# 23. WATER

## 23.1 Introduction

### 23.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to carry out an assessment of the potential likely and significant effects of the onshore elements of the Sceirde Rocks Offshore Wind Farm ('the Project') on the hydrological (surface water) and hydrogeological (groundwater) aspects of the receiving environment.

The Project is described in full in Chapter 5 of this EIAR.

This chapter provides a baseline assessment of the environmental setting of the Onshore Site, as described in Chapter 5, in terms of hydrology and hydrogeology and discusses the potential likely significant effects and cumulative effects that the construction, operation and maintenance, and decommissioning of the Onshore Site will have. Where required, appropriate mitigation measures to avoid any identified significant effects to hydrology and hydrogeology are recommended and the residual effects of the Onshore Site (post-mitigation) are assessed.

As detailed in Section 1.1.1 in Chapter 1, for the purposes of this EIAR, the various project components are described and assessed using the following references: the 'Project', the 'Onshore Site', the Onshore Grid Connection ('OGC'), the Onshore Compensation Compound ('OCC), and the Onshore Landfall Location ('OLL').

### 23.1.2 Statement of Authority

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

Our core areas of expertise and experience include hydrology, hydrogeology and windfarm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types.

This chapter of the EIAR was prepared by Michael Gill, and Conor McGettigan.

Michael Gill (PGeo, BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years of environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable energy projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 100 other wind farm-related projects.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 4 years of experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares the hydrology and hydrogeology chapters of environmental impact assessment reports for wind farm developments. Conor has also prepared several flood risk assessments and Water Framework Directive compliance assessments for various renewable energy developments in Ireland.

### 23.1.3 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Section 2.7.2 of Chapter 2 of the EIAR. Consultation responses relating to the water environment were received from the Geological Survey of Ireland (GSI). Matters raised by Consultees in their responses with respect to the water environment are summarised in Table 23-1 below.

*Table 23-1: Summary of Water Environment Related Scoping Responses*

| Consultee | Description | Addressed in Section |
|---|---|---|
| GSI | The GSI recommend the use of their online databases. | All available and relevant GSI online databases have been used in the preparation of this chapter. |
| | **Groundwater** – Recommend the use of the Groundwater Viewer to identify areas of High to Extreme Groundwater Vulnerability. | Groundwater Vulnerability at the Onshore Site is discussed in Section 23.3.10. |
| | **Groundwater** – Assess the potential effects on Drinking Water Supplies | Water Resources in the vicinity of the Onshore Site are described in Section 23.3.13.<br>Potential effects on drinking water supplies are assessed in Section 23.5.2.9. |
| IPCC | **Water Framework Directive** – The IPCC states that the proposed development should not adversely impact on water quality and lower Ireland's standing with our legal obligations to protect waterways. IPCC also state that there may also be rivers or waterways that are not monitored by the EPA and these need to be evaluated ecologically and hydrologically and included in the assessments. | A full WFD Compliance Assessment has been completed for the Project and is included as Appendix 23-2.<br>Site walkover surveys and hydrological monitoring has been completed to identify all watercourses in the local area, whether mapped by the EPA or not. |
| | **Wetlands** – IPCC state that there are a number of wetlands within the proposed project areas and that these sites need due consideration to ensure that they will not be affected by the development. | All wetlands in the vicinity of the Onshore Site are identified in Section 23.3.12.2.<br>The potential effects of the Project on these wetlands are assessed in Section 23.5.2.14. |
| | **Designated Sites** – The proposed project need to ascertain possible negative impact on designated sites and ensure that no part of the proposed development detrimentally impacts on the integrity of wetlands within them. | All designated sites in the vicinity of the Onshore Site are identified in Section 23.3.12.<br>The potential effects on designated sites are assessed in Section 23.5.2.12. |
| OPW | The OPW highlighted the requirement for a Section 50 consent for any new watercourse crossing. | Refer to Section 23.5.2.8. |

## 23.1.4 Relevant Legislation

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

The requirements of the following legislation are complied with:

- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- S.I. No 296/2018: SI 296 European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law;
- S.I. No. 477/2011: SI 477 European Communities (Birds and Natural Habitats) Regulations 2011, as amended, implementing EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293/1988: SI 293 Quality of Salmon Water Regulations 1988;
- Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission Directive 2014/101/EU ("WFD");
- S.I. No. 272/2009: SI 272 European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 SI 722 European Communities (Water Policy) Regulations 2003, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for the implementation of 'daughter' Groundwater Directive (2006/118/EC);
- S.I. No. 722/2003: SI 722 European Communities (Water Policy) Regulations 2003 (;
- S.I. No: 122/2010: SI 122 European Communities (Assessment and Management of Flood Risks) Regulations 2010, resulting from EU Directive 2007/60/EC;
- S.I. No. 684/2007: SI 684 Waste Water Discharge (Authorisation) Regulation 2007s, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 9/2010: SI 9 European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended; and,
- S.I. No. 296/2009: SI 296 European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.

## 23.1.5 Relevant Guidance

The Hydrology and Hydrogeology chapter of this EIAR is carried out in accordance with guidance contained in the following:

- Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- DoE/NIEA (2015): Wind farms and groundwater impacts - A guide to EIA and Planning considerations;
- OPW (2009) The Planning System and Flood Risk Management;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Energy Development Guidelines for Planning Authorities (2006);

- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001;
- Land Types for Afforestation (Forest Service, 2016b);
- Forest Protection Guidelines (Forest Service, 2002);
- Forest Operations and Water Protection Guidelines (Coillte, 2013);
- Forestry and Water Quality Guidelines (Forest Service, 2000b); and,
- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 (DAFM, 2018).

# 23.2 Assessment Methodology

## 23.2.1 Desk Study

A desk study of the Onshore Site and water study area (defined in Section 23.2.6 below) was undertaken in the Summer of 2023 to collect all relevant hydrological, hydrogeological, and meteorological data. The desk study was completed to supplement site walkover surveys, drainage mapping and site investigations. The desk study information has been checked and updated, where necessary, in October 2024.

The desk study involved consultation with the following sources:

- Environmental Protection Agency Databases (www.epa.ie);
- Environmental Protection Agency's Hydrotool Database (www.catchments.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 17 (Geology of the Shannon Estuary); Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- OPW Flood Mapping (www.floodinfo.ie); and,
- Aerial Photography, 1:5000 and 6-inch base mapping.

## 23.2.2 Baseline Monitoring and Site Investigations

Initial site walkover surveys, including drainage mapping, were completed by Michael Gill and Conor McGettigan of HES on 19th July 2023. Additional site walkover surveys and hydrological monitoring, including surface water flow monitoring, field hydrochemistry and grab sampling, were undertaken by Conor McGettigan of HES on 15th August 2023 (refer to Section 23.1.2 above for qualifications and experience).

In summary, the site investigations to address the Water chapter of this EIAR are as follows:

- HES completed site walkover surveys and drainage mapping at the Onshore Site on 19th July and 15th August 2023 whereby water flow directions and drainage patterns were

recorded. These surveys included field hydrochemistry monitoring and stream flow monitoring of watercourses draining the Onshore Site;
- A total of 5 no. surface water grab samples were taken to determine the baseline water quality of the primary surface waters originating from the Onshore Site. These samples were taken on 15th August 2023;
- Completion of 41 no. peat probes by MKO in November 2023 to determine to geomorphology of the peat at along the OGC;
- IDL completed a total of 390 no. peat probes and 132 no. in-situ shear vane tests along the OGC between February and April 2024;
- Minerex Geophysics Ltd completed a geophysical survey consisting of 2D-Resistivity and seismic refraction surveying along the OGC along the R20301 in Doonmore, Co. Clare on 18th and 19th June 2024. The investigation was completed in order to determine the depth and type of glacial deposits which underlie the peat and the depth to rock;
- IDL completed a total of 12 no. hand augers along the OGC on 18th and 19th June 2024 to investigate the depths of peat and nature of the subsoils;
- IDL completed site investigations at the OLL between 21st and 28th November 2022. These site investigations comprised of the excavation of 2 no. trial pits and the drilling of 2 no. boreholes to investigate the nature of the mineral soil and subsoils and the underlying bedrock; and;
- IDL completed 3 no. trial pits at the OCC on 3rd July 2024.

The Minerex Geophysics Ltd 'Peatland Geophysical Report' (July 2024) is included as Appendix 5-13. IDL Phase 1 site investigation works along the OGC is included as Appendix 5-13. IDL's 'Sceirde Rocks Cable Route Phase 2: Site Investigation Factual Report' (July 2024) is included as Appendix 5-13. DL's 'Sceirde Rocks Landfall: Factual Report' (February 2023) which details the site investigation works completed at the OLL is included as Appendix 5-12.

### 23.2.3 Impact Assessment Methodology

Please refer to Chapter 1 of the EIAR for detail on the impact assessment methodology (EPA, 2022). In addition to the above methodology, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Levels of importance which are defined in Table 23-2 for hydrology and Table 23-3 for hydrogeology are used to assess the potential effects that the Project may have on them.

