11.0 HYDROLOGY AND WATER QUALITY

11.1 INTRODUCTION

This chapter describes the existing hydrological and water quality characteristics at the proposed Oweninny Wind Farm Phase 3 development site. This chapter also includes an assessment of the impact on the water environment arising from the proposed development consisting of 18 turbines. The drainage of the proposed development is also considered which includes proposed mitigation measures to reduce any potential negative impacts associated with the construction and operation of the proposed development.

The proposed development will be located on the eastern part of Oweninny Bog, which is located in North Mayo, 12km west of Crossmolina and 15km east of Bangor Erris, and just north of the N59 National Primary Road. The overall area of Oweninny Bog is approximately 5,090 hectares, while the site area of the proposed development is approximately 2,345 hectares.

The installed turbines will have an individual installed capacity that will range from 4.5MW to 6.5MW. The proposed Oweninny Wind Farm Phase 3 ('the Project') will have a maximum export capacity of approximately 90MW wind energy (81MW to 117MW). Planning permission is sought for a period of 10 years, with an operational life of 30 years from the date of commissioning.

The full project description is included in Chapter 3 of this report.

11.1.1 Statement of Authority

TOBIN Consulting Engineers have completed this chapter. TOBIN Hydrologists and Hydrogeologists are intimately familiar with the site characteristics for the Oweninny Wind Farm, having worked on wind farms at Lisheen, Derryadd and Bruckana set in similar ground conditions and water environment.

This chapter has been completed by Mr. John Dillon (BSc, MSc, MCIWM, PGeo) and Brendan Maloney MIEI., TOBIN Consulting Engineers. John has 18 years of experience in hydrogeological/hydrological assessment for EIS/EIA. John also has experience in the hydrogeological/hydrological assessment and supervision of powerline projects including Curragh wind farm, Castlebanny windfarm, Lisheen Phase III wind farm , Derryadd wind farm,

Ummeras wind farm, Cloon – Lanesboro 110kv uprate, North South 400kV interconnector, Moneypoint substation and Laois Kilkenny 400/110 kV substation.

11.1.2 Scope of Assessment

The scope of the assessment undertaken was set out as follows:

1. Characterise the hydrological and water quality baseline conditions of the existing environment based on a desktop study and site investigation;
2. Identify the possible impacts of the proposed development during construction and operation of the project on the receiving hydrological environment;
3. Assess the proposed project pursuant of the Water Framework Directive;
4. Develop mitigation measures to reduce or eliminate the identified negative impacts; and
5. Identify any residual impacts after mitigation measures are implemented.

11.2 METHODOLOGY

An examination of the existing hydrological regime was carried out through a combination of consultation with relevant authorities, a desktop review of hydrological resource and site-specific fieldwork; these elements are described further below.

The assessment of the water environment consisted of the following:

- A desk study of available information including a review of site investigations, relating to surface water, undertaken within or adjacent to the site;
- A walk-over of the site and surrounding area;
- Surface water quality monitoring;
- Interpretation of all data to establish the baseline environment.
- Assessment of flood risk.

The following guidelines were taken into consideration in the preparation of this EIAR Report:

- "Advice Notes on Current Practice in the Preparation of Environmental Impact Statements" (EPA, September 2003);
- "Guidelines on the Information to be contained in Environmental Impact Assessment Reports" (EPA, 2022); and
- "Draft Advice Notes on Preparing Environmental Impact Statements" (EPA, September 2015).

The guidelines and recommendations of the Institute of Geologists of Ireland (IGI) publication 'Geology in Environmental Impact Statements – A Guide' (2002) and the IGI Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013) were also taken into account in the preparation of this Chapter.

11.2.1 Legislative/Guidance Review

An evaluation of the proposed development was carried out in relation to the relevant European and National legislation and other statutory policies and guidance. The following legislation was considered as part of this impact evaluation.

- S.I. No. 94 of 1997 Quality of Salmon Water Regulations;
- SI 272 of 2009 Surface Water Regulations;
- Consolidated EIA Directive 2011/92/EU and 2014/52/EU;
- European Communities (Water Policy) Regulations 2003 [S.I. No. 722/2003];
- Waste Management Acts 1996 as amended;
- European Communities (Environmental Impact Assessment) (Amendment) Regulations, 2001 [S.I. No. 538/2001];and
- Water Framework Directive (2000/60/EEC)

The following documents were consulted in preparation of this report as they pertain to hydrogeology and hydrology:

- Mayo County Development Plan 2022 - 2028

In addition to the Regulations and Guidelines above, this EIAR has been prepared with cognisance to the *"Draft Wind Energy Development Guidelines for Planning Authorities (2019)"*, and the DCCAE (2017) *preferred draft approach - Review of the Wind Energy Development Guidelines 2006.*

Guidance that informed this assessment is set out in the following documents:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.
- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.

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

11.2.2 Desktop Study

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

Information retained by the Geological Survey of Ireland (GSI), the Office of Public Works (OPW) and Environmental Protection Agency (EPA) was accessed to provide the hydrological setting of the site. Relevant documents and datasets used to provide the setting of the site included EPA Water Quality Data, topography maps and GSI Hydrological Data.

The following sources of information were utilised to establish the baseline environment:

- The Geological Survey of Ireland (GSI) records for the area were inspected, with reference to hydrology and hydrogeology (accessed July 2022 and January 2023);
- 1992 Bellacorick wind farm application (Bord na Mona) – Planning references P90/1077 P92/355;
- 2013 Oweninny Wind Farm Application (Oweninny Power Ltd) Planning reference PA0029;
- Office of Public Works (OPW) flood mapping accessed July 2022 and January 2023);
- Catchment Flood Risk Assessment and Management (CFRAM) and Preliminary Flood Risk (PFRA) Map data accessed July 2022 and January 2023);
- EPA water quality monitoring data for watercourses in the area accessed July 2022 and January 2023);
- EPA Water Framework Directive Monitoring Programme -accessed July 2022 and January 2023);
- EPA Hydrometric System (Hydrotool) accessed July 2022 and January 2023);
- Analysis of the results of water monitoring from 2001 to 2021 (including Bord Na Mona AER data (IPC Licence 505-01), and EPA WFD Chemistry Monitoring), and
- Review of Q values and aquatic report at the site. (accessed July 2022 and January 2023);

11.2.3 Field Work and Surveys

A total of eight site walkovers were undertaken to review the ground conditions and streams were carried out in November 2020, March 2021, June 2021, July 2021, September 2021, November 2021, December 2021 and February 2023.

The hydrological walkover survey involved the following:

- Walkover surveys and hydrological mapping of the proposed project, grid connection route, and the surrounding area were undertaken whereby water flow directions and drainage patterns were recorded;
- An assessment of the hydraulic capacity/adequacy of existing stream culverts and
- A flood risk assessment for the proposed project footprint area.

Site surveys relating to the water environment and ground investigations were undertaken from June to February 2023. These included:

- Flow Measurements;
- Water Sampling;
- A walkover survey of the site to identify hydrological features on site, wet ground, drainage patterns and distribution, exposures, drains and crossings etc;
- Field results from the chemical analysis of water samples taken between 2021 and 2023;
- Logging of the soil layers and sampling of each stratum encountered; and
- Laboratory analyses of the samples collected during the above investigations.

Following the field surveys, the results were reviewed in ArcGIS software in conjunction with publicly available hydrological data from the GSI, EPA and /OPW. Various maps were produced, representing a graphical interpretation of the field results.

TOBIN Consulting Engineers carried out an investigation to assess the water environment in the vicinity of the proposed development.

11.2.4 Consultation

Consultation with various state agencies and environmental Non-Governmental Organisations (NGO's) was undertaken to inform the EIA. All project consultation is detailed in Chapter 1 of the EIAR and all responses received are summarised in Chapter 1. Consultees were informed of updates to the site layout, as appropriate. Consultation letters were sent (Feb 2022) to the following key parties relevant to this chapter:

- An Bord Pleanála;
- Geological Survey of Ireland;
- Irish Peatland Conservation Council;
- Inland Fisheries Ireland; and
- Mayo County Council.

A site investigation programme was undertaken at the subject site to acquire site specific data on the nature and characteristics of the underlying ground. The site investigation programme was undertaken in accordance with the British Standard BS 5390 (Site Investigation – Code of Practice). This enabled the site investigation programme to be undertaken in a systematic manner and provided details of a process of site investigations and interpretation methodology to characterise the underlying groundwater conditions.

Table 11-1 details the responses received in relation to water from the above consultees. Further information on consultation responses is provided in Chapter 1 of this EIAR (Introduction).

Table 11-1: Summarises of the Key Consultee Responses

Consultation Response	EIAR Section
Department of Culture, Heritage and the Gaeltacht (Development Applications Unit [DUA]) **Department of Culture, Heritage and the Gaeltacht (Development Applications Unit [DAU])** A detailed letter received from the DAU highlighted: • The need to follow Guidelines of the European Commission's (2017) 'Environmental Impact Assessment: Guidance on the preparation of the Environmental Impact Assessment Report; • The concerns of landslide risks resulting from constructing of the proposed development;	All water considerations raised by the DAU have been noted by TOBIN: • Literature from the relevant environmental organisations, including guidelines from the EPA, have been referred to while writing this EIAR; • Extensive desktop and field survey has been carried out to avoid the likelihood of a landslide and resulting harm to water environment, relevant literature has also been accessed on the matter; • TOBIN has directly consulted relevant consultees for example the IFI, and has received project specific guidelines to mitigate negative impacts;

Consultation Response	EIAR Section
• Concern for the impacts of grid connections on sensitive habitats • The relevant organisations that should be consulted; • Surveys need to be carried out by suitable persons at an appropriate time of the year. The DAU also noted the special consideration needed to be taken for: • Watercourses and Wetlands • Freshwater Pearl Mussel • Flood Plains • Natura Sites and legislation, • Post construction monitoring Licences	
Environmental Protection Agency (EPA) In their response, the EPA highlighted that the EIAR should: • Identify, describe, and assess all direct and indirect effects on each of the factors listed in Article 3 of the EIA Directive, which in relation to this chapter includes biodiversity and water); • Address matters raised by other consultees which included the HSE, IFI, DAFM and DAU; • Have regard to the rehabilitation plan(s) required under Condition 10 of the IPC licence Reg No. P5050 for any bog areas relevant to the proposed development; • Have regard for the requirements of the draft Guidelines on the information to be contained in	All considerations raised by EPA have been addressed within this chapter (Chapter 11 Water) • All impacts both direct and indirect have been addressed in detail in this chapter. • Concerns relating to water from other consultees have been noted and addressed with appropriate mitigation measures. • Relevant literature has been referenced while composing this EIAR. • TOBIN will ensure the requirements of the EIA Directive are met.

Consultation Response	EIAR Section
Environmental Impact Assessment Reports, as appropriate; • Have regard to the relevant topics contained in the EPA's Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) September 2003; • Satisfy the requirements of the EIA Directive.	
Inland Fisheries Ireland (IFI) IFI highlighted the sensitivity of the proposed development site that crosses three catchments: the Oweninny River, the Shanvolahan River and the Cloonaghmore River all of which provide valuable salmon and trout habitat. IFI discussed the damage caused to aquatic habitats by peat harvesting activities at Bellacorrick in the past. IFI provided 16 recommendations for pre-construction, construction and operational phases of the proposed development to mitigate damage to aquatic species and highlighted the need to address the following concerns : • Water quality; • Surface water hydrology; • Fish spawning and nursery areas; • Passage of migratory fish; • Biological diversity; • Ecosystem structure and functioning; • Sport and commercial fishing and angling; • Sediment transport.	The construction methodology described in Chapter 3 (Description of the Proposed Development) and set out in the Construction Environmental Management Plan (CEMP) takes into account the best practice guidelines for the management of water during construction activities and incorporates with the protective measures set out in the IFI submission. Stringent mitigation measures have been outlined in this chapter (and within Chapters 10 and 11 (Hydrogeology and Hydrology) which will ensure the protection of the surfaces waterbodies during all works associated with the proposed development.

11.2.5 Significance and Magnitude Criteria

The significance of effects of the proposed development was assessed in accordance with the EPA guidance document *Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)*, 2022.

Table 9-1 included outlines guidance for describing the quality and significance of effects and informs the assessment of the relevant potential impacts of the proposed development within this chapter.

The importance of the hydrogeological and hydrological receptors was assessed on completion of the desk study and baseline assessment. Using the NRA Guidance presented in Appendix C of the IGI guidelines (2013), an estimation of the importance of the hydrological and hydrogeological environments is set out in Table 11-2.

Table 11-2: Estimation of Importance of Hydrology Attributes

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale.	• River, wetland or surface water body ecosystem protected by EU legislation, e.g., 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale.	• River, wetland or surface water body ecosystem protected by national legislation – NHA status. • Regionally important potable water source supplying >2500 homes. • Quality Class A (Biotic Index Q4, Q5). • Flood plain protecting more than 50 residential or commercial properties from flooding. • Nationally important amenity site for wide range of leisure activities.
High	Attribute has a high quality or value on a local scale.	• Salmon fishery locally important potable water source supplying >1000 homes. • Quality Class B (Biotic Index Q3-4). • Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Medium	Attribute has a medium quality or value on a local scale.	• Coarse fishery.

Importance	Criteria	Typical Example
		● Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3). ● Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale.	● Locally important amenity site for small range of leisure activities. ● Local potable water source supplying <50 homes. ● Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding. ● Amenity site used by small numbers of local people.

11.3 EXISTING ENVIRONMENT

11.3.1 Desk Based Studies

The delineation of the sub-catchments and general area of confluence shown in Figure 11-1 'Regional Catchment Delineation'.

