouring wind farms. It is not envisaged that there would be an increase in flood risk due to the presence of the wind farms. There is potential for an increase in the total sediment entering the downstream river system. However, because the operating and permitted wind farms include mitigation measures, the overall cumulative risk of an increase in sedimentation or pollution is anticipated to be low. Overall, the potential for significant cumulative impacts on water arising from the proposed development and permitted and planned wind farms in the region is considered to be negligible.

6.4 MITIGATION

The following elements of mitigation have been incorporated into the design of the project which has been outlined in detail in **Chapter 2** of this EIAR. A Construction and Environmental Management Plan (CEMP) has been prepared for the project and is included as **Appendix 4**. The CEMP will be prepared to collate and manage the proposed and agreed mitigation measures, monitoring and follow-up arrangements and management of impacts. A CEMP provides a commitment to mitigation and follow-up monitoring; and reduces the risk of pollution and improves the sustainable management of resources. Environmental protection measures will include:

- Siltation and erosion control
- Management of excavated soils and excavated materials
- Fuel management
- Invasive species management

Best practice approaches will be deployed with regard to all activities including the following:

- Drainage
- Dewatering
- Cement Bound Granular Mixtures (CBGM)
- Accidental spillages

The proposed development will be constructed with cognisance of the guidelines listed in Section 6.1.3.3 to achieve the above. The design of proposed drainage for the proposed development aims to maintain a continuity of existing flows and to manage the discharges at source where possible. A 50m buffer was applied to streams and lakes shown on the 1:50,000 OSI maps at the design phase, and used as a constraint for substation location.

Mitigation measures for surface and groundwater are proposed below. Given that surface and groundwater hydrology is inextricably linked, protection of surface waters in the affected catchments will also help protect groundwater bodies in the study area.

6.4.1 Construction Phase

6.4.1.1 *River crossing*

The River Figile will be crossed by the overhead line (OHL) grid connection. Construction works are designed to be minimal near the river and only require the installation of wooden poles for the OHL. The riparian border will be retained at the River Figile.

6.4.1.2 *Drains*

Rainwater falling on the hardcore rock areas of the compound will filter through the rock into the soils below. The existing land drains will be utilised during the construction phase. Runoff from the construction works will naturally enter the existing land drains. The risk of increase in the rate of run-off and suspended solids release will be mitigated will the following measures;

- Maintenance of the existing vegetative land drains in order to keep them vegetated.
- Where the drains have a gradient greater than 2%, check dams will be installed in the drains.
- Where each land drain exits the proposed development a double silt trap will be placed. Each silt trap will be made up of a stone or straw dam combined with a silt fence. See **Figure 6-8** below for the location of the silt traps