*Table 23-2: Estimation of Importance of Hydrology Criteria (NRA, 2008)*

| 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.<br>Regionally important potable water source supplying >2500 homes.<br>Quality Class A (Biotic Index Q4, Q5).<br>Flood plain protecting more than 50 residential or commercial properties from flooding.<br>Nationally important amenity site for a wide range of leisure activities. |

| Importance | Criteria | Typical Example |
|---|---|---|
| High | Attribute has a high quality or value on a local scale | Salmon fishery<br>Locally important potable water source supplying >1000 homes.<br>Quality Class B (Biotic Index Q3-4).<br>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.<br>Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3).<br>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.<br>Local potable water source supplying <50 homes.<br>Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding.<br>Amenity site used by small numbers of local people. |

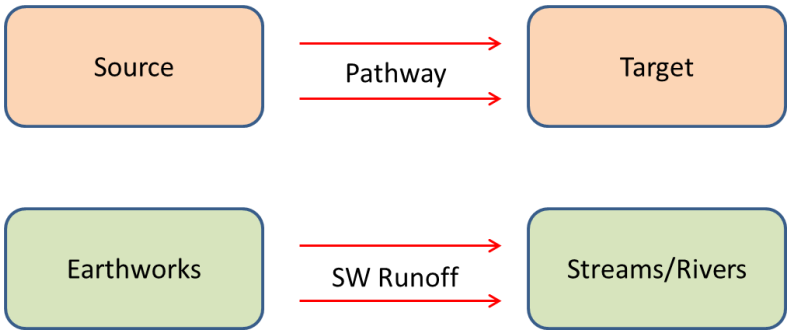
*Table 23-3: Estimation of Importance of Hydrogeology Criteria (NRA, 2008)*

| Importance | Criteria | Typical Example |
|---|---|---|
| Extremely High | Attribute has a high quality or value on an international scale | Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation, e.g. SAC or SPA status. |
| Very High | Attribute has a high quality or value on a regional or national scale | Regionally Important Aquifer with multiple wellfields.<br>Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - NHA status.<br>Regionally important potable water source supplying >2500 homes<br>Inner source protection area for regionally important water source. |
| High | Attribute has a high quality or value on a local scale | Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers.<br>Locally important potable water source supplying >1000 homes.<br>Outer source protection area for regionally important water source.<br>Inner source protection area for locally important water source. |
| Medium | Attribute has a medium quality or value on a local scale | Locally Important Aquifer.<br>Potable water source supplying >50 homes.<br>Outer source protection area for locally important water source. |

| Importance | Criteria | Typical Example |
|---|---|---|
| Low | Attribute has a low quality or value on a local scale | Poor Bedrock Aquifer<br>Potable water source supplying <50 homes. |

## 23.2.4 Overview of Impact Assessment Process

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




Where potential effects are identified, the classification of impacts in the assessment follows the descriptors provided in the Glossary of Impacts contained in the Environmental Protection Agency (May 2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

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

The assessment of effects is Step No. 6 of 7 in the EIAR process. In order to provide an understanding of the stepwise impact assessment process applied below (Sections 9.5.2 to 9.5.4), a summary guide is presented below, which defines the steps (Steps 6a to 6g) taken in each element of the impact assessment process. The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA impact descriptors are combined.

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

*Table 23-4: Impact Assessment Process Steps*

| | | |
|---|---|---|
| Step 1 | Identification and Description of Potential Impact Source<br><br>This section presents and describes the activity that brings about the potential impact or the potential source of pollution. The significance of effects is briefly described. | |
| Step 2 | Pathway / Mechanism: | The route by which a potential source of impact can transfer or migrate to an identified receptor. In terms of this type of development, surface water and groundwater flows are the primary pathways, or for example, excavation or soil erosion are physical mechanisms by which potential impacts are generated. |
| Step 3 | Receptor: | A receptor is a part of the natural environment which could potentially be impacted upon, e.g. human health, plant / animal species, aquatic habitats, soils/geology, water resources, water sources. The potential impact can only arise as a result of a source and pathway being present. |
| Step 4 | Pre-mitigation Impact: | Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact before mitigation is put in place. |
| Step 5 | Proposed Mitigation Measures: | Control measures that will be put in place to prevent or reduce all identified significant adverse impacts. In relation to this type of development, these measures are generally provided in two types: (1) mitigation by avoidance, and (2) mitigation by (engineering) design. |
| Step 6 | Post-Mitigation Residual Impact: | Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impacts after mitigation is put in place. |
| Step 7 | Significance of Effects: | Describes the likely significant post-mitigation effects of the identified potential impact source on the receiving environment. |

### 23.2.5 Consideration of data sources and quality

No limitations or difficulties were encountered during the preparation of the Water Chapter of this EIAR.

### 23.2.6 Water Study Area

The study area for the hydrological and hydrogeological impact assessment is defined by the regional surface water catchments and groundwater bodies within which the Onshore Site is located. The regional surface water catchments and groundwater bodies within which the Onshore Site is located are detailed in Section 23.3.3 and Section 23.3.8 respectively.

# 23.3 Receiving Environment

## 23.3.1 Onshore Site Description and Topography

The Onshore Site includes the Onshore Landfall Location ('OLL'), the Onshore Grid Connection ('OGC'), and the Onshore Compensation Compound ('OCC'). The locations of these elements of the Onshore Site are shown in Figure 23-1

### 23.3.1.1 Onshore Landfall Location

The OLL is located approximately 3.5km northwest of the village of Doonbeg in west County Clare. The OLL stands at an elevation of approximately 10 metres above Ordnance Datum (mOD) in the townland of Killard. This is the location where the Offshore Export Cable will be brought ashore to meet the Transition Joint Bay (TJB). The proposed TJB at the OLL is situated approximately 115m from the cliff edge. This area can be accessed from an unnamed local road which runs from northwest to southeast, approximately 220m southeast of the proposed construction compound location. The site of the OLL is currently a greenfield site comprising of agricultural land.

### 23.3.1.2 Onshore Grid Connection

The OGC has a total length of 22.3km and is divided into 2 no. sections. The first section extends from the TJB to the OCC in the townland of Ballymacrinan and has a total length of 19.3km. The second section extends from the OCC to Moneypoint Power Station and has a total length of 3km. The OGC comprises an underground cable connection which will travel along third-party lands and the local public road network. The local topography is relatively flat to gently undulating with elevations ranging from 5mOD to 55mOD.

Upon exiting the TJB at the OLL, the OGC travels to the south along local roads and third-party lands before crossing the N67 in the townland of Doonmore. The route then continues to the southeast along the L2034 for 6.7km before travelling east and crossing the R483. From here the cables will be routed through Kilrush Golf Club in the townlands of Ballykett and Parknamoney. After exiting Kilrush Golf Club the OGC will then travel across the road into third-party lands, travelling south for 540m before entering onto the L6150 and continuing to the southeast as far as the 220kV OCC in the townland of Ballymacrinan.

Upon exiting the OCC, the OGC cable continues to the south for ~700m on the local road network before joining the N67. From here it travels east in the verge of the N67. In the vicinity of Moneypoint 220kV Substation, a small section of the OGC is located off-road and crosses a forested area in the townland of Carrowdotia South. Local ground elevations along this section of the OGC range from approximately 5 to 25mOD.

The vast majority of the OGC will be located in the existing public road corridor (14.8km from the TJB at the OLL, and 0.7km from the OCC to Moneypoint). The section between the OCC and Moneypoint is located within the road verge along the N67. Meanwhile, 6.1km is located in 3rd party lands. An overview of the sections of the OGC and the associated lengths is provided in Table 5-13 of Chapter 5: Project Description.

### 23.3.1.3 Onshore Compensation Compound

The OCC is located within the townland of Ballymacrinan, approximately 3.5km to the southeast of the town of Kilrush. The site of the proposed OCC can be accessed via the L6150, situated to the east. The local ground elevations stand at ~20mOD. The Lower Shannon Estuary is located ~700m to the south. The site of the OCC is currently greenfield site in agricultural use.

## 23.3.2 Water Balance

Long term rainfall and evaporation data was sourced from Met Éireann. The long-term average annual rainfall (1981 - 2010) recorded at Doonbeg Garda Station, located ~3.5km southeast of the OLL, is presented in

Table 23-5. The long-term average annual rainfall at Doonbeg rainfall station is ~1,186mm/year.

Met Éireann also provide a grid of average annual rainfall for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the average annual rainfall at the Onshore Site ranges from 1,144mm/year in the vicinity of Moneypoint substation to 1,250mm/year along the OCG to the east of Moyasta. The average annual rainfall at the Onshore Site is 1,197mm/yr (this is considered to be the most accurate estimate of average annual rainfall from the available sources).

*Table 23-5: Local Average long-term Rainfall Data (mm)*

| Station | | X-Coord | | Y-Coord | | Ht (MAOD) | | Opened | | Closed | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Doonbeg | | 975655 | | 165500 | | 12 | | 1981 | | 2010 | | |
| Jan | Feb | Mar | Apr | May | Jun | July | Aug | Sept | Oct | Nov | Dec | Total |
| 125 | 87 | 90 | 64 | 74 | 76 | 79 | 98 | 101 | 132 | 127 | 133 | 1,186 |

The closest synoptic station[1] where the average potential evapotranspiration (PE) is recorded is at Shannon Airport, approximately 35km northeast of the OCC. The long-term average PE for this station is 578mm/year. This value is used as a best estimate of the PE at the Onshore Site. Actual Evaporation (AE) at the Onshore Site is estimated as 549mm/year (which is 0.95 × PE).

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

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

$$= 1{,}197\text{mm/year} - 549\text{mm/year}$$

$$\text{ER} = 648\text{mm/year}$$

Groundwater recharge and runoff coefficient estimates are available from the GSI (www.gsi.ie). Within the OLL and the OCC groundwater recharge coefficients range from 15% to 22.5%. These areas are mapped as having low recharge rates due to the presence of low permeability subsoils and poorly drained soils.

An estimate of ~97mm/year average annual recharge is given for the OLL and OCC. This calculation is based on a recharge coefficient of 15% (this represents the worst-case scenario in terms of runoff volumes). This means that the hydrology of these areas is characterised by high surface water runoff rates and relatively low groundwater recharge rates. This is supported by on-site observations made during the site walkover surveys whereby a high density of surface water features were recorded in the vicinity of the Onshore Site.

Therefore, conservative annual recharge and runoff rates for the OLL and the OCC are estimated to be ~97mm/yr and ~551mm/yr respectively.

[1] *A station at which meteorological observations are made for the purposes of synoptic (large spatial scale) analysis*

Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM's). Projections for the period 2041-2060 (mid-century) are available from Met Eireann. The data indicates a projected decrease in summer rainfall from 0 to 13% under the medium-low emission range scenario and an increase in the frequency of heavy precipitation events of ~20%. In total the projected annual reduction in rainfall near the Onshore Site is ~8% under the medium-low emission scenario and ~6% under the high emissions scenario. As stated above the local average long term rainfall data for the Onshore Site is estimated to be ~1,186mm/yr. Under the medium-low emissions scenario this may reduce to ~1,092mm/yr, while under the high emissions scenario this figure may reduce to ~1,115mm/yr.