The proposed development for Oweninny Wind Farm Phase 3 lies on the border of two Water Framework Directive (WFD) catchments. The western side of the windfarm belongs to the Blacksod-Broadhaven Catchment (ID 33) and the eastern side lies within the Moy and Killala Bay Catchment (ID 34).

More locally, four sub catchments are present at the proposed development wind farm site. These are the Cloonaghmore_SC_010 sub catchment located to the northeast of the site. This sub catchment is part of the Moy and Killala Bay catchment. The west of the site lies within the Owenmore [Mayo]_SC_020 sub catchment and is located in the Blacksod-Broadhaven catchment. The majority of the site lies within the catchment of the Oweninny/Owenmore River. The southeast of the site is within the Deel [Crossmolina]_SC_010 sub catchment which is a part of the Moy and Killala Bay hydrometric area.

Limited groundwater flow occurs as detailed in Chapter 10 due to deep till deposits on site. It is assumed that groundwater flow would mirror topography, and local flows are likely to be varied reflecting the local drainage patterns. A number of designated habitats occur adjacent to the proposed development. Designated habitats including Bellacorick Iron Flush SAC and Lough

Dahybaun SAC and Bellacorick Bog Complex SAC occur within 1 km of the proposed development.

11.3.2 Surface Water Hydrology

The purpose of this section is to describe the surface water environment including the following:

- Catchments;
- Site surface water features and drainage;
- Flood assessment;
- Assessment of hydrometric data;
- Surface water abstractions within the catchment of the site;
- Surface water quality

Catchments

A catchment is simply defined as an area contributing water to a river and its tributaries, with all the water ultimately running off to a single outlet. The catchment boundary is the line dividing land where surface drainage flows toward a given stream from land where it drains into a separate stream. A summary of the catchment is included in Table 11-2 below. The regional natural surface water drainage pattern, in the environs of the proposed Oweninny Wind Farm Phase 3 development site, is outlined in Figure 11-1 'Regional Catchment Delineation'. The proposed development site is located mostly within the Oweninny/Owenmore River catchment, located on the eastern part of Oweninny Bog. The naming of the streams varies between the historical maps, OSi maps and the EPA catchment maps.

Table 11-3 Catchment Summary

Bog	Catchment	Hydrometric Area	Sub catchment	River Subbasin	Relevant Rivers /streams	Turbines/Substation /compound in each catchment
Oweninny Wind Farm Phase 3	Blacksod and Broadhaven	**HA33**	Owenmore_SC_010	**Owenmore_010**	Oweninny, Sheskin, Fiddaunnamuingeery	T6, cable route, BP1, C1
				Owenmore_020	Owenmore	Cable
			Owenmore_SC_020	**Muing010**	Owenmore, Muing, Lough Dahybaun	T1-T5, T7, Substation, C2, cable route, BP1
	Moy - Killala	**HA34**	Deel Crossmolina_SC_020	**Shavolahan_010**	Fiddaunagosty, Shanvolahan and Fiddauntoughaun	T12, T13, C3, C4, BP2, PDA2, PDA3, PDA4
			Cloonaghmore SC_010	**Cloonaghmore010**	Shanvodinnaun, Fiddaunfura, Cloonaghmore	T8 to T11, T13 to T18,

The bog then consists of four sub-catchments, which are the Owenmore SC_010 to the northwest and west, the Cloonaghmore SC_020 to the north east and the Deel Crossmolina_020 to the southwest. The regional natural surface water drainage pattern, in the environs of Oweninny Bog is shown in Figure 11-1 below.

11.3.2.1.1 Blacksod and Broadhaven Catchment

The Blacksod-Broadhaven catchment includes the area drained by all streams entering tidal water in Blacksod and Broadhaven Bays draining a total area of 1,302km² (EPA, 2022[1]). Rivers within the catchment includes the Owenmore, Oweninny and Owenduff Rivers. The Owenmore River flows west until it reaches Tullaghan Bay and drains a catchment of approximately 332 km^2. Numerous small rivers and tributary streams (Oweninny, Sheskin, Muing, Fiddaungal, Fiddaunnaglogh, Fiddaunnameenabane, Fiddauncam and the Fiddaunnamuinggeery) flow into the Owenmore River. The Oweninny is joined by the Sheskin Steam which drains the forested upper catchment slopes of Slieve Fyagh before entering the Oweninny River. There are no Nutrient Sensitive Areas in the catchment. The proposed development is located in two subcatchments of the Blacksod and Broadhaven Catchment, i.e., Owenmore_010 and Owenmore_020 and are discussed further below.

Owenmore_010 Subcatchment

The Owenmore_010 subcatchment includes the upper reaches of the Owenmore river and includes the Oweninny, Fiddaunnamuinggeery, Sheskin and Sruffaunnamuingabatia Rivers. Oweninny Phase 1 and 2 are located primarily in Owenmore_010 Subcatchment. Part of the cable route and Borrow Pit 1 are located in the Oweninny_010 subcatchment. There are no proposed turbines in Owenmore_010. The Sruffaunnamuingabatia, which drains the Bellacorick Iron Flush SAC is located to the west of the phase 3 wind farm boundary, flows westwards and joins the Oweninny river, 1 km further west.

Owenmore_020 Subcatchment

The Owenmore_020 subcatchment is located downgradient of Owenmore_010 and comprises the Muing River, Altanabrocky River and the Owenmore River between Bangor and Bellacorrick.

Downgradient of the Oweninny and Sheskin river confluence, the Owenmore flows southwards, externally to the site and joins the Muing and Altanabrocky River, turning westwards after Bellacorick Bridge and runs paralleling the N59.

The Muing River and the Muingamolt (EPA name - Croaghaun East) tributary rise within the site and flows to Oweninny river at Bellacorick bridge. Lough Dahybaun, a small lake is located to

[1] www.catchment.ie (assessed Sept 2022)

the upper reaches of the Muing river. A number of ponds or small lakes occur in the catchment. These are referred to as the Muingaleeaun Loughs, Swan Lough and Nacrom Lough on the 6inch OSi maps. In addition, due to the rehabilitation works on the peat extraction site, a large number of additional ponds were created in topographical lows. Turbine 1 to Turbine 7 and the proposed substation are located in the Owenmore_020 subcatchment.

11.3.2.1.2 Moy – Killala catchment (HA34)

The Moy-Killala catchment includes the area drained by the River Moy and all streams entering tidal water in Killala Bay between Benwee Head and Lenadoon Point, Co. Sligo, draining a total area of 2,345km². The proposed development is located in the upper reaches of the Cloonaghmore subcatchment SC_010 and Deel [Crossmolina] subcatchment SC_010.

Cloonaghmore Subcatchment SC_010

To the north eastern part of the proposed development the Cloonaghmore River drains a catchment of 132 km^2 before entering the sea at Rathfran Bay to the north of Killala village. The Cloonaghmore subcatchment comprises the Fiddaunfura (EPA name Kilfian South ED), Doobehy River and Shanvodinnaun tributaries flow north eastwards to the Owenmore East (HA34) and Cloonaghmore River. The Cloonaghmore River is also known as the Palmerstown River.

An afforested hill (Furnought Hill) forms the topographical high (and catchment boundary) within the site and represent discrete glacial/post glacial geomorphological features. Turbines T8 to T11, T14 to T18 are located in the catchment of the Cloonaghmore River.

Deel [Crossmolina] Subcatchment SC_010

The south-eastern part of the site drains to Shanvolahan River and its tributaries (Fiddaunagosty and Fiddauntooghaun) before entering the Deel River, 8km to the southeast. The River Deel flows to Lough Conn and eventually discharges the River Moy before entering the sea at Killala Bay. The Moy catchment drains an area of 1,966 km^2;

The south-eastern part of the proposed wind farm drains to tributaries of the Shanvolahan River. T12 and T13 lies within the Deel [Crossmolina] Subcatchment SC_010.

The River Deel as a prioritised area for action (AFA) in the Draft River Basin Management Plan (3rd Cycle) and is part of the Moy-Deel Margaritifera Sensitive Area. The Shanvolahan is a tributary of the Deel river which supports an important population of *Margaritifera*

margaritifera the Freshwater Pearl Mussel. The population of this protected species was mapped in 2009 by Moorkens and Killeen for the Department of Environment Heritage and Local Government[11] The nearest recorded freshwater pearl mussel population is located some 8 km downstream of the Oweninny site boundary. Pearl Mussel was absent on the River Shanvolahan in 2009, 2013 and 2021 aquatic surveys. In 2021, all the rivers including the Shanvolahan tributaries draining from the bog have populations of trout and salmon. Crayfish were found on two of the Shanvolahan tributaries indicting the overall good water quality.

Figure 11-2 depicts Surface Water Features/Local Catchment Delineation in relation to site area which includes a significant number of unnamed streams although EPA reference names have been applied for identification purposes. The proposed development is not located in a delineated area for action as set out in the 2018-2021 National River Basin Management Plan.

Each of the streams flowing through or adjacent to the site has its own sub-catchment area. The delineation of these catchment boundaries, see Figure 11-2 and Figure 11-3.