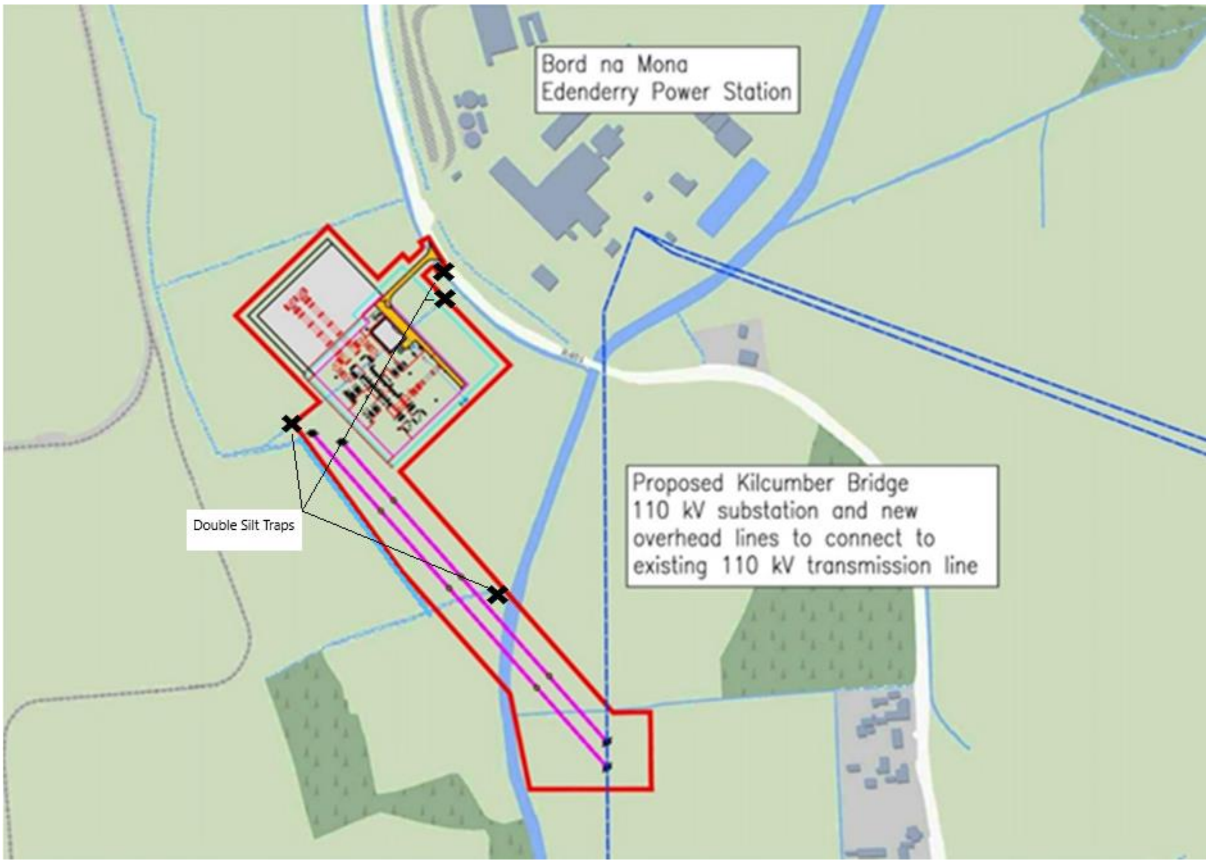

Figure 6-8 Silt trap locations

6.4.1.3 *Sediment Control*

Prior to any construction activity, the site will be inspected for areas that would be prone to siltation of the nearby River Figile. Existing pollution prevention measures (vegetation in drains, check dams and silt ponds) will be maintained / upgraded to ensure optimum standard of water running into the River Figile from the land drainage system.

The control of sediment will be carried out by the measures as outlined in section 6.4.1.2 Drains above. In addition the following mitigation measures will be used;

- Additional silt fencing and emergency spill kits will be kept on site for use in emergencies.
- Continuation of flows by natural flow paths via existing drains before entering the watercourse, providing further retention and treatment of discharges.

Prior to and during construction works, operations will be monitored by a competent member of the construction team on a regular basis to check if working appropriately.

6.4.1.4 *Concrete Control*

During the pouring of concrete, effective containment measures will be implemented to avoid spilling concrete outside construction areas and to prevent concrete entering any drainage system. To reduce the potential for cementitious material entering watercourses, concrete pours will be supervised by the Construction Manager. The construction manager will ensure that the area of the pour is completely drained of water before a pour commences. Pours will not take place during forecasted heavy rainfall.

There will be a dedicated concrete chute washout area on site. Concrete trucks will be washed out off site at the source quarry. Wet concrete operations are not envisaged for this site within or adjacent to watercourses or aquatic zones. However, if wet concrete operations are required in such locations, a suitable risk assessment will be completed prior to works being carried out.

6.4.1.5 *Storage areas*

Temporary storage of cement bound granular mixtures will be on hardstand compound area. Cement products are hazardous and should always be stored in a COSHH store or similar (shipping container), and only be in the open when in use. If cement products are temporarily located in the open, then they will be located within an impermeable bunded area and covered to prevent contact with rainwater. This will prevent direct drainage of cement storage areas to surface waters. Bunding will be in the form of sandbags or silt fencing.

Excavated topsoil and subsoil will be stored onsite for reuse. Temporary stockpiles of soils will not be permitted within 50m of any watercourse.

Any diesel or fuel oils stored on site will be protected by a bund with 110 % of the capacity of the storage tank.

6.4.1.6 *Plant and refuelling*

Only qualified persons shall operate machinery or equipment. Machinery and equipment shall be checked on a regular basis to ensure they are working properly (no oil/fuel leaks etc.). No refuelling shall take place within 50m of any watercourse. Fuel will be stored in doubly-bunded bowsers or in bunded areas at the site compound. Plant nappies and spill kits will be readily available on plant equipment or when working with fuel operated heavy tools. To mitigate against sources of contamination, refuelling of plant and vehicles will only take place within designated areas of the site compound or in other areas specifically designated for this purpose. Only emergency breakdown maintenance will be carried out on site. Appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site.

A suitable permanent fuel and oil interceptor shall be installed to deal with all substation surface water drainage. Temporary petrol and oil interceptors will be installed at the site compound for plant repairs/storage of fuel/temporary generator installation.

6.4.1.7 *Waste*

A dedicated storage area will be provided at the site compound for building materials such as cables, geotextile membranes, blocks, tools and equipment, fence posts and wire, booms, pipes etc. A Waste Management Plan will be prepared by the Appointed Project Contractor for the construction phase. This will be prepared with reference to 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects' (DoEHLG, 2006).

Any material deemed unsuitable for re-use in the works will be transported off site in trucks and disposed of under license from Offaly County Council. This will prevent any contaminated run-off to drains adjacent to access tracks during heavy rainfall.

All personnel working on site will be trained in pollution incident control response, and an emergency response plan will be prepared as part of the CEMP.