In addition to average rainfall data, extreme value rainfall depths are available from Met Éireann. Table 23-6 below presents return period rainfall depths for the area of the Onshore Site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year and 100-year). These extreme rainfall depths will be the basis of the Onshore Site drainage hydraulic design as described further below.

*Table 23-6: Return Period Rainfall Depths (mm) for the OCC*

| Return Period (Years) | | | | |
|---|---|---|---|---|
| Storm Duration | 1 | 5 | 30 | 100 |
| 5 mins | 3.7 | 5.1 | 7.0 | 8.5 |
| 15 mins | 6.1 | 8.3 | 11.4 | 13.9 |
| 30 mins | 8.0 | 10.8 | 14.7 | 17.9 |
| 1 hour | 10.3 | 14.0 | 19.0 | 23.0 |
| 6 hours | 20.3 | 27.1 | 36.6 | 44.0 |
| 12 hours | 26.3 | 35.1 | 47.1 | 56.6 |
| 24 hours | 34.2 | 45.4 | 60.7 | 72.7 |
| 2 days | 43.3 | 56.2 | 73.4 | 86.7 |

## 23.3.3 Regional Hydrology

Regionally, the Onshore Site is located in 2 no. regional surface water catchments. The northern section of the Onshore Site, including the OLL and the northern section of the OGC, is located in the Mal Bay surface water catchment within Hydrometric Area 28. The southern section of the Onshore Site, including the OCC and the southern section of the OGC, is located in the Shannon Estuary North surface water catchment within Hydrometric Area 27. Both of these regional surface water catchments are located in the Shannon River Basin District.

### 23.3.3.1 Onshore Landfall Location

Within the Mal Bay surface water catchment, the OLL site is located in the Doonbeg River WFD sub-catchment (Doonbeg_SC_010) and the Doonbeg_050 WFD river sub-basin. There are no EPA mapped watercourses within the OLL. The closest mapped EPA watercourse is a small unnamed 1st order stream located ~150m to the southeast. This watercourse flows to the northeast and discharges directly into the sea. The OLL is situated approximately 115m south of the Shannon Plume coastal waterbody.

### 23.3.3.2 Onshore Grid Connection

Within the Mal Bay surface water catchment, the OGC is predominantly located in the Doonbeg river sub-catchment (Doonbeg_SC_010). Within this catchment, there are a total of 4 no. crossings over EPA mapped watercourses:

- 1 no. existing watercourse crossing is located along a local road in the townland of Killard. This watercourse is locally unnamed but has been assigned a name by the EPA (Killard Stream). This watercourse directly discharges into Doonbeg Bay;
- The OGC crosses a locally unnamed stream, referred to by the EPA as the Caherlean Stream on the boundary between the townlands of Killard and Doonmore. This watercourse flows to the east and discharges directly into Doonbeg Bay;
- An existing crossing along a local road over a locally unnamed stream, referred to by the EPA as the Doonbeg stream, in the townland of Doonmore to the south of the N67. This watercourse flows to the northeast and discharges into the Doonbeg River immediately upstream of Doonbeg Bay; and,
- An existing crossing along a local road over a locally unnamed stream, referred to by the EPA as the Carrowmore South Stream. This watercourse originates from Tullaher Lough and flows to the northeast, before discharging into the Doonbeg River.

Within the Shannon Estuary North surface water catchment, the OGC is predominantly mapped in the Wood River sub-catchment (Wood_SC_010). Approximately 1.7km in the south is located in the Cloon[Clare] River sub-catchment (Cloon[Clare]_SC_010). Within the Shannon Estuary North surface water catchment, there are a total of 7 no. existing watercourse crossings over EPA mapped watercourses.

- An existing crossing along a local road over a locally unnamed stream, referred to by the EPA as the Einagh Stream, on the boundary between the townlands of Einagh and Moanmore North. This stream originates from Moanmore Lough and flows to the southeast before it confluences with the Moyasta Stream;
- An existing crossing along a local road over a locally unnamed stream, referred to by the EPA as the Moyasta Stream. This crossing is located at the boundary between the townlands of Moanmore Lower and Moanmore South;
- An existing crossing along an access road within Kilrush Golf Club over the EPA named Parknamoney Stream. This crossing is located at the boundary between the townlands of Ballykett and Parknamoney;
- An existing crossing over the EPA named Wood River in the townland of Kilcarroll;
- An existing crossing along a local road over the EPA named Moyne Stream in the townland of Dysert;
- An existing crossing over the EPA named Ballynote East Stream in the townland of Ballymacrinan, north of the OCC; and,
- An existing crossing along the N67 over a locally unnamed 2$^{nd}$ order stream, referred to by the EPA as the Mologha Stream. This watercourse is mapped to discharge into the Lower Shannon Estuary in Ballymacrinan Bay directly downstream of this existing crossing. However, surveys along this section of the OGC have revealed that the Mologha Stream has been diverted through outfalls to accommodate the Moneypoint Power Generation Fly Ash Storage facility.

The WFD river sub-basins within which the OGC is mapped are detailed in Table 23-7.

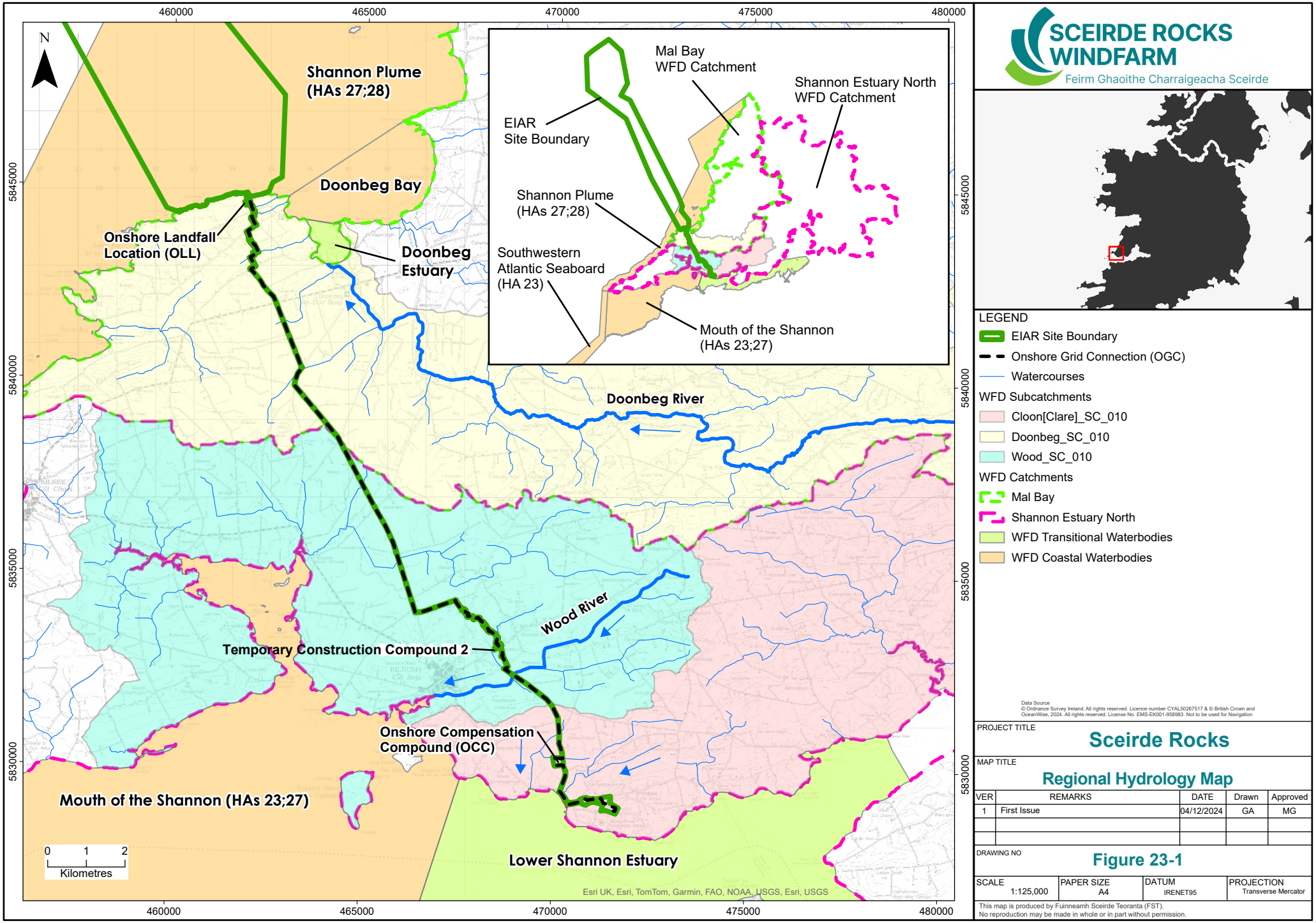
A regional hydrology map showing the WFD catchments and sub-catchments is included as Figure 23-1.

### 23.3.3.3 Onshore Compensation Compound

Within the Shannon Estuary North surface water catchment, the OCC is located in the Cloon[Clare] River sub-catchment (Cloon[Clare]_SC_010) and the Tonavoher_010 river sub-basin. The closest EPA mapped watercourse is a locally unnamed 1st order stream, referred to by the EPA as the Ballynote East stream. This watercourse runs along the northern boundary of the OCC and flows to the west before veering to the south for 1.8km and discharges into the Lower Shannon Estuary.