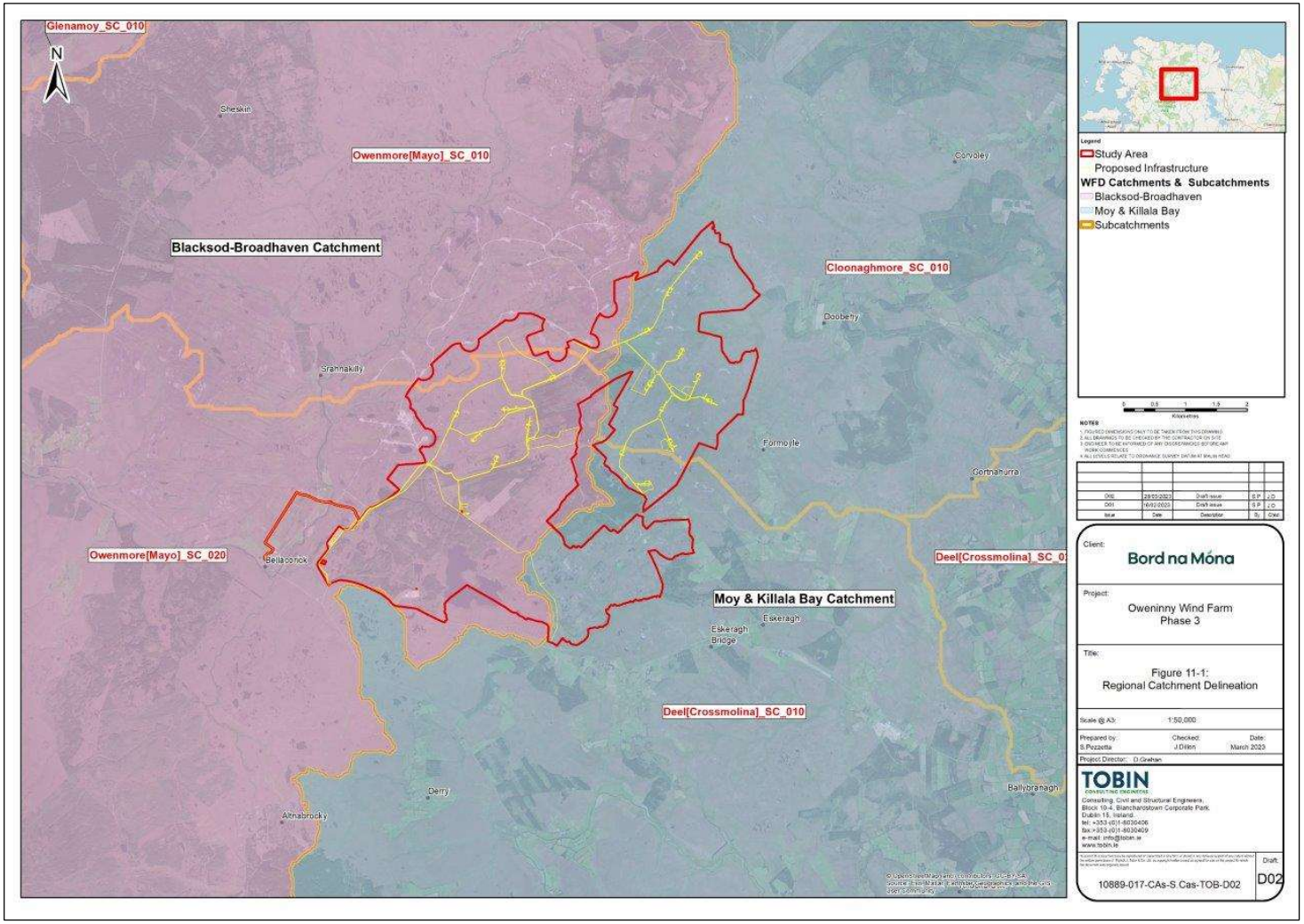

Figure 11-1: Regional Catchment Delineation

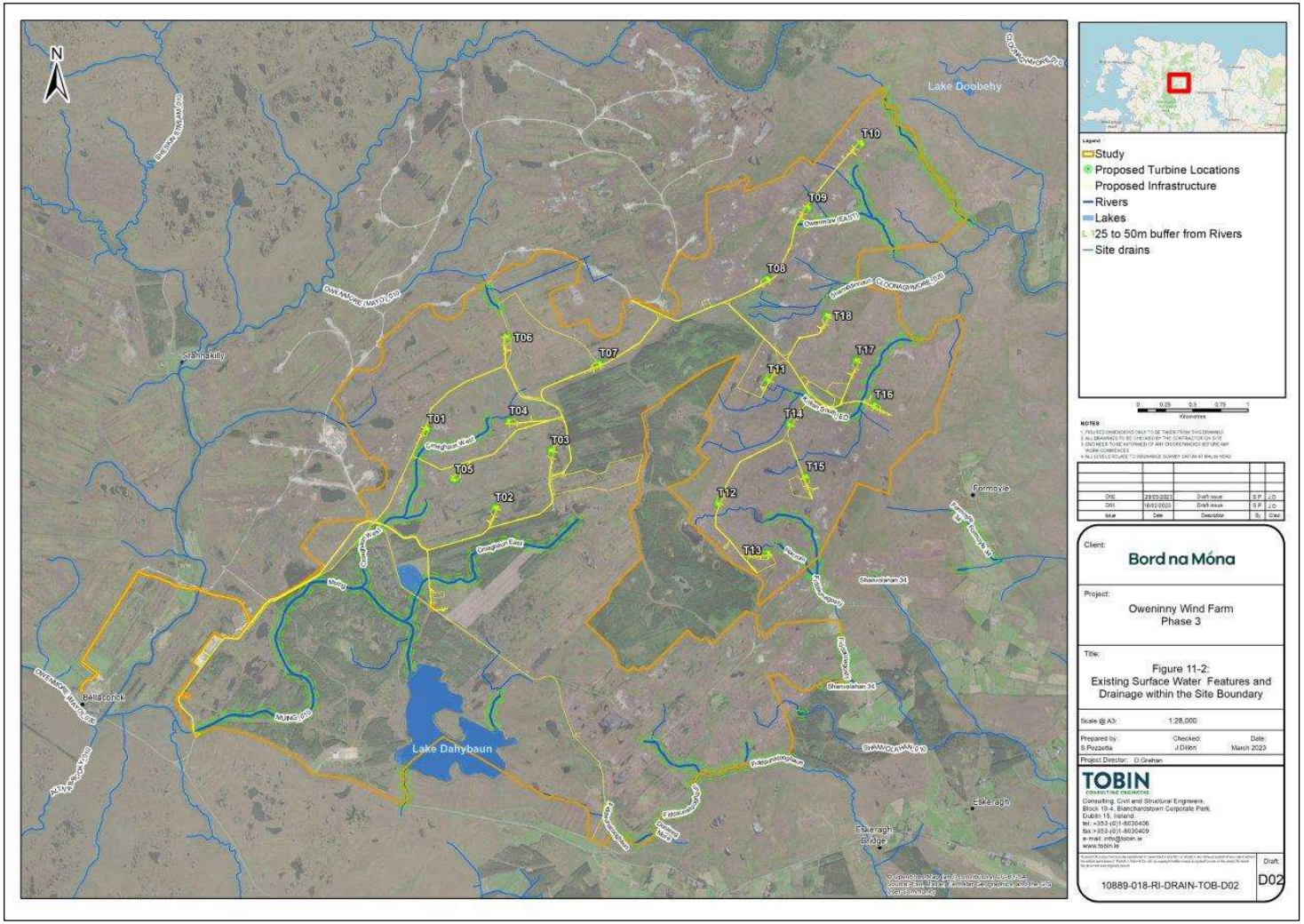

Figure 11-2: Existing Surface Water Features and Drainage within the Site Boundary

Surface Water Features and Drainage

The proposed wind farm is located within a former peat extraction site. An extensive network of drainage channels is present throughout the peatland is managed under IPC licence P0505-02 Oweninny bog group. The historical data reveals that individual catchments vary in respect with conductivity, pH, nitrate, nitrite and ammonium. Sites with a large percentage of their catchment area draining BnM peatlands, including the Muing, Shanvolahan and Doobehy river, were found to have higher concentrations of nitrate, nitrite and ammonium compared with other catchments in the region. These differences were not evident in the Oweninny River which had concentrations similar to that recorded at control sites for these parameters (IFI, 2012)[2] . Ortho-phosphate concentrations taken as part of the BnM/IFI study reveals Ortho-P concentrations were highest in the non-drained peatlands. Any long-term phosphorus release from these managed peatlands has been demonstrated to be insufficient to bring about a serious deterioration to a lower ecological status in a study of an artificial cutaway lake in the Oweninny catchment undertaken by Higgins et al., 2007.

While high concentrations of suspended solids were recorded historical in the overall peatland, a comparison of the suspended solids concentrations between the former peat harvesting and control sites were found to be statistically nonsignificant during the sampling period.

Oweninny Bog has been relatively good in terms of water quality since regular monitoring commenced. The waters of the Owenmore/Oweninny catchment area are of very good quality with Q-values being consistently between 4-5 and 5 throughout the years. As discussed previously, the waters of the Deel River Catchment that overlap the bog boundary are the poorest in terms of quality. However, since then the water quality has shown slight improvements and more consistency in terms of good water quality.

The drainage hierarchy is outlined below;

Field/Production Drains -> Main Drains -> Silt ponds and outfalls -> External Streams and Drains

A number of streams/drainage channels were identified to be flowing through or adjacent to the proposed wind farm site (see Figure 11-2). These include the Muing River, Croaghaun East

[2] Kennedy, B., McLoughlin D., Caffrey J., (IFI, 2012) A physical, chemical and biological assessment of fluvial habitat draining the Oweninny Peatlands, North Mayo with reference to peat siltation.

Croaghaun West and Kilfian South ED (Doobehy) Rivers. The site and adjacent lands also include a large number of drains which flow to the streams identified in Figure 11-2 and assist in the drainage of peatland, reclaimed peatland areas under agricultural land use and forestry.

There are no long-term recording surface water flow gauging stations in or near the site. In the 1950s and 1960s however, three water level gauging stations associated with the original Bellacorick Power Station recorded levels in the rivers for a short period and flows were measured at one of these, in the Owenmore River downstream of the site. These provide an indication of the surface water response at the time. Anecdotal observations at Oweninny during peat harvesting agree with field measurements of blanket peatland drainage made in a neighbouring bog at Glenamoy, which concluded that flood runoff was reduced in frequency and amount, and summer flow of streams was increased. The bog rehabilitation programme would have reversed this process to some extent. A number of ponds or surface water ponding now occupy low lying areas created by the rehabilitation process. A water level recession curve measured in 1962, prior to peat harvesting, indicates some storage in and around the peat and possibly in the underlying groundwater.

More recently, an investigation of groundwater at the Bellacorick Iron Flush SAC area within the site recorded water tables, phreatic pressures and flows where links between surface and groundwater were identified.

Flows estimated using the EPA Hydrometric System (Hydrotool), also suggest a relatively fast runoff, which is a characteristic of blanket peatlands. This estimation method does not account for the cutaway nature of the site, with rewetting and revegetation, explicitly. This rehabilitation has stabilised the sediment through revegetation of former bare peat areas.

Flood Risk Assessment

The OPW 'Flood Hazard Database' was used to obtain information on historical flooding events within the proposed development area. No flood events were identified within 4km of the proposed development.

The national programme of Catchment Flood Risk Assessment and Management (CFRAM) Studies comprises the execution of three parts:

(1) Preliminary Flood Risk Assessments;

(2) Flood Hazard Mapping; and

(3) The development of Flood Risk Management Plans.

The OPW initially produced a series of maps to assist in the development of the Preliminary Flood Risk Assessment (PFRA) throughout the country. These maps were produced as part of a desktop study of several sources. In July 2011, the Office of Public Works (OPW) published a series of maps showing the estimated 100-year flood plain from the Preliminary Flood Risk Assessment (PFRA) study. This information was used to establish the current baseline conditions. Areas of pluvial flooding were noted on the OPW PFRA mapping, but no records of fluvial flooding were noted for the substation location. The PFRA study maps (i.e., the MyPlan.ie viewer) were reviewed and the proposed site is not located within a groundwater flood risk zone. There is no evidence of historic groundwater flooding at the site.

Mayo County Council has prepared a flood risk assessment of its county development plan in line with requirements of the Regional Planning Guidelines 2010 to 2022. There are no recorded incidences of flooding at or near the site.

Flood Risk Assessment reports have been prepared for the proposed substation location, see Appendix 11-1. The Flood Risk Assessment concludes that the development complies with the principles of "The Planning System and Flood Risk Management - Guidelines for Planning Authorities, November 2009".

For a more detailed description of flood risk see section 4.0 of the Stage 3 Flood Risk Assessment for the Phase 3 development site in Appendix 11.1.

Based on the results of the Flood Risk Assessment, the risk of flooding associated with the development site is minimal. The substation is located outside of the predicted fluvial flood extents and will not impede flow paths or floodplain storage during extreme flood events.

The layout of the substation and overall development will minimise the flood risk to people, property, the economy, and the environment.

Assessment of Hydrometric Data

As outlined previously, the surface water drainage pattern in the environs of the proposed development site is shown in Figure 11-2. The streams are identified as follows:

Oweninny Subcatchment - River Muing (Location of Turbines T1 to T7)

The proposed turbines T1 to T7 and their associated roads are located within the catchment of the Muing River (IE_WE_33M010100). This river occupies the western side of the site and has a catchment area of 18.9km^2. The catchment area for this river was estimated using the EPA's online database (gis.epa.ie/Envision) and geographic contours available from OS Maps.

Cloonaghmore Subcatchment - (Location of Turbines T8 to T11, T14 to T18)

The proposed turbines and their associated roads are located within the catchment area of the Cloonaghmore River (IE_WE_34C030100). This river catchment occupies the north-eastern side of the windfarm site and has an estimated total catchment area of 31.5km^2. The catchment area for this river was estimated using the EPA's online database (gis.epa.ie/Envision) and geographic contours available from OS maps.

Deel Subcatchment - Shanvolahan River (Location of Turbines 12 and 13)

These turbines and their associated roads are located within the catchment of the Shanvolahan River (IE_WE_34S010400). This river is located to the southeast of the site and has a catchment area of about 27.5km^2. The catchment area for this river was estimated using the EPA's online database (gis.epa.ie/Envision) and geographic contours available from OS maps.

Surface Water Abstractions within the Site

There are currently no known surface water abstractions from the streams adjacent to the site or from any surface water features <10km from the site boundary.

Surface Water Quality

Off-Site Surface Water Quality:

The Environmental Protection Agency (EPA) regularly monitors water bodies in Ireland as part of their remit under the Water Framework Directive (WFD) (2000/60/EC), which requires that rivers are maintained or restored to good/ favourable status. Quality of watercourses are assessed in terms of 4 No. quality classes; 'unpolluted' (Class A), 'slightly polluted' (Class B), 'moderately polluted' (Class C) and 'seriously polluted' (Class D). These water quality classes, and the water quality monitoring programme are described in the EPA publication 'Water Quality in Ireland, 2019'. The EPA water quality assessments detailed in Table 11-4 below are largely based on biological surveys. Biological Quality Ratings or Biotic Indices (Q values) ranging from Q1 to Q5 are defined as part of the biological river quality classification system.

The relationship of these indices to the water quality classes defined above, are set out in Table 11-4 below.

Table 11-4: Relationship between biotic indices and water quality classes

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

There are five national water monitoring locations concentrated to the southwest of the site, and 1 no. to the northwest of the site about 1.5 km from the proposed development (Figure 11-4). The most recent EPA results for 2020 indicate that these monitoring points show that the quality of water at this location is Q4-5 – 'Unpolluted' (or Good/High Status . These stations have consistently recorded high status Q values of between 4-5 since recording began at the stations. The results are summarized in Table 11-5 below.

Table 11-5 : EPA Monitoring Results - Biological Quality of water - Owenmore Catchment

Location	Br SE Srahnakilly	Owenmore [Mayo] – 1.1 km d/s Bellacorick Bridge	OWENMORE (MAYO) - S. of Tawnaghmore (nr School)	Just u/s Owenmore River confluence	Just u/s Owenmore River confluence
River	Owenmore	Owenmore	Owenmore	Altnabrocky	Muing
River Waterbody	Owenmore [Mayo]_020	Owenmore [Mayo]_020	Owenmore [Mayo]_040	Altnabrocky_010	Muing_010
Station Code	RS33O040050	RS33O040150	RS33O040250	RS33A020100	RS33M010100
2021	Q4-5	-	Q5	-	Q4
2020	Q5	Q4-5	Q5	Q4	Q4
2017	Q4-5	Q4-5	Q4-5	Q4	Q4
2014	Q4-5	Q4	Q4-5	Q4	Q4

Table 11-6: EPA Monitoring Results - Biological Quality of water – Cloonaghmore and Shanvolahan River

Location	Eskeragh	Shanvolahan	Deel (Crossmolina)	Cloonaghmore -	Cloonaghmore
Location	Eskeragh Br	Bridge S.W. of Coolturk	Ford E. of Ballycarroon House	Bridge near Lecarrownwaddy	Bridge near Belville
River	Fiddauntooghaun	Shanvolahan River	Deel River	Cloonaghmore	Cloonaghmore
River Waterbody	Shanvolahan _010	Shanvolahan _010	Deel[Crossmolina]_040	Cloonaghmore_020	Cloonaghmore_030
Station Code	RS34F060100	RS34S010300	RS34D010050	RS34C030060	RS34C030100
2022	Q4	Q4-5	Q5		Q4
2019	3-4	Q4	Q4-5	Q5 (1989)	Q4
2016	3-4	Q4	Q4-5		Q4
2013	4	Q3-4	Q4-5		Q4

The majority of EPA monitoring points indicate that the overall water quality in this area is unpolluted. The overall status of surface water/rivers in the vicinity of the proposed site is good status. This classification is based on a high macroinvertebrate value (Q-Value) according to EPA monitoring data.