6.4.1.8 *Monitoring*

Daily visual monitoring of the drainage system will occur in order to ensure it is working properly. During the construction phase of the project, a surface water monitoring schedule, drawn up prior to construction, and agreed with the county council will be followed. Suspended solids monitoring will be undertaken on a weekly basis and ad-hoc if required (rainfall event for example), while monthly monitoring of pH, metals, nitrates and phosphates will also take place.

6.4.1.9 *Environmental Manager*

A Construction Environmental Management Plan (CEMP) will be developed and will be implemented during construction works providing a commitment to water quality mitigation and follow-up monitoring, reducing the risk of pollution and improving the sustainable management of resources.

The implementation of the proposed environmental control measures, proposed and agreed mitigation measures, monitoring, and follow-up arrangements and management of impacts will be managed through the CEMP. The waste management plan provides for systematic waste management identifying types and quantities of wastes arising, their management, documentation, treatment or disposal, and the parties responsible, at all stages of the project. The CEMP provides the client and main project contractor with a practical guide to ensuring compliance with Planning and Environmental requirements by all parties.

An Environmental Manager with appropriate experience and expertise will be employed by the appointed Principal Contractor for the duration of the construction phase to ensure that all the environmental design, control and mitigation measures outlined in the EIAR and supporting planning documentation in relation to the water environment are implemented. The Environmental Manager together with an environmental team will deal with drainage maintenance, mitigation measures and monitoring. The Environmental Manager will be awarded a level of authority to stop construction activity if there is potential for adverse environmental effects to occur. Additional detail on environmental commitments can be found in the Environmental Management Plans given in the CEMP.

6.4.2 Operational Phase

During the operational phase of the project, the stormwater drainage system will direct storm water from the impermeable areas (entrance road and control building) within the compound through a fuel interceptor and discharge into a soakpit.

Potential impact on water quality due to the operation and maintenance of the substation is principally related to the minor risk of oil spillages. This has been mitigated by design through the provision of adequate bunding and implemented in the construction stage.

The other potential risk during the operational phase is due to sanitary waste from the substation toilet facility. This will be mitigated by collecting the effluent in a sealed holding tank which will be emptied as part of the maintenance regime for the development.

All vehicular movement during operation and maintenance will be restricted to the internal access roads and hardstands.

6.5 RESIDUAL IMPACTS

On implementing the above mitigation measures, the significance of the residual impact on the water environment during the construction and operational phase of the development is assessed as negligible negative to minor negative. Mitigation measures will be monitored throughout the construction and operation phases. It is considered that the proposed project design including control measures together with mitigation measures will ensure that no significant impact occurs to adversely affect surface water quality, surface water flows or groundwater resources.

Mitigation systems will, where required, be put in place before development works commence. As a result of the retention and treatment measures to be applied, the Kilcumber Bridge 110kV substation is expected to have a low impact on the receiving environment. As a result, the proposed development is not expected to contribute to any significant, negative cumulative effects of other existing or proposed developments in the vicinity. When the mitigation measures are implemented in full, a high degree of confidence can be assured that any effects on the receiving environment will be minor. In particular, the development and operation of the substation, if undertaken as proposed, is not expected to have a significant adverse effect on the ground water regime. The risks associated with sedimentation and contamination of the aquifers due to erosion and runoff will be reduced to minimal levels as areas are re-vegetated and construction traffic is stopped.

Table 6-9 Residual Hydrological Impact Significance on Sensitive Receptors

Activity		Potential Impact	Receptor	Sensitivity	Prior to mitigation		After mitigation	
					Magnitude	Significance	Magnitude	Significance
Site Preparations	Excavation of topsoils and subsoils for substation and grid connection	Erosion and sedimentation	River Figile	Moderate	Moderate	Minor	Negligible	Negligible
Construction	Site access road and substation construction	Increase in rate of run-off from hard surfaces	River Figile	Moderate	Minor	Minor	Negligible	Negligible
	Site access road, substation and grid connection construction	Erosion and sedimentation	River Figile	Moderate	Moderate	Minor	Negligible	Negligible
	Spillages of fuels, oils and other hydrocarbons during construction	Hydrocarbon pollution	River Figile	High	Minor	Moderate	Minor	Minor
O & M	Access tracks and substation	Increase in rate of run-off	River Figile	Moderate	Minor	Minor	Negligible	Negligible

6.6 CONCLUSION

During construction and operation/maintenance phases of the proposed development, a number of activities will take place on site, some of which will have the potential to affect the hydrological regime or water quality at the site or its vicinity.

Pollution control and other preventative measures have been incorporated into the project design to minimise adverse impacts on water quality. Mitigation by design will be the principal means for reducing suspended sediment run-off arising from construction activities. Preventative measures also include fuel, concrete and waste management, which will be incorporated into the project Construction Environmental Management Plan (CEMP). It is considered that the proposed project design including control measures together with mitigation measures will ensure that no significant impact occurs to adversely affect surface water quality, surface water flows or groundwater resources.