*Table 23-7: Onshore Site and WFD Regions*

| Project Infrastructure | Nearest Mapped Watercourses - Common Name (EPA Name) | WFD River Sub-Basin | WFD Sub-Catchment | WFD Regional Surface Water Catchment |
|---|---|---|---|---|
| Onshore Landfall Location | | | | |
| Temporary construction compound, temporary access road and transition joint bay. | Shannon Plume coastal waterbody | Doonbeg_050 | Doonbeg_010 | Mal Bay Surface Water Catchment |
| Onshore Grid Connection | | | | |
| Underground cable in the carriageway of the existing public road network and off-road sections in private 3rd party lands | 4 no. EPA mapped watercourse crossings | Doonbeg_050 | Doonbeg_010 | Mal Bay Surface Water Catchment |
| | No watercourse crossings | Ballard_010 | | |
| | 2 no. EPA mapped watercourse crossings | Moyasta_010 | Wood_SC_010 | Shannon Estuary North Surface Water Catchment |
| | 2 no. EPA mapped watercourse crossings | Wood_020 | | |
| | No watercourse crossings | Wood_010 | | |
| | 3 no. EPA mapped watercourse crossings | Tonavoher_010 | Cloon[Clare]_SC_010 | |
| Onshore Compensation Compound | | | | |
| OCC | Ballynote East Stream mapped ~50m to the north | Tonavoher_010 | Cloon[Clare]_SC_010 | Shannon Estuary North Surface Water Catchment |




SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

- EIAR Site Boundary
- Onshore Grid Connection (OGC)
- Watercourses

WFD Subcatchments

- Cloon[Clare]_SC_010
- Doonbeg_SC_010
- Wood_SC_010

WFD Catchments

- Mal Bay
- Shannon Estuary North
- WFD Transitional Waterbodies
- WFD Coastal Waterbodies



PROJECT TITLE

**Sceirde Rocks**

MAP TITLE

**Regional Hydrology Map**

| VER | REMARKS | DATE | Drawn | Approved |
|---|---|---|---|---|
| 1 | First Issue | 04/12/2024 | GA | MG |
| | | | | |
| | | | | |

DRAWING NO

**Figure 23-1**

| SCALE | PAPER SIZE | DATUM | PROJECTION |
|---|---|---|---|
| 1:125,000 | A4 | IRENET95 | Transverse Mercator |

## 23.3.4 Surface Water Flows

There are no Office of Public Works (OPW) gauging stations located in the immediate vicinity of the Onshore Site. There is only 1 no. OPW gauging station located downstream of the Onshore Site. This gauging station (Station Number: 28002) is located on the Doonbeg River, downstream of some sections of the OGC. At this location the Doonbeg River has an upstream catchment of 108km$^2$ and the 95%ile flow is recorded as being 0.171m$^3$/s (171L/s). This means that at this location on the Doonbeg River, the flow is greater than or equal to 0.171m$^3$/s 95% of the time.

The EPA's Hydrotool, available on www.catchments.ie, was consulted in order to estimate baseline flow volumes in the local area. The Hydrotool dataset contains estimates of naturalised river flow duration percentiles. Several nodes were consulted in the vicinity and downstream of the OGC. No nodes are available for the watercourse downstream of the OLL, the OCC or section of the OGC from the OCC to Moneypoint.

Figure 23-2 below presents the estimated flow duration curves for each of the consulted Hydrotool Nodes downstream of the OGC in the Mal Bay surface water catchment.

The greatest flow volumes downstream of the OGC are located on the Doonbeg River. For example, at Node 28_734, upstream of where the Doonbeg river discharges into Doonbeg Bay, the 95%ile flow is estimated to be 0.322m$^3$/s. Smaller flow volumes occur on the other watercourses for which Hydrotool Nodes are available. The 95%ile flow on the Moyasta Stream upstream of Poulnasherry Bay is estimated to be 0.063m$^3$/s whilst the 95%ile flow in the Wood River in the vicinity of the OGC is estimated to be 0.026m$^3$/s.

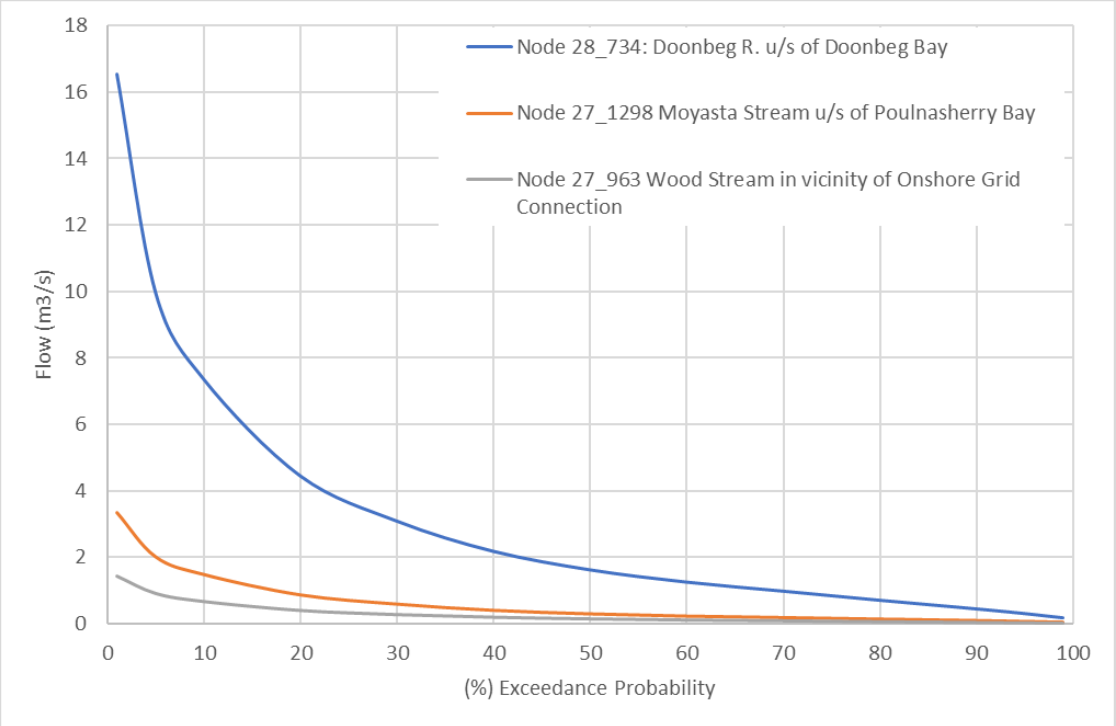



*Figure 23-2: EPA Hydrotool Node Flow Duration Curves (OGC)*

1 no. round (15th August 2023) of surface water flow monitoring was completed on the main watercourses draining the OGC and the results are shown in Table 23-8 below. The measured flows in the watercourses along the OGC were small, ranging from 0.5 to 6L/s. These flows are typical of summer low flows in small 1st order and 2nd order streams. Due to the nature of the Onshore Site and the lack of any significant watercourses in the vicinity of the Onshore Site, no additional monitoring was required.

*Table 23-8: Surface Water Flow Monitoring (15th August 2023)*

| Location | Easting (ITM) | Northing (ITM) | Watercourse – EPA Name | Flow Volume (l/s) |
|---|---|---|---|---|
| SW1 | 495220 | 666500 | Caherlean Stream | ~3 |
| SW2 | 495743 | 663364 | Carrowmore South Stream | ~0.5 |
| SW3 | 497349 | 660301 | Einagh Stream | ~0.5 |
| SW4 | 498268 | 658409 | Moyasta Stream | ~1 |
| SW5 | 500986 | 655589 | Parknamoney Stream | ~6 |
| SW6 | 502413 | 653926 | Moyne Stream | ~0.5 |

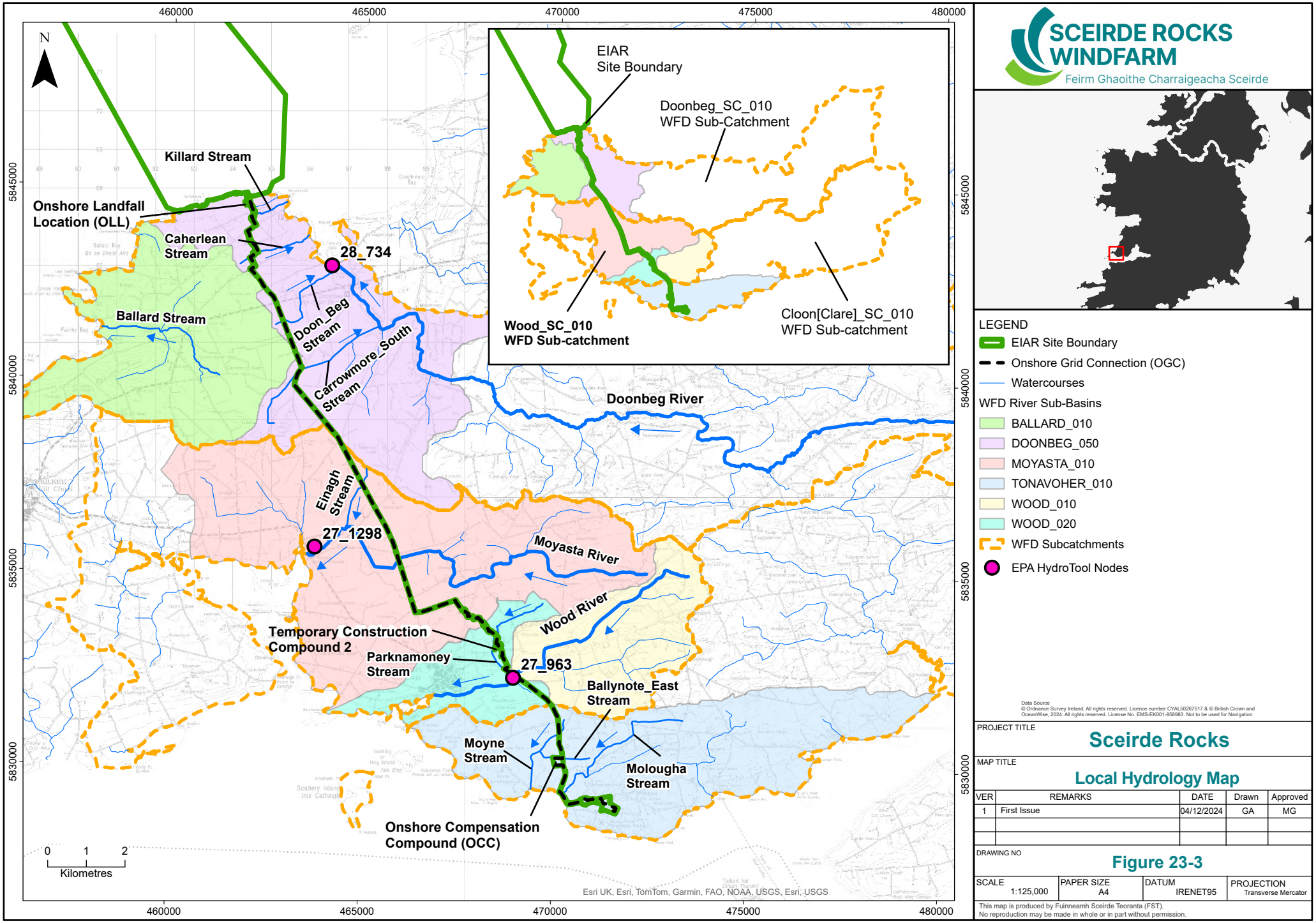
### 23.3.5 Onshore Site Drainage

The drainage map was created using OSI mapped watercourses, aerial photography, field mapping and available Lidar data.