The most recent Q value assessment in 2021 at the Oweninny River has shown satisfactory condition maintained in the catchment, High and Good ecological condition was maintained in 2021. Q4-5 was encountered on the Owenmore River, 1.1 km d/s Bellacorick Bridge. This is further supported by the presence of high quality indicator species such as Salmon and Trout in all streams.

Water Framework Directive (WFD)

The WFD requires all water bodies to achieve both good chemical status and good ecological status (GES). For each River Basin District, a River Basin Management Plan (RBMP) outlines the

actions required to enable natural water bodies to achieve this. The proposed development is located in five Subbasins

- Owenmore 010
- Owenmore 020
- Muing 010
- Shanvolahan 010
- Cloonaghmore 020

Owenmore 020 is the only subbasin currently at high status. Muing 010 and Cloonaghmore are achieving good status while Shanvolahan is at Moderate status. In order to be compliant with the requirements of the WFD, any activity which has the potential to have an *impact* on WFD water bodies must be assessed to determine whether it could cause deterioration in the ecological status or potential of a water body. It is, therefore, necessary to consider the possible changes associated with the Proposed Project.

A WFD assessment report has been prepared for the Oweninny Phase 3 Wind farm - see Appendix 11.3. All the tributaries draining this area, even minor ones have populations of salmonids. This is due in part to the existing good water quality at the existing windfarms and due to low intensity agricultural activity.

The Tributaries drain to Special Areas of Conservation, are outside the proposed area of activity however they must be regarded as sensitive as they all produce salmon. Crayfish were found on two of the Shanvolahan tributaries.

11.3.3 Field Based Studies

Site Specific Surface Water Quality:

Field monitoring results from September 2021 and February 2023 are included in Table 11-7 to Table 11-7 below.

Table 11-7: Field monitoring results from September 2021

Parameter / Catchment	Unit	Muing	Muing	Pond on site – Croaghaun River catchment	Pond on site – Croaghaun River Catchment	Oweninny River	Kilfian South	Shanvolahan 1	Shanvolahan 2
	units	L. Dahybaun	Downstream of L. Dahybaun	Pond to the SW of T5	Pond to the East of T2	Bellacorrick Bridge	Site boundary - Kilfian South – T16	Br at N89 road crossing - am	Br at N89 road crossing - pm
Suspended Solids	mg/l	<5	<5	7	<5	<5	<5	<5	<5
Phosphorus	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Ammonium	mg/l	0.03	<0.03	<0.03	0.03	0.03	0.02	0.08	0.07
Orthophosphate	mg/l	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02
Chloride	mg/l	20.2	20.0	16.8	18.0	12.1	21.3	24.2	24.1
Conductivity	µS/cm	168	166	61	86	527	277	369	370

Table 11-8: Field monitoring results from December 2021

		SW1	SW2	SW3	SW4	SW5	SW6
Location	Units	Muing - DS of lough Dahybaun	Muing - Site entrance	Shanvolahan 1 – N89 bridge	L. Dahybaun	Pond to the east of T2	Cloonaghmore – Bridge near Lecarrownwaddy
River Waterbody Name		Muing_010	Muing_010	Shanvolahan_010	Muing_010	Muing_010	Cloonaghmore_020
TSS	mg/l	<5	<5	<5	5	13	<5
Ammonium	mg/l	<0.03	0.09	0.04	0.04	0.16	0.08
Phosphorous	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Ortho-P	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	mg/l	140	160	163	159	96	160
Chloride	mg/l	15.1	17	15.4	14.5	12.4	16.9
DOC	mg/l	11.9	16	16.6	15.3	9.49	15.9

Table 11-9: Field monitoring results from February 2023

		SW1	SW2	SW4	SW6
Location	Units	Muing - DS of Lough Dahybaun	Muing - Site entrance	L. Dahybaun	Cloonaghmore – Bridge near Lecarrownwaddy
River Waterbody Name		Muing_010	Muing_010	Muing_010	Cloonaghmore_020
Conductivity	mg/l	181	170	145	170
TSS	mg/l	<5	<5	5	<5
pH	Units	7.5	7.6	7.8	7.2
Turbidity	FNU	<10	<10	<10	<10
Ammonium	mg/l	0.1	<0.1	<0.03	<0.1
Ortho-P	mg/l	<0.02	-	<0.02	-
Nitrate	mg/l	<1	-	<1	-
Nitrite	mg/l	<0.1	-	<0.1	-

Surface water monitoring has been carried out at the various locations listed in the table above. These results are as expected for the natural background environment in this area.

In terms of suspended solids most monitoring locations had <5 mg/l with the exception of SW5 which has 7 to 13 mg/l suspended solids. It is possible that results were elevated (compared to nearby streams) due to floating sediment in the pond area, however all results are <25mg/l.

All sites recorded phosphorous levels of <0.1 mg/l and orthophosphate levels of <0.02. The low phosphorous is typical of peatland environments with low or negligible phosphorous inputs.

Typically, ammonium levels are less than 0.065 mg/l on average based on site results and EPA monitoring data.

Finally, the pond areas had the lowest levels of conductivity which were both below 90µS/cm. Pond 1 had a conductivity of 61µS/cm, reflecting the low groundwater inputs and meteoric water.

Table 11-10 shows surface analysis data collected from Owenmore River downgradient of the site in 2020 to 2021. These surface waters were monitored at two stations labelled RS33O040200 and RS33O040300.

Table 11-10: Surface Water Analysis – Owenmore River

Monitoring	Location	Sampled	pH	Conductivity	Chloride	Ammonia	Alkalinity ($CaCO_3$)	BOD	Colour
RS33O040200	2.7km Downgradient of Bellacorrick Br	20/2/20	6.6	96	19.2	0.01	26	1.1	44
RS33O040200		22/6/20	7.1	86	41.2	0.01	12	0.5	135
RS33O040200		10/9/20	8.4	209	34.5	0.01	18	0.5	312
RS33O040200		2/11/20	6.1	165	14.7	0.01	10	1.4	46
RS33O040200		22/2/21	8.1	164	22	0.01	76	0.5	109
RS33O040200		28/4/21	7.2	245	15.6	0.01	18	0.5	73
RS33O040200		30/6/21	8.1	205	20.7	0.01	69	0.5	276
RS33O040300	Bangor Erris –10km downgradient of Bellacorrick Br	20/2/20	6.6	93	41.8	0.01	74	0.5	108
RS33O040300		23/7/20	7.3	98	24.4	0.01	75	0.5	101
RS33O040300		10/9/20	8.1	89	14.2	0.01	5	0.5	103
RS33O040300		2/11/20	6.2	208	14.9	0.01	26	0.5	92
RS33O040300		22/2/21	6.7	158	21.7	0.01	81	0.5	100
RS33O040300		28/4/21	6.8	89	18.5	0.01	5	2	87
RS33O040300		30/6/21	8.2	201	20.5	0.01	15	0.5	90

These locations were analysed based on a variety of different parameters. These included mainly pH, conductivity, chloride, ammonia, alkalinity ($CaCO_3$), BOD and colour. pH values ranged from 6.1 on the 02/11/2020 at RS33O040200 to 8.4 on the 10/09/2020 at the same station. Ammonia concentration were below 0.01mg/l for 2020 and 2021. BOD concentrations are also low, with most samples <0.5mg/l at each location. The highest BOD was experienced at RS33O040300 which was 2mg/l on the 28/04/21.

The highest alkalinity value was 81mg/l. This was recorded at RS33O040300 on the 22/02/21. The lowest values were also recorded at this station. On the 10/09/20, a value of 5mg/l was recorded. On the 28/04/21, a value of 5mg/l was also recorded.

The highest colour value is recorded at RS33O040200 which was 312. This was recorded on the 10/09/20. The lowest colour value was also recorded at RS33O040200 which was 44 on the 20/02/20. Overall, the water quality in the Owenmore/Oweninny River is good.

Table 11-11 below, shows the results of handheld probe data for surface water at Lough Dahybaun located in the southwest of the proposed Phase 3 development.

The highest temperature in the lake is 20.2°C at the NW drain where turbidity is 0.5. The lowest temperature is 17.8°C at the NE drain. The average temperature at the lake is 18.5°C in August 2021.

Table 11-11: Surface Water Analysis at Dahybaun Lake 20/08/2021

Sample location	pH	mV ORP	Cond (A)	FNU	Temp	Note
78	5.2	130	54	1	18	Surface runoff from gravels - away from lake
79	6.97	156	91	1.6	17.8	NE drain
80	7.18	138	94	1.4	17.8	NE drain
81	7.96	104	248	0.5	20.2	NW drain
82	8.14	101	166	2.3	18.12	Lake North
83	8.05	114	163	4.6	18.4	Lake North East
84	8.05	114	163	4.6	18.4	Lake
85	7.7	121	132	1.4	19	Stream entering lake NE
88	7.3	110	89	1.7	19	Stream entering lake SW

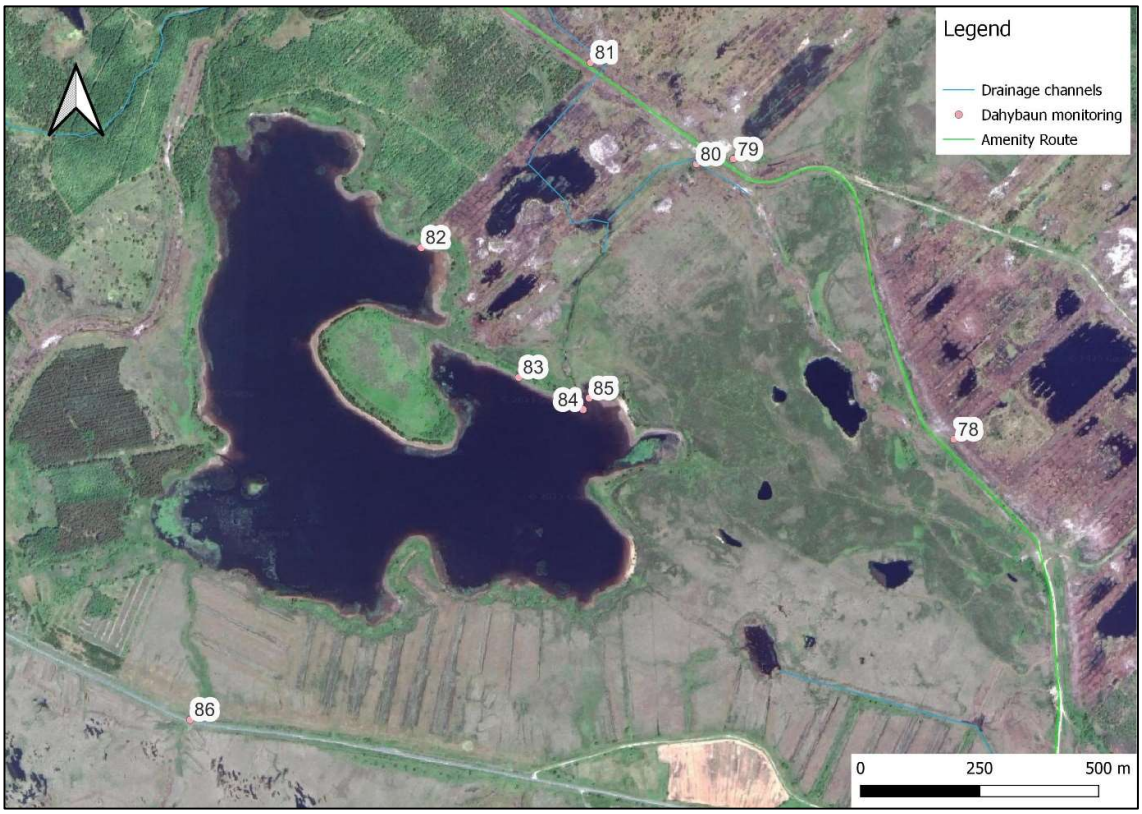

Figure 11-3:Surface water monitoring locations- Lough Dahybaun

The pH ranges from 5.2 (acidic) to 7.2 in the surface water runoff, to pH 8.14 (alkaline) in the lake. The pH in Lough Dahybaun is 0.7 to 1 pH unit higher than the surface water runoff which indicates a groundwater contribution and/or a diurnal increase in pH due to photosynthesis.

Conductivity is highest in the northwest and lowest in the eastern sections of the lake. Conductivity at the NW drain is 248 µS/cm and only 54µS/cm where there is surface runoff to the east. Oxidation reduction potential, or ORP, is a measure of a waters ability to either oxidize or reduce another substance. Positive values for ORP were recorded throughout the catchment.

Turbidity values at Lough Dahybaun were low with good water clarity on the lake shore. The highest value of 4.6 FNU is recorded to the northeast of the lake whilst the lowest value of 0.5 is recorded in the NW drain.

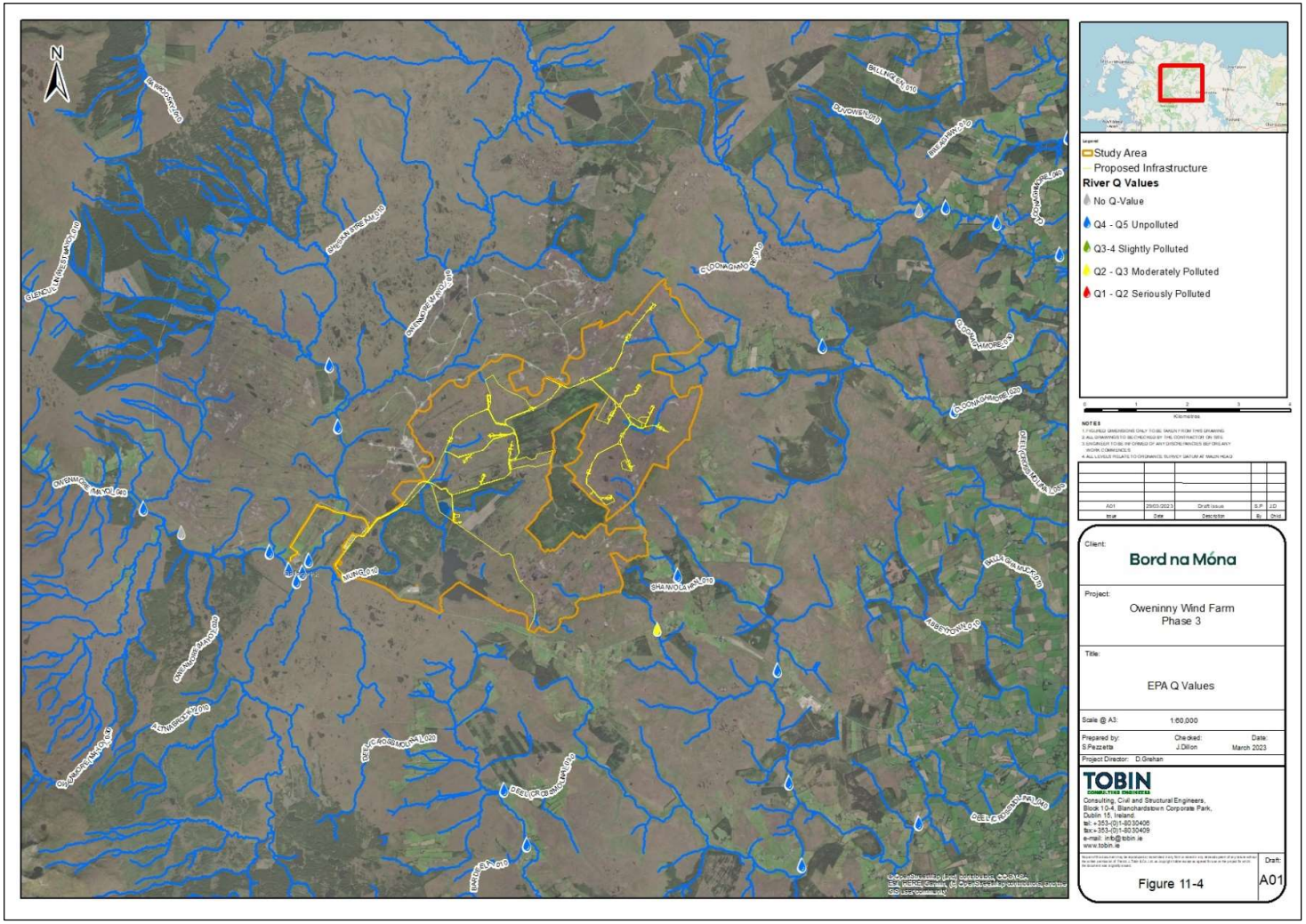

Figure 11-4: EPA Surface Water Monitoring Locations

11.3.4 Hydrogeology and Groundwater

Please see Chapter 10 for detailed descriptions of hydrogeology and groundwater at the Oweninny Phase 3 development site. Section 10.3.2 discusses aspects of groundwater quality, vulnerability, flow and usage as well as aquifer potential and characteristics throughout the site.

11.4 POTENTIAL IMPACTS

11.4.1 Introduction

This section addresses the potential impacts on the hydrological environment of the proposed wind farm. The description of the likely significant effects covers direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the project. The criteria (EPA, 2022) for the assessment of impacts require that likely significant effects are described with respect to their magnitude, frequency, extent, complexity, probability, duration, reversibility etc.

A qualitative approach was used in the evaluation, following the significance classification and through professional judgement. The significance of the effect has been determined through the consideration of the importance/sensitivity of the receptor (attribute) likely to be impacted and the magnitude (the degree or level) of that impact. Effects have been identified as beneficial, adverse or negligible, temporary or permanent and their significance as major, moderate, slight or not significant (negligible). Both the adverse and beneficial effects are considered. The hydrological assessment identified water sensitive waterbodies downstream from the proposed infrastructure works.

The construction activities, operational infrastructure and decommissioning were reviewed to identify activities likely to impact upon identified water bodies including water courses within and remote from the site. Following the identification of sensitive waterbodies, the extent and severity of potential construction, operational and decommissioning impacts were evaluated considering all proposed control measures included in the project design.

Sensitivity of Receptors:

The sensitivity of an environmental receptor is based on its ability to absorb an impact without perceptible change. The hydrological environment is considered to be of moderate to high sensitivity for receptors draining to Oweninny Rivers via hydrological links. The EPA and aquatic surveys have found the water quality in the receiving waters to be high/good (Q4 to Q5) and the area is considered to host good salmonid rivers. There are no 'Registered Protected Areas' (RPA) nutrient sensitive rivers in hydrological connection with the proposed development. There are no RPA habitat rivers in hydrological/hydrogeological connection with the proposed development. There are no RPA nutrient sensitive lakes and estuaries in hydrological/hydrogeological connection with the proposed development and there are no RPA shellfish/pearl mussel areas within the proposed development.

11.4.2 Do Nothing Effects

If the Oweninny Windfarm Phase 3 development does not proceed, the proposed development site will remain as peatland/bogland. The increasing or decreasing pressures on the local water quality will continue without separate intervention. There are no significant impacts to the hydrological environment in a do-nothing scenario.

In this scenario, the WFD 'High' status objective will likely be maintained. The status of the Shanvolahan_020 is likely achieve good status by 2027 due the recent improvement (2021 data) in water quality.

Net positive effects will continue to accrue with the implementation of Bord na Móna's peat rehabilitation activity, notably with regard to peat stabilization, vegetation re-growth, and re-establishment of natural drainage patterns in the immediate project area.

11.4.3 Potential Effects – Construction

The construction phase of the development will involve the following key activities that may have potential impacts on surface water conditions.

Potential impacts of these activities include:

- Water management at borrow pits/peat deposition areas;
- Flow alteration and water quality effects of drainage;
- Channel modifications - Culvert installation;
- Wastewater management;

- Hydrocarbons and cement effects;
- Cable works installations;
- WFD water body status;
- Designated sites; and
- Water supplies.

11.4.3.1 Hydrocarbon and Cement Effects

During construction of the wind farm, there is a risk of accidental pollution incidences from the following sources:

- Spillage or leakage of stored on site;
- Spillage or leakage of oils and fuels from construction machinery/vehicles;
- Spillage of oil or fuel from refuelling machinery on site;
- Spillages arising during the use of concrete and cement for turbine foundations and hardstanding areas.

There will be a risk of pollution from site traffic through the accidental release of oils, fuels, and other contaminants from vehicles. Concrete (specifically, the cement component) is highly alkaline and any spillage to a local watercourse would be detrimental to water quality as well as flora and fauna.

The potential for a significant spillage of hydrocarbons is limited on site. The risk of a serious spillage occurring on site is negligible. Notwithstanding the negligible risk of serious spillage, additional spillage protection measures are included in the Proposed Development.

Potential effects are negative, direct, short term, unlikely and moderate.

11.4.3.2 Wastewater

The presence of construction workers at the proposed development will lead to the generation of foul sewage from toilets and washing facilities. This foul sewage will be collected and tankered off-site for disposal at a licensed waste water treatment facility.

Potential effects are negative, direct, short term, likely and slight.

11.4.3.3 Channel Modification /Flooding

There will be one new river crossing of the Kilfian South ED Stream to T16 (Cloonaghmore catchment) as part of the development, and a number of drainage ditch crossings. Approximately 1% of the Muing river catchment and less than 1% of the other river sub-catchments will be modified by the development. The culvert will be of a size adequate to carry expected peak flows. No significant impact from changes to hydrology arising from development on the site is predicted.

A flood risk assessment was undertaken to determine whether the site is at risk from extreme fluvial flooding events. This report is discussed in Section 11-3 and concluded that the key infrastructure including the substation site is not at risk from extreme flooding.

It can be concluded that the risk of accidents associated with this development is low and would not cause unusual, significant, or adverse effects on human health or the environment during the construction or operational phase.

Potential effects are negative, direct, short term, likely and slight/moderate.

11.4.3.4 Borrow Pit Excavations and Peat Deposition areas

Peat depths at the borrow pit locations are absent to shallow, being only 0.1m in areas. This material will be removed from the surface, stored locally, and backfilled into the borrow pit following material extraction. With the installation of boundary drains, Borrow pit 2 material will be dry extracted.

Groundwater levels in Borrow pit 1 are approximately 1.2m bgl to 2.1m bgl and require a perimeter drain to locally lower the water table level. Alternatively wet excavation could be undertaken with dewatering of the borrow bit as this could impact on the groundwater levels and no additional discharges to the surface water network. Construction works (surface water runoff or pumped groundwater) can contain elevated sediment including silt and peat and effect water quality and aquatic species. Potential pre-mitigation effects are negative, direct, short term, likely and moderate.

The borrow pits will be reinstated using two material sources (a) overburden from the opening of the borrow pits, and (b) peat and mineral soils excavated elsewhere on the site that cannot be reused in wind farm construction. In addition, five peat deposition areas are proposed. Potential pre-mitigation effects are negative, direct, short term, likely and moderate.

11.4.3.5 Flow alteration and Water Quality

Based on construction phase activities outlined above, the potential hydrological impacts can be summarised as follows:

- Surface water quality impacts;
- Surface water flow alterations;

Construction activities could potentially reduce the infiltration capacity of the soils in areas where earthworks are undertaken and increase the rate and volume of direct surface runoff. Due to the low infiltration rate at present the potential for reduced infiltration is minimal. Surface water control measures are incorporated into the design of the proposed development. A slight reduction in peak rainfall runoff is anticipated where areas of peat are replaced with gravel trackways and gravel hardstand areas. The potential for an increase in runoff to streams is limited as surface water runoff is already controlled and managed in accordance with the IPC licence and site management procedures.

The four subcatchments support salmonids and supports unpolluted, good status (Q4) water quality. In light of the outlined sensitivities, potential negative effects on water quality resulting from construction in the absence of mitigation. Pre-mitigation, the potential construction impact varies from a slight/moderate negative and short term.

There is a potential impact as a result of dewatering borrow pits and turbine bases on site. Borrow pit 1 for example, is up to 3m deep, while borrow pit 2 is up to 5m deep. There are no water abstraction wells within 1.1 km of the proposed development.

The construction of the temporary site compound areas, site access tracks, turbine foundations, turbine hardstands, laying of underground electrical cabling, borrow pits, drainage channels will involve the removal of vegetation and the excavation of peat and mineral subsoil. Exposed and disturbed ground may increase the risk of erosion and subsequent sediment laden surface water runoff. The release of suspended solids is primarily a consequence of the physical disturbance of the ground during the construction phase, if not correctly compacted. Incorrect site management of earthworks and excavations could, therefore, lead to loss of suspended solids to surface waters as a consequence of the following activities:

- Soil stripping, if necessary, to construct the access roads, passing/turning bays, site compounds, turbine foundations, hardstands, borrow pits, turbines, hardstanding, roads, and substation
- Run-off and erosion from soil stockpiles (prior to reinstatement/profiling/side casting)

- Dewatering of excavations for turbine foundations, met mast foundations and borrow pits (where necessary). The result of increased sediment loading to watercourses is to lower water quality of the receiving water.

11.4.3.5.1 Excavation for Turbine Foundations

The material encountered in the trial pits excavated at each turbine location was soft sandy peat overlying soft to firm silty gravelly SAND and sandy gravelly SILT. Turbine excavations have the potential to have a slight negative short-term effect on the surface water environment in terms of increased runoff volumes. Preliminary volume calculations provide an approximate estimation of fill required for all of the Phase 3 development – See Chapter 9 (Soils and Geology). It is estimated 35,000m^3 of fill will be required. Additional geotechnical investigations will be undertaken at the site prior to commencement of construction to enable finalisation of structural design of foundations. As a worst-case design scenario turbine both gravity and piled foundations. For the piled turbine foundations, a typical driven piling type and configuration could be up to 70 no. 300mm square concrete driven piles. For the bored pile turbine foundations, a typical driven piling type and configuration is 16 no. 1600mm cylindrical piles. A similar type pile and configuration was used for the turbine foundations on the Phase 1 and 2 of the Oweninny wind farm. For gravity type turbine foundations, unsuitable material will be excavated and replaced by granular fill (6N) and excavated material will be placed in the peat deposition areas or utilised near the proposed turbines.

Potential effects are negative, direct, short term, likely and slight/moderate.

11.4.3.5.2 Excavation for Access tracks, Hardstanding Foundations/Temporary Construction Compounds

The environmental effects of the construction of the hardstanding foundations are similar to that of the turbine foundations. Volume calculations provide an approximate estimation of fill required for all the hardstanding foundations. It is estimated that 118,000m^3 of fill will be required for the hardstanding areas/compounds. It is proposed to install bottomless culverts/clear span bridges anywhere the proposed road layout intersects a stream. Culverts will be of a size adequate to carry expected peak flows.

Potential effects are negative, direct, short term, likely and slight/moderate.

11.4.3.5.3 Excavation for Substation Foundations

The construction of the 110kV substation will require the removal of topsoil and subsoil to a competent founding layer. Concrete/ structural fill will be used to upfill to the required finished floor level (75.9mOD). Ground investigations at the substation location, have only been undertaken for the purpose of the EIAR and have been used to inform the depth of excavation and upfill required. The substation will occupy an area of about 0.85ha.