The Onshore Site is drained by several 1st and 2nd order streams and in places the natural drainage is further facilitated by a network of manmade drains. These manmade drains are concentrated within the areas of peat bog located along the OGC in the townlands of Doonmore and Carrowmore South. The majority of the OGC is located in the carriageway of the existing public road network which is flanked by deeply incised drains on either side. In agricultural areas, including at the OLL and the OCC, deeply incised manmade field drains were noted along several field boundaries and hedgerows. The field within which the OCC is proposed was also noted to be quite wet underfoot during walkover surveys.

With the exception of the EPA mapped watercourses, no significant drainage features, other than manmade field drains, are located in the vicinity of the Onshore Site.

A local hydrology map including the WFD river sub-basins is included as Figure 23-3.






PROJECT TITLE

**Sceirde Rocks**

MAP TITLE

**Local Hydrology Map**

| VER | REMARKS | DATE | Drawn | Approved |
|---|---|---|---|---|
| 1 | First Issue | 04/12/2024 | GA | MG |
| | | | | |
| | | | | |

DRAWING NO

**Figure 23-3**

| SCALE | PAPER SIZE | DATUM | PROJECTION |
|---|---|---|---|
| 1:125,000 | A4 | IRENET95 | Transverse Mercator |

## 23.3.6 Summary Flood Risk Assessment

A Flood Risk Assessment for the Onshore Site has been carried out by HES, the findings of which are presented in full in Appendix 23-1 and are summarised below.

To identify those areas as being at risk of flooding, the OPW's Past Flood Events Maps, the National Indicative Fluvial Mapping, National Catchment-based Flood Risk Assessment and Management (CFRAM) River Flood Extents, historical mapping (i.e. 6" and 25" base maps) and the GSI Groundwater Flood Maps were consulted. These flood maps are available to view at Flood Maps - Floodinfo.ie.

### 23.3.6.1 Onshore Landfall Location

The OPW Past Flood Events Maps have no records of recurring or historic flood instances within the OLL. Similarly, identifiable text on local available historical 6" or 25" mapping does not identify any lands that are "liable to flood". The closest mapped historic and recurring flood events are situated near Doonbeg Village, approximately 3.1km from the OLL. There is no hydrological connectivity between the OLL and the area near Doonbeg village.

The GSI's Winter 2015/2016 Surface Water Flood Map shows surface water flood extents for this winter flood event. This flood event is recognised as being the largest flood event on record in many areas. The flood map for this event does not record any flood zones in the vicinity of the OLL. The nearest mapped flood zones are along the Doonbeg River ~3.76km to the southeast.

No CFRAM fluvial or coastal mapping has been completed for the area of the OLL. The closest mapped CFRAM flood zones for the Present Day Scenario are mapped near Kilkee, ~9.2km to the southwest.

The National Indicative Fluvial Flood Map (NIFM) for the Present Day Scenario does not map any flood zones in the area of the OLL. The closest mapped flood zones are along the Doonbeg River.

Furthermore, the OLL is not mapped within any historic or modelled groundwater flood zones.

The main risk of flooding is via pluvial flooding. Surface water ponding/pluvial flooding may occur in some flat areas due to the presence of low permeability soils and subsoils.

### 23.3.6.2 Onshore Compensation Compound

The OPW Past Flood Events Maps have no records of recurring or historic flood instances at the OCC. Similarly, identifiable text on local available historical 6" or 25" mapping does not identify any lands that are "liable to flood". The closest mapped historic flood event is located approximately 1km to the southeast and relates to coastal flooding at Carrowdotia.

The GSI's Winter 2015/2016 Surface Water Flood Map does not record the presence of any historic surface water flooding in this area. The closest mapped flood zone is located approximately 600m to the southeast.

No CFRAM fluvial or coastal mapping has been completed for the area of the OCC. The closest mapped CFRAM flood zones for the Present Day Scenario are mapped approximately 2.2km to the northwest along the Wood River.

The NIFM for the Present Day Scenario does not map any flood zones in the local area. The closest mapped flood zones are along the upper reaches of the Wood River, approximately 2.5km to the northeast.

Furthermore, the OCC is not mapped within any historic or modelled groundwater flood zones.

The main risk of flooding is via pluvial flooding. Surface water ponding/pluvial flooding may occur in some flat areas due to the presence of low permeability soils and subsoils.

### 23.3.6.3 Onshore Grid Connection

Text on the local 6" Cassini base maps states that the area along the OGC in the townland of Carrowmore South is 'liable to flood'. This text is situated proximal to the EPA mapped Carrowmore Stream which indicates that this text is referring to fluvial flooding. No other text along the OGC indicates flooding.

The OPW Past Flood Events Maps have no records of recurring or historic flood instances along the OGC. However, some historic and recurring flood events are mapped downstream. Several historic flood events dating from 1st January 2014 are mapped downstream of the OGC. These historic flood events are mapped to the north of Doonbeg village and at Moyasta. The closest mapped flood events are located at Kilrush Town, approximately 1km to the south of the OGC.

The GSI's Winter 2015/2016 Surface Water Flood Map does not record the presence of any historic surface water flooding along the OGC. Some historic flood zones corresponding to the location of Moanmore and Tullaher Loughs are mapped in the local area. These flood zones are located in excess of 500m from the OGC.

CFRAM fluvial and coastal mapping has been completed along the Wood River. Approximately 500m of the OGC along local roads is mapped in the low probability fluvial and coastal flood zones. Some CFRAM fluvial flood zones are also mapped along the Parknamoney Stream as it flows through Kilrush Golf Club. The NIFM for the Present Day Scenario records fluvial flood zones along the Wood River and the Moyasta Stream. The mapped flood zones are located at existing watercourse crossings.

Furthermore, the OGC is not mapped within any historic or modelled groundwater flood zones.

In relation to the section of the OGC between the OCC and Moneypoint, identifiable text on local available historical 6" or 25" mapping does not identify any lands that are "liable to flood". The OP Past Flood Events Map records the presence of a historic flood event, dating from 1st January 2014, along the N67. This flood event related to coastal flooding. The GSI's Winter 2015/2016 Surface Water Flood Map does not record the presence of any historic surface water flooding along this section of the OGC. Some surface water flood zones are mapped to the west in Ballymacrinan Bay but do not encroach upon the Onshore Site. Additionally, no CFRAM fluvial or coastal mapping has been completed for this area, and no NIFM flood zones are located in this area.

In summary, the OGC is of low risk of flooding. However, there are areas which may be prone to flooding, principally at existing watercourse crossings. Due to the depth of the OGC underground cabling, this will have no impact during the operation and maintenance phase of the Onshore Site. During the construction phase, works may have to be postponed following heavy rainfall events which could cause flooding in these areas.

### 23.3.6.4 FRA Summary

The Flood Risk Assessment concludes that OLL, the OCC and the vast majority of the OGC are located in Flood Zone C and are considered to be at low risk of flooding. The only areas of the Onshore Site which are located in flood zones are located at existing watercourse crossings along the OGC. Considering the temporary and transient nature of the grid construction process, and its below ground reinstated finish, there will be no significant flood risk issues arising along the OGC.

Furthermore, the risk of the Onshore Site contributing to downstream flooding is very low. The works areas at the OLL will be reinstated following construction and the vast majority of the OGC will be reinstated to a comparable ground surface. Where new access tracks are proposed over the OGC, these areas will drain over the edge, have a very small footprint and no potential to impact downstream flooding. In addition, a drainage system is proposed for the OCC which will attenuate and treat all water before discharge to a local stream. The discharge rate will be restricted to greenfield runoff rates and there will be no potential to increase the downstream flood risk.

## 23.3.7 Surface Water Quality

### 23.3.7.1 EPA Water Quality Monitoring

Biological Q-rating[2] data for EPA monitoring points in the local catchments downstream of the Onshore Site are shown in Table 23-9 below. The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from Q1 (Bad) to 4-5 (High).

No recent EPA Q-ratings are available for most of the watercourses downstream of the Onshore Site. The EPA do not typically complete monitoring on small watercourses, such as those which are present in the vicinity and downstream of much of the Onshore Site. Where available, the most recent EPA monitoring data in this area dates from 2021-2022. The available data has been supplemented by water quality monitoring as presented in Section 23.3.7.2.

Some historic Q-ratings are available for the Doonbeg River and the Moyasta Stream downstream of the OGC. However, these are from 1991 and are therefore considered to be outdated and are not included here. In 2021, the Doonbeg River achieved a Q-rating of Q4 ('Good' status) immediately upstream of its confluence with the Doonbeg Stream which drains a section of the OGC (Station Code: RS28D020770). Meanwhile, recent Q-ratings are available for the Wood River in the vicinity of the OGC. The Wood River achieved a Q-rating of Q3-4 ('Moderate' status) in 2022 at a bridge 1.5km upstream of Kilrush (Station Code: RS27W010100) and downstream of Kilrush (Station Code: RS27W010200).

A map of the EPA monitoring stations for which recent data (2021-2022) is available are shown on Figure 23-4.

The EPA monitoring has been supplemented by surface water monitoring completed by HES as described in Section 23.3.7.2.

*Table 23-9: EPA Water Quality Monitoring Q-Rating Values*

| Waterbody | Station Code | Year | Easting | Northing | EPA Q-Rating Status |
|---|---|---|---|---|---|
| Doonbeg River | RS28D020770 | 2021 | 97830.97 | 164373.05 | Q4 ('Good') |
| Wood River | RS27W010100 | 2022 | 101295 | 155391 | Q3-4 ('Moderate') |
| Wood River | RS27W010200 | 2022 | 99373 | 154857 | Q3-4 ('Moderate') |

[2] *The Q-Rating scheme method is used whereby a Quality-index is assigned to a river or stream based on macroinvertebrate data.*

### 23.3.7.2 HES Water Quality Monitoring

Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) along with turbidity (NTU) were taken at 6 no. surface water sampling locations on 15th August 2023 within surface watercourses draining and directly downstream of the Onshore Site. The results are listed in Table 23-10 below. The monitoring locations are shown in Figure 23-4 below.

Specific electrical conductivity values at the monitoring locations ranged between 86 and 460µS/cm, with an average conductivity value of 242µS/cm. Turbidity ranged from 0.34 to 11.8NTU. Dissolved Oxygen ranged from 63 to 93% saturation. The pH values were generally slightly basic, ranging between 7.16 and 7.92, with an average pH of 7.63.

*Table 23-10: Field Parameters - Surface Water Chemistry Measurements (15/08/2023)*

| Location ID | Temp °C | DO (% Sat) | SPC (µS/cm) | pH | Turbidity (NTU) |
|---|---|---|---|---|---|
| SW1 | 15.9 | 92.1 | 460 | 7.92 | 0.34 |
| SW2 | 15.2 | 93.4 | 420 | 7.65 | 11.8 |
| SW3 | 17.2 | 63 | 97.9 | 7.16 | 2.43 |
| SW4 | 16.3 | 91.4 | 243.5 | 7.83 | 7.24 |
| SW5 | 15.8 | 85.5 | 145 | 7.65 | 4.16 |
| SW6 | 15.3 | 72 | 86.2 | 7.62 | 2.02 |

Surface water grab samples were also taken at 5 no. locations for laboratory analysis on 15th August 2023. Results of the laboratory analysis are shown alongside relevant water quality regulations in Table 23-11 below. The laboratory reports are attached as Appendix 23-3. Note that no laboratory results are available for SW4 due to loss of sample on transit to the lab.

Suspended solid concentrations ranged from <5 to 16mg/l. Suspended solid concentrations were well below the S.I 293/1988 threshold limit of 25 mg/l in all samples.

Ammonia concentrations in 3 no. samples were found to be of 'High' status with regards to the threshold of ≤0.04mg/l as detailed in S.I. 272/2009. The ammonia concentrations at SW5 and SW6 were of 'Good' status. There was no exceedance of the 'Good' status threshold of ≤0.065mg/l.

Biological Oxygen Demand (BOD) concentrations ranged from <2 to 12mg/l. BOD concentrations exceeded the 'Good' status threshold of ≤1.5mg/l (S.I. 272/2009) in all samples.

Ortho-phosphate concentrations ranged from <0.02 to 0.12mg/l. 4 of the 5 no. samples achieved 'Good' status with regard to ortho-phosphate concentrations (≤0.035mg/l). Meanwhile, 1 no. exceedance of the Good status threshold value was recorded at SW3.

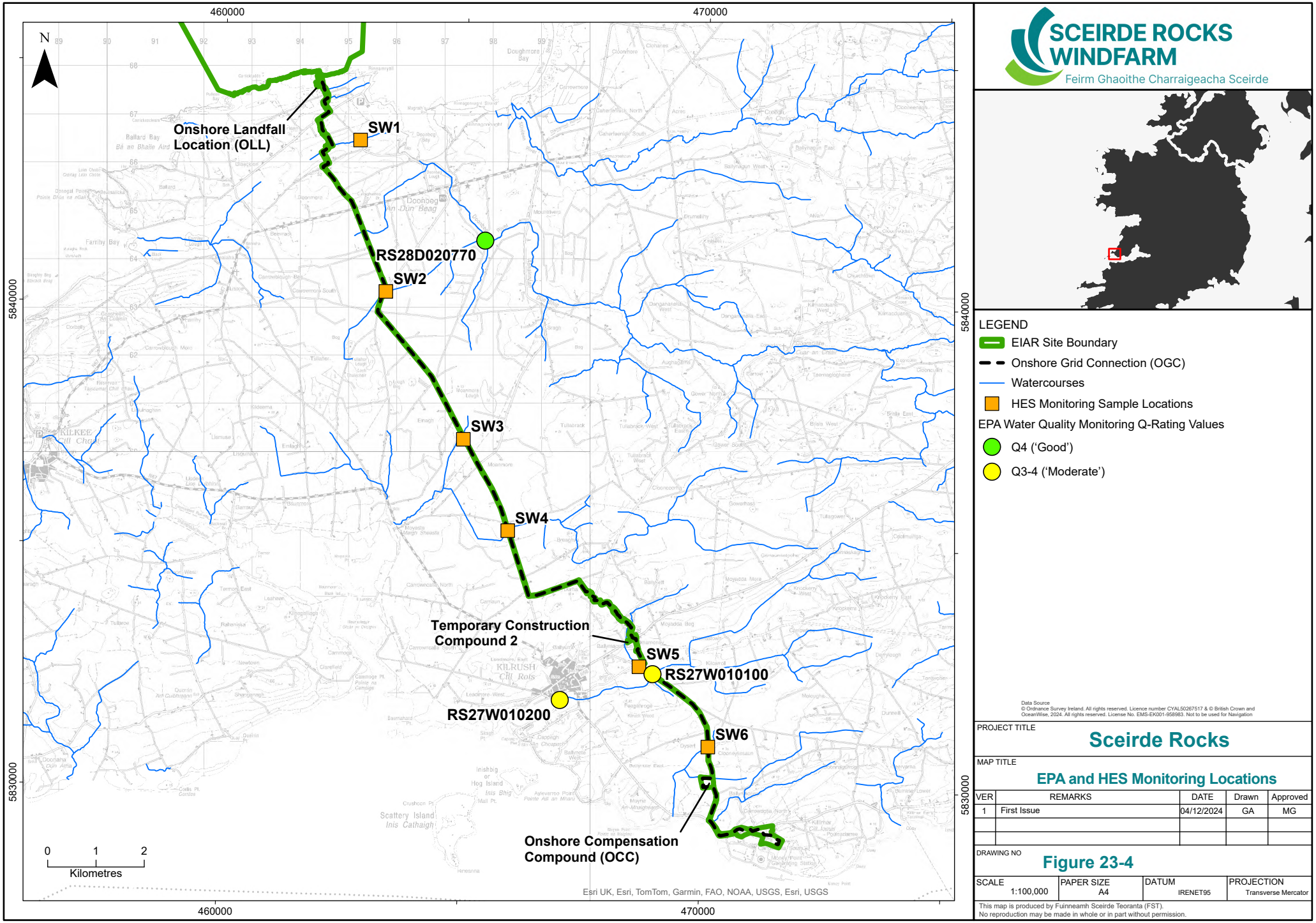
Nitrate concentrations were found to be below the level of detection of the laboratory in all samples. Chloride concentrations ranged from 34.3 to 65.3mg/l.

*Table 23-11: Summary surface water quality data (15/08/2023)*

| Location ID | Suspended Solids (mg/l) | $BOD_5$ (mg/l) | Orthophosphate (mg/l) | Nitrate (mg/l $NO_3$) | Ammonia (mg/l) | Chloride (mg/l) |
|---|---|---|---|---|---|---|
| **EQS** | **≤25([3])** | **≤ 1.3 to ≤ 1.5([4])** | **-≤ 0.035 to ≤0.025([2])** | - | **-≤0.065 to ≤ 0.04([2])** | - |
| SW1 | <5 | <2 | 0.03 | <1 | 0.03 | 65.3 |
| SW2 | 16 | 12 | <0.02 | <1 | <0.02 | 42.7 |
| SW3 | <5 | 5 | 0.12 | <1 | 0.03 | 34.3 |
| SW5 | <5 | 3 | 0.03 | <1 | 0.05 | 35.6 |
| SW6 | <6 | 4 | 0.03 | <1 | 0.06 | 35.6 |

*(+) S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations, 1988.*
*(*) S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009.*

[3] *S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations*
[4] *S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy).*




# SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde



LEGEND

- EIAR Site Boundary
- Onshore Grid Connection (OGC)
- Watercourses
- HES Monitoring Sample Locations

EPA Water Quality Monitoring Q-Rating Values

- Q4 ('Good')
- Q3-4 ('Moderate')



PROJECT TITLE

**Sceirde Rocks**

MAP TITLE

**EPA and HES Monitoring Locations**

| VER | REMARKS | DATE | Drawn | Approved |
|---|---|---|---|---|
| 1 | First Issue | 04/12/2024 | GA | MG |
| | | | | |
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DRAWING NO

**Figure 23-4**

| SCALE | PAPER SIZE | DATUM | PROJECTION |
|---|---|---|---|
| 1:100,000 | A4 | IRENET95 | Transverse Mercator |

## 23.3.8 Hydrogeology

According to GSI mapping (www.gsi.ie) the northern section of the Onshore Site, including the OLL and the majority of the OGC, is underlain by Namurian Sandstones. The southern section of the OGC and the OCC are underlain by Namurian Undifferentiated rocks. Both of these are classified by the GSI as being a Locally Important Aquifer -Bedrock which is Moderately Productive only in Local Zones. A bedrock aquifer map is included as Figure 23-6.

In terms of WFD Groundwater Bodies (GWBs), the north of the Onshore Site, including the OLL and the north of the OGC, is underlain by the Miltown Malbay GWB. The south of the Onshore Site is underlain by the Kilrush GWB. Both of these GWBs are characterised by poorly productive bedrock. Further details are including in the following paragraphs.