Preliminary volume calculations provide a rough estimation of fill required for the foundation of the substation assuming spread foundations are used where they are founded on competent material. This is estimated as 41,000 m^3 of material is required.

The potential impact is considered to have slight to moderate, negative, short-term effect on the surface water environment.

11.4.3.5.4 TDR and Cable Route

The environmental effects of the construction of the cable route and access roads are similar to that of the hardstanding areas. It is proposed to install bottomless culverts/clear span bridges anywhere the proposed road layout intersects a stream.

Potential effects are negative, direct, short term, likely and slight/moderate.

11.4.3.6 WFD Status

The Proposed Development site is within the Owenmore 020 river subbasins The Owenmore is currently achieving High status by EPA, and maintaining 'High' status is a priority for WFD implementation in Ireland (See Section 11.3.2). A WFD assessment is included in Appendix 11-3. Shanvolahan 020 is an area of action as detailed in the current WFD assessment however the monitoring locations.

The Proposed Development has the potential to affect surface water quality. However, the duration of the construction phase is approximately 24 months. WFD status updates are determined and reported by EPA every 6 years. Accordingly, risks to WFD status are more relevant for the operational phase.

Pre-mitigation, the potential effects on WFD status of the four subbasins are negative, indirect, imperceptible, short-term, and unlikely.

11.4.3.7 Water Supply

The Proposed Development site is not located with a designated drinking water supply zone. There are no registered drinking water supplies within 10km downgradient of the proposed development.

Pre-mitigation, the potential effects are imperceptible, indirect, short-term, and unlikely.

11.4.3.8 Designated Sites

A number of designated habitats occur adjacent to the proposed development. Designated habitats including Bellacorick Iron Flush SAC and Lough Dahybaun SAC and Bellacorick Bog Complex SAC occur within 1 km of the proposed development.

There is no hydrological connection to the qualifying interests of the Bellacorick Iron Flush SAC or Bellacorick Bog Complex SAC. The amenity track is located upgradient of Lough Dahybaun. Minor improvement to the existing track is predicted to have a negligible, short term indirect effect on Lough Dahybaun.

11.4.4 Potential Effects – Operation

Do Nothing Effects

If the wind farm development does not proceed, the proposed development site will remain as peatland with an existing windfarm to the west of the site. In areas where agriculture and forestry are adjacent or within the site, normal agricultural and forestry will continue to occur into the future. There are no significant impacts to the hydrological environment in a do-nothing scenario.

Turbines, Hardstanding, Temporary Construction Compounds, Met Mast and Roads

The site is historically a peat extraction site which has ceased peat harvesting operations in 2003. The installation of permanent infrastructure (35 ha) could result in a slight increase in runoff during the operational phase of the wind farm. The proposed permanent wind farm footprint comprises 35 ha within the overall wind farm site area of 2,282 (1.5%). The potential for significant changes in runoff is, therefore, low with a slight potential increase in runoff.

The presence of hardstanding areas and the additional water control measures is likely to have a slight long-term impact in the water quality in particular ammonium and suspended solids.

The principal behind sustainable drainage devices is to reduce the quantity of discharge from developments to predevelopment flows and to improve the quality of run-off from proposed developments. The sustainable drainage devices will mimic existing greenfield runoff in terms of volume, rate of runoff and quality of the runoff. In this case, it is proposed to decrease the quantity of run-off to Greenfield rates by providing surface water attenuation lagoons.

With regard to water quality impacts, there will be no direct discharges to the surface water environment during the operational phase. Due to the nature of the development, there will be vehicles periodically on the site at any given time. The potential impacts are limited by the size of the fuel tank of the vehicles using on the site. As a result, occasional/accidental emissions, in the form of oil, petrol or diesel leaks, which could cause slight/negligible temporary and localised contamination of site drainage channels.

Substation

An on-site 110 kV substation will be constructed as part of the proposed development and will occupy a hard-standing area of approximately 0.85ha. Elements of the electrical plant at the substation site (primarily transformers) may contain oil for insulation purposes which may be a potential source of contamination.

The presence of occasional maintenance workers at the proposed substation will lead to the generation of foul sewage from toilets and washing facilities. This foul sewage will be collected and tankered off-site for disposal at a licensed waste water treatment facility.

Surface water arising from roof drainage will be allowed to percolate naturally within the substation.

Potential effects are negative, direct, short term, likely and slight.

11.4.5 Potential Effects – Decommissioning

Decommissioning of the proposed wind farm development will involve the disassembly and removal of the turbines offsite. These impacts have been assessed as similar to the Construction Phase and, therefore, the mitigation measures for the Construction Phase will also be implemented during decommissioning. Turbine hardstands will be covered over with soil and allowed to vegetate. It is not proposed to restore the hardstanding areas after decommissioning.

Potential impacts will be minimised by leaving elements of the proposed development in place where appropriate including the site roads, turbine foundations, substation and the grid connection infrastructure. Internal roads and drainage will remain in place for recreational access and management.

11.4.6 Summary of Effects

The magnitude of an impact includes the timing, scale, size and duration of the potential impact (pre-mitigation). The magnitude criteria for hydrology/hydrogeology are defined as set out in

Table 11-12 and Table 11-13 below.

Table 11-12: Magnitude and Significant of Hydrological Criteria - Construction Phase (Pre mitigation)

Criteria	Description	Duration and Frequency of Effects	Significance of potential effect
Run-off regime	Potential Increase in surface runoff may be caused by impermeable areas on site may give rise to a slight increase in surface water flow locally but is expected to have a negligible impact on the volumetric flow rate of downstream rivers.	Short term and rarely	Slight negative
Surface Water Quality	No significant loss in water quality is expected. Potential for minor spills of fuels and concrete.	Short term and occasional	Slight to moderate negative

Table 11-13: Magnitude and Significance of Hydrological Criteria - Operational Phase (Pre mitigation)

Criteria	Description	Duration and Frequency of Effects	Significance of potential effect
Run-off regime	Increased surface runoff caused by impermeable areas on site may give rise to a slight increase in surface water flow locally but is expected to have a slight potential effect on the volumetric flow rate of downstream rivers.	Long term and rarely	Slight negative
Surface Water Quality	No significant loss in water quality is expected. A slight beneficial impact could occur as a result of reduced runoff from peatlands.	Long term and rarely	Slight to negligible

As shown in the previous two tables above the potential impacts(pre-mitigation) are of slight/ moderate significance due to the sensitivity of the adjacent streams.

11.4.7 Major Accidents and Disasters

Major Accidents and Disasters assessment considers the potentially significant effects of a development on the environment as a result of its vulnerability to, or introduction of, risks of major accidents and/or disasters. It is clear from the EIA directive that a major accident and/or natural disaster assessment should be mainly applied to Control of Major Accident Hazards (COMAH) sites, SEVESO sites or nuclear installations. The proposed project is not a COMAH or nuclear installation, however the assessment is included for completeness. The starting point for the scope and methodology of this assessment is that the Proposed Development will be designed, built and operated in line with best international current practice and the type of project, as such, major accidents will be extremely unlikely. The management of any potential environmental accidents will be managed through the adoption of site best practises in the CEMP.

A flood risk assessment was undertaken to determine whether the site is at risk from extreme fluvial flooding events. This report is discussed in Section 11-3 and concluded that the key infrastructure including the substation site is not at risk from extreme flooding. The potential for a significant spillage of hydrocarbons is limited on site. The risk of a serious spillage occurring on site is negligible. Notwithstanding the negligible risk of serious spillage, additional spillage protection measures are included in the Proposed Development. During a spillage event, the spill will be collected by the drainage network and managed within the site boundary where it can be safely removed and treated/disposed. Section 8.5 outlined mitigation measures in relation to potential contaminants.

It can be concluded that the risk of accidents associated with this development is low and would not cause unusual, significant, or adverse effects on human health or the environment during the construction or operational phase.

11.4.8 Decommissioning

Decommissioning of the proposed development would result in the cessation of renewable energy generation and the removal of infrastructural elements. These impacts have therefore been assessed as similar to the construction phase and mitigation measures for the construction phase should also be implemented during decommissioning.

The decommissioning phase would be expected to have a number of potential impacts to water quality mainly arising from soil disturbance during decommissioning and with the potential for pollutants such as fuels, oils and greases to enter water courses. However, by this stage surface additional re-vegetation resulting from the bog rehabilitation programme and ongoing natural revegetation will be well established and this will act as a silt trapping mechanism on the site reducing the potential from soil run off impact to occur.

Concerning the hydrological impacts, there is no potential for impact on a number of the sensitive aquatic receptors as a result of keeping most of the below ground infrastructure. No changes to the internal drainage which could lead to localised erosion are anticipated. The decommissioning phase would have an unlikely and imperceptible impact.

11.5 MITIGATION MEASURES

As outlined in Chapter 3, Description of the Proposed Development, the design of the proposed development has considered a range of best practice construction measures which ensure avoidance of impacts throughout the construction and operational phases. Additional measures have been developed to mitigate the impacts identified in the preceding section.

11.5.1 Mitigation by Avoidance

Incorporation of measures to mitigate environmental impacts is inherent in the planning and design of wind farms such as at Oweninny Phase 3. This extends to all phases of the wind farm project from site selection and the concept phase, including consideration of alternatives, through development, pre-planning and design phases to construction, operation and decommissioning.

The hierarchy in mitigating environmental impacts in the Oweninny Wind Farm Phase 3 project has been avoidance, reduction, and remedy. The objective of the development has been to maximise the sustainable wind energy capture of what is a very suitable site for wind energy development without causing significant adverse environmental impacts. The design of Oweninny Wind Farm meets the primary objective of avoidance of impacts on environmental resources.

A consideration in all projects is to manage the scope of project activity necessary to achieve the project objectives in a manner that is environmentally responsible. At Oweninny impacts on all aspects of the environment have been minimised by selection of the proposed scheme over the

multiplicity of possible alternatives. An example of mitigation is the use of existing river crossing to minimise disturbance to river banks and locating turbines over 100m from streams.

11.5.2 Mitigation by Prevention and Reduction

A number of mitigation measures are outlined below and are considered as in-built to the design of the project. These mitigation measures are a combination of measures to comply with legislation and best practice construction methods to be implemented in order to prevent water (surface and groundwater) pollution.

11.5.3 Mitigation Measures – Construction Phase

In order to mitigate potential impacts during the construction phase, best practice construction methods will be implemented in order to prevent water (surface and groundwater) pollution. A Construction Environmental Management Plan (CEMP) has been developed for the project to ensure adequate protection of the water environment. All personnel working on the project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.

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

Surface water mitigation and management measures outlined hereunder are incorporated into the Surface Water Management Plan. Mitigation measures are incorporated into the CEMP and will be incorporated into the specification for the Civil Engineering Works contract. The implementation of the Surface Water Management Plan will be overseen by the appointed Site Ecologist and the Project Manager and will be regularly audited throughout the construction phase. The Project Manager will be required to stop works on site, if he/she is of the opinion that a mitigation measure or corrective action is not being appropriately or effectively implemented. A surface water management plan is included in Appendix 11.2 of this report.

An example of a hydrology mitigation is the minimisation of sediment runoff from the borrow areas and incorporation of settlement lagoons.

11.5.3.1 Concrete

Concrete is required for the construction of the turbine bases and foundations. After concrete is poured at a construction site, the chutes of ready mixed concrete trucks must be washed out to remove the remaining concrete before it hardens. Wash out of the main concrete bottle will not be permitted on site; wash out is restricted only to chute wash out. Wash down and washout of the concrete transporting vehicles will take place at an appropriate facility offsite.

The best management practice objectives for concrete chute washout are to collect and retain all the concrete washout water and solids in leak proof containers or impermeable lined wash out pits, so that the wash material does not reach the soil surface and then migrate to surface waters or into the ground water. The collected concrete washout water and solids will be emptied on a regular basis. Washout will be undertaken at the construction compounds.

11.5.3.2 Fuels and Chemicals

With regards to on-site storage and handling of potentially pollutant materials:

- Fuels and chemicals will be stored within bunded areas as appropriate to guard against potential accidental spills or leakages. The bund area will have a volume of at least 110 % of the volume of such materials stored;
- All on-site refuelling will be carried out by a trained competent operative.
- Mobile measures such as drip trays and fuel absorbent mats kept with all plant and bowsers and will be used as required during all refuelling operations;
- A spill kit will be stored with the bowser and the person operating the bowser will be trained in their use;
- No refuelling will take place within 50 m of any watercourse;
- All equipment and machinery will have regular checking for leakages and quality of performance and will carry spill kits;
- Any servicing of vehicles will be confined to designated and suitably protected areas such as construction compounds; and
- Additional drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.

11.5.3.3 Surface Water Flow and Watercourse Crossings

Potential impacts on surface water flow during the construction phase of the wind farm are mitigated by the proposed drainage design which has been designed to minimise disturbance to

the current hydrological regime by maintaining diffuse flows. Near-stream construction work will be carried in accordance with the requirement of the Inland Fisheries Ireland.

Where main drain crossings and stream crossings occur (i.e., access tracks), it is proposed to use a clear-span design bridge or bottomless culverts. Installation of such features will take place during dry periods to reduce the risk of sediment entering the watercourse. Smaller peatland drains with be crossed using normal culverts.

Near-stream construction work will only be carried out during the period permitted by Inland Fisheries Ireland (IFI, 2016)[3] guidance document *"Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites"*, that is, May to September inclusive. This time period coincides with the period of lowest expected rainfall and, therefore, minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.

Culverts will be designed to be of a size adequate to carry expected peak flows. Culverts will be installed to conform, wherever possible, to the natural slope and alignment of the drainage line. Where required, culverts will be buried at an appropriate depth below the channel bed and the original bed material placed at the bottom of the culvert. The sizing of any new internal drainage crossings will maintain existing depth of flow and channel characteristics.

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

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.
- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.
- CIRIA (2015a). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London.
- CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.

[3] IFI (2016) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*

- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney & Company for the Irish Wind Energy Association.
- Kilfeather, P.K. (2007) Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board. Southern Regional Fisheries Board, Clonmel, Co. Tipperary
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- SNH (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage, March 2012.
- SNH (2019). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

Embedded culverts will be buried to a depth of 0.3m or 20% of their height (whichever is greatest) below the bed. Crossing construction will be carried out, in so far as is practical, with minimal disturbance to the drain bed and banks. If they have to be disturbed, all practicable measures including location of stockpiles away from drainage ditches will be taken to prevent soils from entering any water. Any culverting works at drains will take place only during dry periods when the drains are dry/stagnant. Silt traps will be placed on the downgradient side of the crossing.

Cement and raw concrete will not be spilled into watercourses. No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and emplacement of pre-cast elements will take place. Pre-cast elements for bridge, culverts and concrete works will be used where possible. During the delivery of concrete on site, only the chute will be cleaned on-site, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout lagoons. These lagoons will be cleaned out by a licensed waste contractor. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Weather forecasting will be used to plan dry days for pouring concrete. The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

Earth embankments constructed for bridge approaches will be protected against erosion e.g., by re-vegetation or rock surfacing etc. In accordance with the IFI (2016) *Guidelines On Protection Of Fisheries During Construction Works In And Adjacent To Waters,* watercourse banks should use rock or other course material to protect from scour.

Pre-emptive Site Drainage Management

The works programme for the initial construction stage of the Proposed Development will take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a

composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,

- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest. Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests any of the following is likely to occur:

- >10 mm/hr (i.e., high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded; and
- Provide cover to material storage areas i.e., adequate tarpaulin over stockpile areas if material cannot be reinstated prior to suspension.

Runoff will be maintained at Greenfield (pre-development) runoff rates. The layout of the development has been designed to collect surface water runoff from hardstanding areas within the development and discharge to associated surface water attenuation lagoons adjacent to the proposed infrastructure. It will then be managed by gravity flow at Greenfield runoff rates.

It is proposed, that during the ground clearance of the proposed development, the contractor will implement water control measures to limit the impact on water quality using standards measures. Suspended solid (silt) removal features will be implemented in accordance with CIRIA C697 SuDS Manual, and CIRIA C648 Control of water pollution from linear construction projects.

All temporary and permanent drainage from the site shall be designed to have as a minimum three stages of treatment, as defined in the SuDS Manual. Management of runoff will include the following:

- Filtration of water through filter media (sand / stone check dam, silt fence);
- Detention / settlement in settlement ponds or behind check dam in swales; and
- Conveyance of shallow depths of water in vegetated swale.

Interceptor Drains

Interceptor drains/diversion ditches will be installed ahead of the main earthworks activities to minimise the effects of collected water on the stripped/exposed soils once earthworks commence. This drainage will integrate into the existing peatland drainage. These drainage ditches will be installed on the upgradient boundary of the areas affected by the access track earthworks operations and installed ahead of the main track construction operations commencing. They will generally follow the natural flow of the ground. The interceptor drains will intercept any storm water surface run-off and collect it to the existing low points in the ground, allowing the clean water flows to be transferred independently through the works without mixing with the construction drainage. It will then be directed to areas where it can be redistributed over the ground by means of a level spreader.

11.5.3.4 Borrow Pits

In order to mitigate potential impacts during the construction phase, best practice construction methods will be implemented in order to prevent water (surface water and groundwater) pollution. During the construction phase, all works associated with the construction of the wind farm will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015). Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016). Groundwater from the borrow pits will be treated in the settlement lagoons, see Figure 10889-2033 and Drawing 2039 to 2047.

A CEMP (Appendix 3.1 of the EIAR) was developed for the project to ensure adequate protection of the water environment. All personnel working on the project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.

11.5.3.5 Peat Deposition areas

Where possible excavated peat material will be reused local to the excavation area by side casting, battered back and profiled to reduce rainfall erosion potential. The stockpiling of

materials will be carefully supervised as per the mitigation measures listed in Chapter 9, Soils and Geology. Surplus material will be placed in the peat deposition areas.

The nature of the peat deposition areas is an important element in mitigating against suspended solids in run-off. The peat deposition areas have the following characteristics; >100m from rivers, shallow to no peat, relatively flat (<2 degrees), compartmentalised by former peat extraction high fields and topography. This mitigates against any potential lateral movement of peat. The drainage scheme for the peat deposition area will be controlled through a series of proposed settlement ponds with the provision of an overflow. Settlement ponds will be maintained over the course of the development and for a period until such time as outlined by the relevant authority.

Oil traps and oil spillage kits will be installed at the construction compounds to mitigate against pollution from fuel spillages and/or other potential pollutants. No fuel oil will be stored in the peat deposition area. The settlement ponds have been designed to take into consideration maintenance and a monitoring schedule will be put in place. Works will be undertaken during appropriate climatic conditions.

Revegetation of the peat deposition areas will stabilise the peat surface and bind the introduced peat into the former deposited peat and cutaway areas. Based on the existing plant species, the vegetation will comprise predominantly Juncus effusus with a ground layer of sedges and bryophytes. These areas will reseed naturally utilising adjacent and local seed banks. These plants will cover the bare peat, and also filter rainfall passing through.

A number of possible re-instatement options are outlined, and the appropriate option will be selected that will allow the system to naturalise and utilise the vegetative features to filter water on site and possibly restore peat-forming conditions.

11.5.3.6 Turbines, Hardstanding, Temporary Construction Compounds, Met Masts, and Roads

In order to mitigate potential impacts during the construction phase, best practice construction methods will be implemented in order to prevent water (surface water and groundwater) pollution. During the construction phase, all works associated with the construction of the wind farm will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015). Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016).

A CEMP (Appendix 3.1 of the EIAR) was developed for the project to ensure adequate protection of the water environment. All personnel working on the project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.

To minimise any impact on the underlying subsurface strata from material spillages, all oils and solvents used during construction will be stored within specially constructed dedicated bunded areas. Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area of the site, away from surface water gullies or drains. Spill kits and hydrocarbon absorbent packs will be stored in this area and operators will be fully trained in the use of this equipment. For certain vehicles which are less mobile, refuelling may need to occur elsewhere on site. This will be carried out using a double skinned and bunded bowser, towed behind a jeep (or similar). Refuelling using this will take place only by trained personnel, and only at locations greater than 50m from any watercourse. A spill kit will be stored with the bowser and the person operating the bowser will be trained in their use. When not in use this will be stored in the designated area of the construction compounds.

All mitigation and management measures outlined hereunder have been incorporated into the Surface Water Management Plan, which forms part of the CEMP (Appendix 3.1 of the EIAR). Mitigation measures are incorporated into the CEMP and will be incorporated into the specification for the Civil Engineering Works contract. The implementation of the Surface Water Management Plan will be overseen by a suitably qualified ecologist/engineer and will be regularly audited throughout the construction phase. The assigned ecologist/engineer will be required to stop works on site if he/she is of the opinion that a mitigation measure or corrective action is not being appropriately or effectively implemented.

Swales

Track edge drainage/swales are required to control run-off from the running surface to lower water levels in the subgrade, to control surface water and to carry this flow to outlet points. Swales along access tracks are to be installed in advance of the main construction phase. On sections of track where there is significant longitudinal gradient, regular surface water interception channels will be employed – these will typically be at 10-20m intervals to collect any surface water that is discharging as sheet flow along the track and discharge the flow into the trackside swale. Swales will provide additional storage of storm water where located along gradient. Given the steep longitudinal gradients on some sections of access track, regular check dams will be employed within the trackside swale on these sections to reduce the flow velocity

and provide settlement opportunity. Check dams will be constructed from course gravel/ crushed rock. Check dams will have a minimum 0.2m freeboard (from top of check dam) to top of swale level, to prevent overtopping of flows onto the access track. All check dams, etc to be checked at least once weekly via a walkover survey during the full period of construction. All excess silts to be removed and disposed of appropriately. Where check dams have become fully blocked with silt, they will be replaced.

Swales will re-vegetated following excavation. Vegetation will reduce the flow velocity, treat potential pollutants, increase filtration and silt retention.

Settlement Ponds

Settlement ponds will be located downstream of road swale sections and at turbine/hardstand locations, to manage/buffer volumes of runoff discharging from the drainage system during periods of high rainfall, thereby reducing the hydraulic loading to watercourses. Settlement ponds are designed in consideration of the greenfield runoff rates.

The following shall apply to construction of settlement ponds at the site:

- Pond depths generally to be excavated to less than 2m;
- Side slopes to be shallow, nominally at a 1 in 3 side slope (maximum); and
- Material excavated from the settlement pond should be compacted around the edge of the pond.

Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained.

The settlement pond design (Drawing 10889-2036) is based on primary settling out of suspended solids from aqueous suspension. The theory behind the design of the settlement lagoons is the application of Stoke's Law. The settlement lagoons will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment. Flow rates for storm events will be maintained at or below greenfield runoff rates as detailed above in Section 9.5.4.

Settlement lagoons will be installed concurrently with the formation of the road and will be fenced off for safety. They will be located as close to the source of sediment as possible and as

far as possible from the buffer zones of existing watercourses. The minimum buffer zone width will be 50m as outlined above.

Settlement lagoons will be regularly cleaned/maintained to provide effective and successful operation throughout the works. Outfalls and drainage ditches will be cleaned, when required, starting up stream with the outfalls blocked temporarily prior to cleaning.

The sediments/silt in the settlement lagoons will be cleaned regularly and removed via the contractor and deposited at suitable locations on site, away from watercourses. Machine access is required to excavate the accumulated sediment. Control measures include:

- Regular inspection and maintenance of settlement lagoons and drains;
- Settlement lagoon maintenance and/or cleaning will not take place during periods of extended heavy rain;
- Settlement lagoons will be fenced off for safety;
- Settlement lagoons will where practicable be constructed on even ground and not on sloping ground and where possible will discharge into vegetation areas to aid dispersion; and
- The settlement lagoons will be monitored closely over the construction timeframe to ensure that they are operating effectively.

Traffic on site will be kept to a minimum. Only the proposed onsite access track will be used for project-related traffic.

The slopes across the proposed Wind Farm site are flat to slight slopes. As the soil type varies across the site, this suggests that a 10 to 20m buffer zone is appropriate. As an additional measure, all infrastructure on the proposed wind farm site including for turbines, borrow pits, site compounds, substation and access tracks (excluding grid connection) will maintain a 50m set back from streams.

11.5.3.7 Temporary Site Compounds Construction

During the construction phase, five temporary site compounds will be required. Temporary on-site toilet facilities (chemical toilets) will be used. These will be sealed with no discharge to the surface water or groundwater environment adjacent to the site.

11.5.3.8 Substation

The mitigation strategies for the substation foundations follow similar procedures to the excavations for turbine and hardstanding foundations. A suitably qualified and experienced engineer will monitor all works.

Where existing drainage ditches need to be realigned (e.g., around substation), the new perimeter drain will match the profile of the existing ditch in relation to side-slope profile.

11.5.3.9 Turbine Delivery Route and Grid Connection Route

Silt fencing will be erected at the location of stream crossings along the grid connection route. Silt curtains and floating booms will also be used where deemed to be appropriate and this will be assessed separately at each individual location.

No refuelling of machinery will take place within 50m of a watercourse. Excavated material will not be stockpiled or side-cast within 50m of a watercourse. Appropriate steps will be taken to prevent soil/dirt generated during the temporary upgrade works to the TDR from being transported on the public road. Road sweeping vehicles will be used as required, to ensure that the public road network remains free of soil/dirt from the location of the TDR works when required. This will reduce the potential for sedimentation of surface watercourses locally.

Further mitigation measures in relation to the grid connection cable route and road/junction accommodation works on the TDR are outlined in the CEMP in Appendix 3.1 of the EIAR.

There will be one new watercourse crossing of the Kilfian South ED Stream to T16 as part of the development, and a number of drainage ditch crossings. Shallow trefoil formation will be used for the other two crossings in order to cross over existing drains/ culverts. Where existing drainage ditches need to be realigned (e.g. around substation), new ditches will match profile of existing ditch in relation to width, existing side slope profile (or lower) and material at base of channel will reused. The sizing any new culverts will be designed to maintain existing flow characteristics and depth of flow. Within the site development area, culverts will be assessed to ensure no barriers to fish migration occur. Where barriers occur, such culverts will be improved to increase fisheries potential.

Monitoring

It is recommended that local surface water features in the immediate vicinity of the site boundary are monitored pre-construction and during construction to take account of any variations in the quality of the local surface water environment as a result of activities related to the proposed development. A surface water management plan is included in Appendix 11-2. The main water parameters in terms of their potential to cause damage to aquatic life, ecosystems, human health, and water quality in the receiving waters are outlined in the outline surface water monitoring schedule.