The GSI's Characterisation Report for the Miltown Malbay GWB (GSI, 2003) states that this GWB is composed primarily of low permeability siliceous rocks, although localized zones of enhanced permeability do occur along faults and in coarser layers. Groundwater flows along fractures, joints and major faults. Recharge occurs diffusely through the subsoils and via outcrops. It occurs especially in areas where the subsoil is thinner or absent. The aquifers within this GWB are both unconfined and confined. Most flow in this aquifer will occur near the surface; the effective thickness of the unconfined part of aquifer is likely to be about 10-15 m, comprising a weathered zone of a few metres and a connected fractured zone below this. Unconfined flow path lengths are relatively short, and in general are between 30 and 300 m. Confined flow paths may be significantly longer. Groundwater discharges to the numerous small streams crossing the aquifer, and to the springs and seeps.

The GSI's Characterisation Report for the Kilrush GWB (GSI, 2003) is similar to the Miltown Malbay GWB described above. The GSI note that east of Poulnasherry Bay, the flow direction is to the west and south.

### 23.3.8.1 Site-Specific Hydrogeology

#### 23.3.8.1.1 *Onshore Landfall Location*

The site investigations completed at the OLL comprised of the excavation of 2 no. trial pits and the drilling of 2 no. boreholes.

The trial pits extended to a maximum depth of 1.7mbgl (metres below ground level) and encountered glacial till deposits. No ingress of groundwater was recorded during the trial pit excavations.

The borehole drilling encountered weathered bedrock at depths of 1.7 to 1.8mbgl. The rock was described as strong, thinly laminated medium grained SILTSTONE interbedded with fine sandstone. The boreholes extended to depths of 23.7 and 31mbgl and no water strikes were recorded during the drilling process. A standpipe was inserted into BH01 in November 2022 to facilitate groundwater level monitoring. The recorded manual water levels ranged from 6.4mbgl on 12th July 2022 to 5.08mbgl on 3rd February 2023.

In addition, a continuous datalogger was installed in BH01 on 1st December 2022 and recorded winter water levels at 2-hour intervals until it was removed on 3rd February 2023. The recorded water levels ranged from 4.19 to 6.68mbgl. The hydrograph presented in Figure 23-5 below shows a clear tidal influence. This was to be expected given the close proximity of the OLL to the coast.

### 23.3.8.1.2 Onshore Grid Connection

Due to the shallow nature of the works proposed along the OGC no specific hydrogeological investigations were completed.

The site investigations completed along the OGC comprised of peat probes, hand augers and geophysical surveys and the results are summarised in Appendix 5-13.

### 23.3.8.1.3 Onshore Compensation Compound

The 3 no. trial pits excavated at the OCC location extended to a maximum depth of 3mbgl. The ground conditions encountered were as expected and comprised of peat and/or silt overlying glacial tills. No inflows of groundwater were recorded, and all TPs were dry upon excavation.

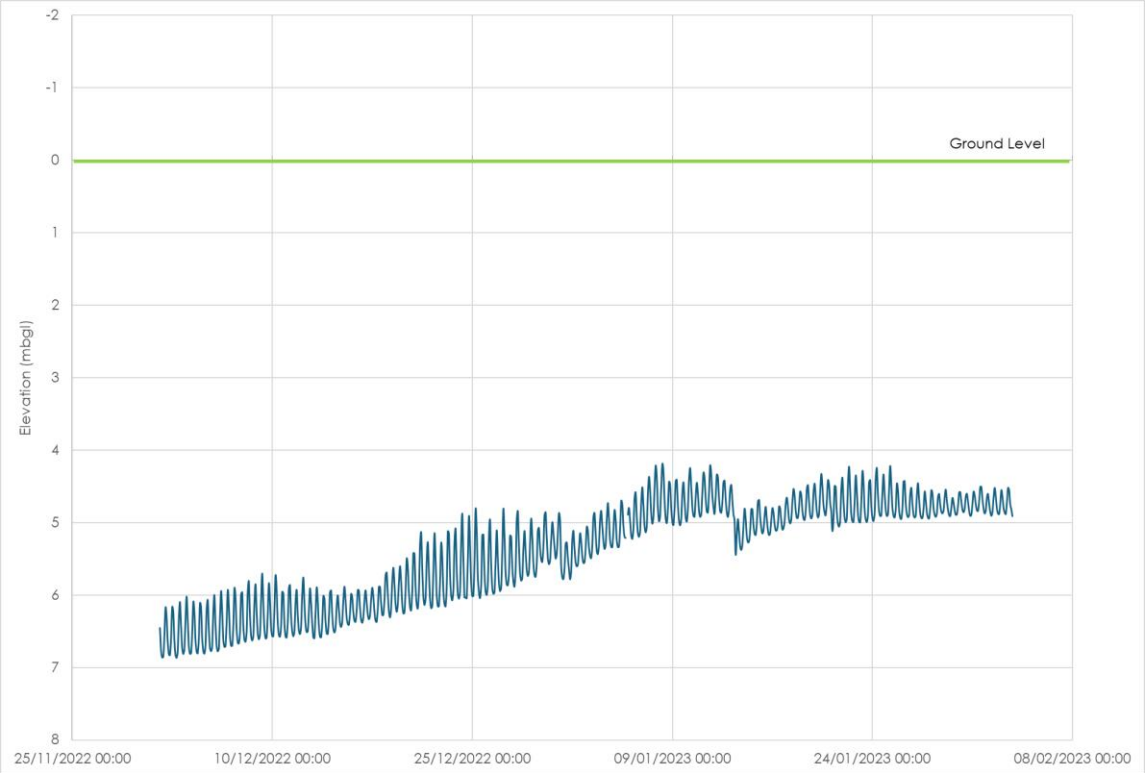
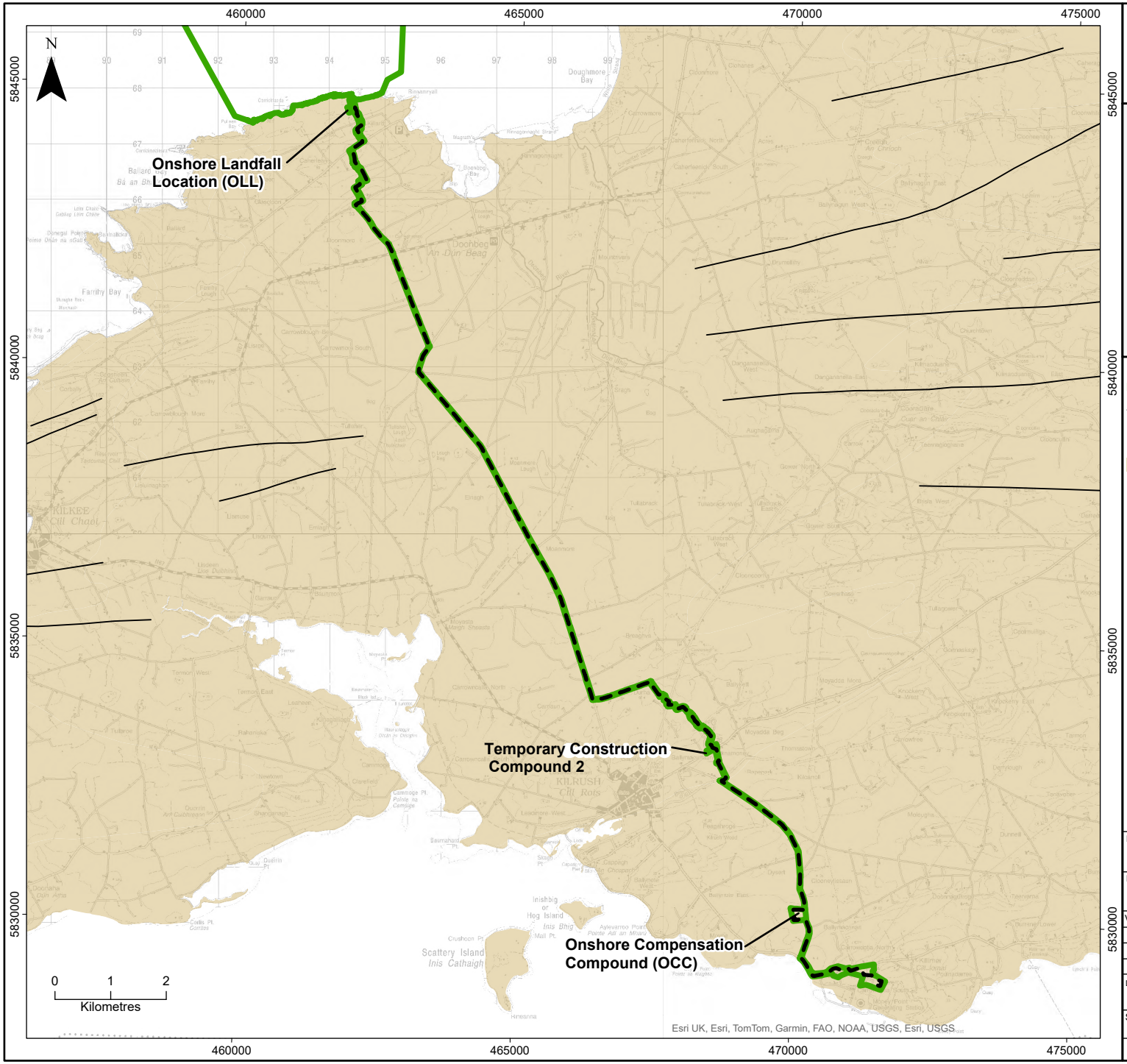



*Figure 23-5: Continuous Water Level Monitoring at OLL (BH01) (Dec 22 to Feb 2023)*




SCEIRDE ROCKS WINDFARM

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LEGEND

- EIAR Site Boundary
- Onshore Grid Connection (OGC)
- Mapped Faults
- LI - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones



PROJECT TITLE

**Sceirde Rocks**

MAP TITLE

**Local Bedrock Aquifer Map**

| VER | REMARKS | DATE | Drawn | Approved |
|---|---|---|---|---|
| 1 | First Issue | 04/12/2024 | GA | MG |
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DRAWING NO

**Figure 23-6**

| SCALE | PAPER SIZE | DATUM | PROJECTION |
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| 1:100,000 | A4 | IRENET95 | Transverse Mercator |

## 23.3.9 Groundwater Hydrochemistry

There are no groundwater quality data for the Onshore Site and groundwater sampling would generally not be undertaken for this type of development in terms of EIAR reporting, as groundwater quality impacts would not be anticipated due to the small scale and shallow nature of the proposed works.