Table 11-14 Outline Surface Water Monitoring Schedule for the Phase 3

PHASE	Preconstruction	Construction	Post construction
Monitoring Period	3 months	24 months	3 months
Frequency Surface Water Sampling Parameters	**Daily** N/A	**Daily** Turbidity and visual checks (examination of surface drainage/ sediment control measures/ watercourses). In line turbidity monitor/alarm on the Ballytarsna and Arrigle River.	**Daily** N/A
	Weekly pH, Electrical Conductivity, Turbidity, Temperature. (Handheld meter)	**Weekly** pH, Electrical Conductivity, Turbidity, Temperature. (Handheld meter) Monitoring during clearance phase and construction works.	**Weekly** N/A
	Monthly Conductivity, Chloride, Dissolved Oxygen, Molybdate Reactive Phosphorus, Mineral Oil, pH, Turbidity, Total Ammonia, Total Phosphorus, Total Suspended Solids (Grab Samples)		
	Quarterly N/A	**Quarterly** Conductivity, Chloride, Dissolved Oxygen, Molybdate Reactive Phosphorus, Mineral Oil, BTEX, pH, Turbidity, Nitrate, Total Ammonia,	**Quarterly** N/A

PHASE	Preconstruction	Construction	Post construction
		Total Phosphorus, Total Suspended Solids (Grab Samples)	
Reporting	**Pre-construction report.** Update limits/ values for construction phase surface water monitoring.	**Monthly and Quarterly Monitoring Report.** Results screened against construction phase surface water monitoring results.	**Final monitoring reporting.** Results screened against construction phase surface water monitoring results.

Inspections of silt traps are critical after prolonged or intense rainfall while maintenance will ensure maximum effectiveness of the proposed measures. Turbidity monitors/alarms will be strategically placed upgradient on the River Muing and downgradient of works to assess the main construction works including turbine base construction. A programme of inspection and maintenance will be designed, and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed and records kept.

During the construction phase, field testing and laboratory analysis of a range of parameters will be undertaken at adjacent watercourses, specifically following heavy rainfall events (i.e., weekly, monthly and event based as appropriate).

Major Accidents/ Disasters

It can be concluded that the risk of accidents associated with this development is low and would not cause unusual, significant or adverse effects on human health or the environment during the construction phase. No specific mitigation measures are required.

11.5.4 Mitigation Measures – Operational Phase

The following mitigation measures will be implemented during the operational stage.

Turbines, Hardstanding, Temporary Construction Compounds, Met Masts, and Roads

Any vehicles utilised during the operational phase will be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected. The potential impacts are limited by the size of the fuel tank of vehicles used on the site.

Borrow Pits

There are no proposed borrow pit mitigation measures required for the operational phase.

Substation

Within the selected substation, all fuel will be stored in bunded areas. The bund capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. The exception to this being double walled tanks equipped with leak detection, which do not require additional retention.

A hydrocarbon interceptor will be installed at the proposed substation site with regular inspection and maintenance, to ensure optimal performance.

Given the requirement for sanitary facilities during occasional operation and maintenance works, wastewater effluent will be directed to an onsite holding tank, from where it will be tankered off site to a suitably licensed wastewater treatment plant.

Within the National River Basin Management Plan 2018 – 2021 (released in April 2018), extractive or anthropogenic pressures are not identified as a significant pressure on a catchment scale basis. As is detailed in the River Basin Management Plan 2018 – 2021, Bord na Móna ceased extraction in 2003 at Oweninny. Bord na Móna stabilised and rehabilitated the cutaway bog using best-available mitigation measures. The surrounding peatlands will continue to be managed in accordance with their relevant EPA IPC Licence and rehabilitation plan.

11.5.5 Mitigation Measures - Decommissioning

Decommissioning of the proposed wind farm development will involve the disassembly and removal of the turbines offsite. These impacts have been assessed as similar to the Construction Phase and, therefore, the mitigation measures for the Construction Phase will also be

implemented during decommissioning. Turbine hardstands will be covered over with soil and allowed to vegetate. It is not proposed to restore all hardstanding areas after decommissioning. The risks associated with leaving tracks and infrastructural components in situ are relatively low. The decommissioning phase will not require any significant works that will impact the drainage network. A fuel management plan to avoid contamination by fuel leakage during decommissioning works will be implemented as per the construction phase mitigation measures.

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant. Some of the impacts will be avoided by leaving elements of the Proposed Development in place. The turbine bases and hardstanding areas will be rehabilitated by covering with locally sourced peat in order to regenerate vegetation which will reduce runoff and sedimentation effects.

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures in Section 11.5.3.

These impacts have therefore been assessed as similar to the construction phase. Mitigation measures for the construction phase will therefore also be implemented during decommissioning.

11.5.6 Monitoring

Local surface water features in the immediate vicinity of the site boundary will be monitored pre-construction and during construction to take account of any variations in the quality of the local surface water environment as a result of activities related to the proposed development.

Inspections and maintenance of settlement ponds, check dams and silt fences are critical after prolonged or intense rainfall while maintenance will ensure maximum effectiveness of the proposed measures. A programme of inspection and maintenance will be designed, and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed, and records will be kept of inspections and maintenance. Monitoring proposals is included in the CEMP, attached as Appendix 3.1.

11.6 RESIDUAL IMPACTS

The following conclusions can be drawn in relation to surface water:

- The site drains to a number of tributaries surrounding the site boundary, primarily to the Owenmore river;
- The site is underlain by poorly drained blanket peat, with minor amounts of glacial till and sand and gravels particularly in the southeast of the site. Alluvial deposits are found along the Owenmore/Oweninny River;
- Man-made drains are located throughout the site and will continue to operate as part of the existing water management system on site. The proposed drainage plan will further enhance the water management at this location;
- The site does not exhibit strong topographical trends and might be considered to be generally flat lying with gentle falls to principal water course; occasional isolated hills exist within the site and represent discrete glacial/post glacial geomorphological features. As a result, it is of low risk due to changes caused by the development on the hydrological regime;
- Water quality in the immediate area of the site is good/high and is consistent with the expected natural water quality for an environment. The water quality reported by the EPA downstream of the site is of good status;
- The site overlies a poor aquifer that is unproductive except for local zones and underlies an entire site of sandstone and siltstone bedrock.

The residual impacts on the surrounding water quality, hydrology and existing drainage regime at the site are considered to be negligible and short term in nature. The existing on-site drainage system will remain active during construction and operation of the proposed wind farm and will be enhanced by a proposed drainage plan that has been designed for this development.

The construction timescale of activities within the site will be phased and short-term in duration and, thereafter, the only activities within the site that will be associated with maintaining existing drains, ongoing maintenance and monitoring during the operational phase. There are no significant long-term impacts.

11.6.1 Cumulative Effects

Cumulative effects of this project with other developments in the region, as discussed in Chapter 5 - Policy, Planning and Development Context. Efficient design along with material

management will ensure optimisation of the volume of materials required to be imported to site. This will mitigate any cumulative effects relating to importing of material and use of public roads as haul roads.

Cumulative effects of this project with other developments in the region, relate to the effects on Hydrology. These developments include other existing or planned developments in the environs of Oweninny Bog and/or developments with the potential to interface with the bog in terms of environmental effects. Key developments in the area include:

- Sheskin Wind Farm – Phase 1 and Phase 2;
- Doonleg Wind Turbine;
- Oweninny Wind Farm; and
- Green Hydrogen Plant (Planning Phase).

Sheskin Wind Farm – Phase 1

Sheskin Wind Farm (Mayo Co. Co. Planning reference: 15825) is comprised of 8 wind turbines and associated works, is located approximately 150 metres from the proposed development sit. Each turbine will have a maximum overall height of 150 metres. It was granted conditional planning permission 2016. An NIS and EIAR for this development concluded the implementation of appropriate mitigation measures, the proposed wind farm at Sheskin will have no potential for cumulative impacts with other known projects.

Sheskin Wind Farm – Phase 2

The proposed Sheskin Wind Farm (ABP Planning reference: PA16.315933) comprises 21 wind turbines and associated works. The windfarm is located approximately 2km west of the proposed Oweninny Phase III site. An NIS and EIAR for this development concluded the implementation of appropriate mitigation measures, the proposed wind farm at Sheskin will have no potential for cumulative impacts with other known projects. The application is due for decision by August 2023.

Dooleeg Wind Turbine

Permission for a single wind turbine generator (Mayo Co. Co. Planning Reference: 20467), with an overall max height of 180 metres and 20kV grid connection to Bellacorick 110kV substation. It is located approximately 300m from the proposed development site and was granted conditional permission in 2021. The Wind Turbine is located in the An EIAR and NIS have been produced for this proposed development. The NIS concluded that this project alone or in-

combination with other plans or projects, will not result in significant adverse effects to any European sites.

Oweninny Wind Farm Phase 1 and 2

Oweninny Bog is currently subject to ongoing wind farm development. Construction of Oweninny Wind Farm Phase 1 has been completed and the project is in the operational phase. Oweninny Wind Farm Phase 2 is currently in the construction phase where there is the greatest potential for impact.

The bog remnant and bog rehabilitation areas will not be significantly affected by the wind farm development and the overall site development will be carried out in a manner that integrates with the bog rehabilitation programme. The criteria defining successful rehabilitation are the same with or without the windfarm; Stabilisation of peat through revegetation, mitigation of silt run-off and establishment of wetland communities where possible.

The bog is relatively flat lying, with cutover blanket peat overlying glacial till that in turn overly sedimentary bedrock of mixed lithology. No significant groundwater resources are present at the site, although localised perched groundwater may be associated with areas of granular overburden. No significant geological resources are known at the site and geological heritage is limited to the banks of the Oweninny/Owenmore River.

The principal risks associated with hydrology and water quality at the site are the generation of silty waters due to runoff from construction areas, and the loss of construction and operational materials (concrete, fuel and oil, etc) to water. It is expected that these risks can be mitigated through the adoption of construction and operational good practice. The major potential impacts from Oweninny Wind Farm are listed below.

- Pollution with suspended solids due to runoff of soil from construction areas;
- Pollution with nutrients release;
- Pollution during construction phase with substances such as fuels, lubricants, waste concrete, wastewater from site toilet and wash facilities, etc;
- Pollution with surface drainage water from paved areas and track surfaces during operation;
- Hydrological impact due to changes in the flow rates of streams/rivers; and
- Permanent loss of habitat due to culverting or bank/stream alteration.

As mentioned, these risks can be mitigated through the adoption of construction and operational good practice and hence, it is unlikely that the development will give rise to any significant cumulative impacts with regards to hydrology, hydrogeology, and water quality.

Permission for a single wind turbine generator (Mayo Co. Co. Planning Reference: 20467), with an overall max height of 180 metres and 20kV grid connection to Bellacorick 110kV substation. It is located approximately 300m from the proposed development site and was granted conditional permission in 2021. An EIAR and NIS have been produced for this proposed development. The NIS concluded that this project alone or in-combination with other plans or projects, will not result in significant adverse effects to any European sites.

Oweninny Bog Substitute Consent

TOBIN have been commissioned to submit a substitute consent application on behalf of Bord na Mona for the historic peat extraction at Oweninny Bog. Within this application an assessment was carried out on of any likely significant effects on biodiversity as a result of this peat extraction. The proposed development site is located within Oweninny Bog.

A remedial EIAR has been developed (unpublished TOBIN reports) for the Oweninny Bog, which included an assessment on any likely significant effects from the historic peat extraction within the receiving water environment. It is expected that there will be no likely residual impacts in relation to surface water.

Mayo Green Hydrogen Production Plant

The development of a hydrogen plant (Mayo Co. Co. Planning Reference: 22502) that will produce hydrogen by the electrolysis of water, is proposed at a site approx. 1km from the Oweninny Phase 3 site boundary. The hydrogen produced will be stored on site and available for Injection into the transmission gas network or the removal off site by trucks with tube trailers. Water will be abstracted from the adjacent Oweninny river, ground water or a combination of both. The oxygen produced from electrolysis will be vented to atmosphere.

In terms of the potential effects of the Mayo Green Hydrogen Plant development on downstream surface water bodies, the biggest risk is during the construction phase of the development as this is the phase when earthworks and excavations will be undertaken at the sites. The proposed development has potential hydrological connectivity at downstream sites

and therefore there can be potential cumulative effects or interactions with both the construction, operation, and decommissioning phases of other developments.

However, the implementation of the proposed mitigation measures will ensure there will be no cumulative significant adverse effects on the water environment from the proposed hydrogen plant in combination with other relevant developments within a 10km radius in the Blacksod-Broadhaven catchment, as well as with the proposed grid and gas connection works associated with the project.

Other Smaller Developments

A review of the Mayo County Council planning portals revealed a number of small scale residential and rural developments (e.g., residential one-off housing and agriculturally based developments) proposed in areas between Crossmolina, Bellacorick and Bangor-Erris in proximity to the proposed development site. Considering the small scale residential and rural developments, there is no potential for significant adverse effects on hydrology. A full list of planning applications within the wider area of the site are provided in Chapter 5 (Policy, Planning & Development Context) Appendix 5-1 of this EIAR.

11.6.2 Cumulative Assessment

No significant residual effects on any ecological receptor have been identified from the sections above.

No significant residual effects were reported for any receptors within any of the nearby wind farm/other assessment reviewed. Taking into consideration other plans or projects no residual cumulative effects are anticipated.

Due to the localised nature of the proposed works within the site boundary, there is no potential for significant, negative cumulative effects in-combination with other local developments on the water environment.

11.7 SUMMARY

The proposed development has been analysed in relation to the potential impacts it could have on the receiving hydrological environment. Where potential impacts could occur in the construction, operational and decommissioning phases of the development it is expected that these risks can be fully mitigated through the adoption of construction and operational good practice.

Hence, it is not expected that this project will give rise to any significant residual impacts with regards to hydrology and water quality.