The GSI's Characterisation Reports for the Miltown Malbay and Kilrush GWBs state that no data are currently available for these GWBs. However, in relation to groundwater hydrochemistry the GSI state that groundwaters in the Ballylongford GWB (on the opposite side of the Shannon Estuary) are moderately hard (120-270 mg/l $CaCO_3$) and have moderate alkalinities (170-240 mg/l$CaCO_3$). Measured electrical conductivity ranges from ~440-560 µS/cm. Phosphates occur naturally in the Clare Shales and can wash out into the local watercourses, resulting in elevated, but naturally occurring concentrations. Background chloride concentrations will be higher than in the Midlands, due to proximity to the sea.

## 23.3.10 Groundwater Vulnerability

The GSI describe groundwater vulnerability as a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability embodies the characteristics of the intrinsic geological and hydrogeological features at a site that determine the ease of groundwater contamination. Groundwater vulnerability is related to recharge acceptance, whereby in areas where recharge occurs more readily, a higher quantity of contaminants will have access to groundwater.

The GSI mapped vulnerability rating of the bedrock aquifer underlying the Onshore Site ranges from 'Low' to 'Extreme'. The areas mapped as having 'Extreme' vulnerability are as follows:

- The OLL in the townland of Killard;
- The north of the OGC, to the north of the N67, in the townlands of Killard and Doonmore. The length of this section is approximately 3.2km;
- A small section (approximately 175m) of the OGC in the townland of Einagh;
- Areas in the south of the OGC, totalling approximately 4.2km, in the townlands of Ballykett, Parknamoney, Ballymacurtain, Kilcarroll, Dysert and Clooneylissaun; and,
- The south of the OGC between the OCC and Moneypoint, in the townlands of Carrowdotia North and South, totalling approximately 1km.

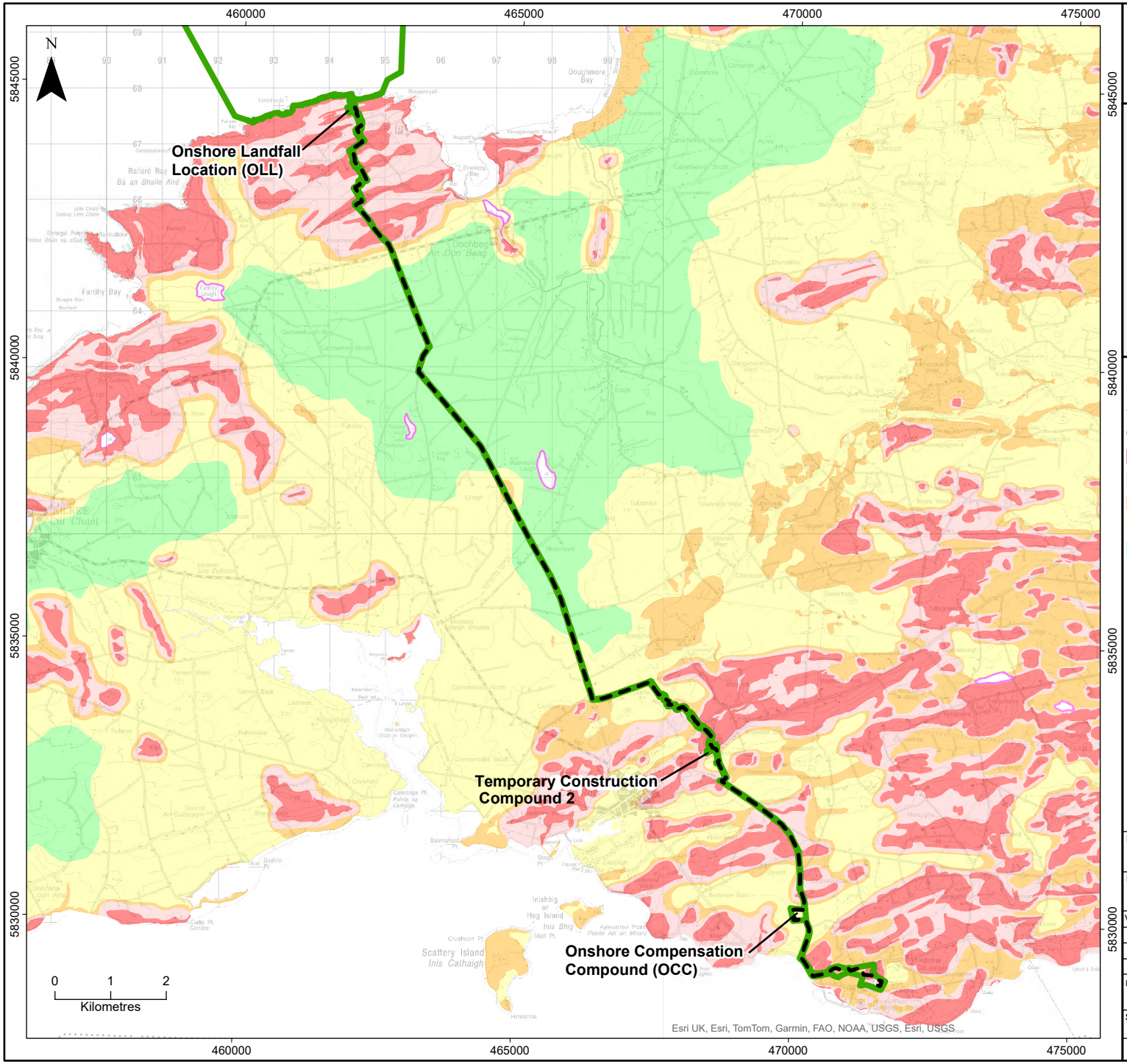
Note that the OCC Location is mapped in an area of 'Moderate' groundwater vulnerability. The GSI mapped groundwater vulnerability at the Onshore Site is presented in Figure 23-7 below.

However, due to the low permeability nature of the underlying bedrock aquifers, groundwater flow paths are likely to be short (30 – 300m), with recharge emerging close by and discharging into local surface water streams. This means there is a low potential for groundwater dispersion and movement within the underlying aquifers, therefore surface water bodies such as drains and streams/rivers are more vulnerable (to contamination from human activities) than groundwater at the Onshore Site.

*Table 23-12: Groundwater Vulnerability and Subsoil Permeability and Thickness*

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

Notes: (1) N/A = not applicable.
(2) Precise permeability values cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.




SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

- EIAR Site Boundary
- Onshore Grid Connection (OGC)

Groundwater Vulnerability

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



PROJECT TITLE

**Sceirde Rocks**

MAP TITLE

**Groundwater Vulnerability Map**

| VER | REMARKS | DATE | Drawn | Approved |
|---|---|---|---|---|
| 1 | First Issue | 04/12/2024 | GA | MG |
| | | | | |
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DRAWING NO

**Figure 23-7**

| SCALE | PAPER SIZE | DATUM | PROJECTION |
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| 1:100,000 | A4 | IRENET95 | Transverse Mercator |

## 23.3.11 Water Framework Directive Water Body Status & Objectives

The River Basin Management Plan was adopted in 2018 and has amalgamated all previous river basin districts into one national river basin management district. The Water Action Plan 2024 is Ireland's third River Basin Management Plan and it outlines the measures the Government and other sectors are taking to improve water quality in Ireland's groundwater, rivers, lakes, estuarine and coastal waters, and provides sustainable management of our water resources. The Water Action Plan 2024 enhances and builds upon the work of the first and second-cycle plans. The Water Action Plan objectives, which have been integrated into the design of the Onshore Site, include the following:

- Ensure full compliance with relevant EU legislation;
- Build on the achievements of the 2nd Cycle;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with the aim to achieve at least 'good' status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at restoring impacted waters and protecting waters from deterioration.

Our understanding of these objectives is that surface waters, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status at all. Furthermore, any development must not in any way prevent a waterbody from achieving at least good status by 2027.

### 23.3.11.1 Groundwater Body Status

Local Groundwater Body (GWB) status information is available from (www.catchments.ie) and the available information is summarised in Table 23-13.

All GWBs underlying the Onshore Site achieved 'Good' status in all 3 no. WFD cycles. The status of these GWBs is defined based on the quantitative status and chemical status of each GWB. The Miltown Malbay and Kilrush GWBs have been deemed to be 'not at risk' of failing to meet their respective WFD objectives. Furthermore, no significant pressures have been identified on these GWBs.

*Table 23-13: WFD Groundwater Body Status*

| GWB | Overall Status 2010-2015 | Overall Status 2013-2018 | Overall Status 2016-2021 | 3rd Cycle Risk Status | WFD Pressures |
|---|---|---|---|---|---|
| Miltown Malbay | Good | Good | Good | Not at risk | None |
| Kilrush | Good | Good | Good | Not at risk | None |

### 23.3.11.2 Surface Water Body Status

Local Surface Water Body (GWB) status information is available from (www.catchments.ie) and the available information is summarised in Table 23-14.

Within the Mal Bay surface water catchment, the status of the SWBs in the vicinity and downstream of the Onshore Site ranges from 'Moderate' to 'Good'. The Ballard_010 river waterbody in the vicinity of the OGC achieved 'Moderate' status in the latest WFD cycle (2016-2021). The Doonmore_050 river

waterbody achieved 'Good' status. In terms of transitional waterbodies, the Doonbeg Estuary is of 'Moderate' status whilst the Doonbeg Bay and Shannon Plume coastal waterbodies are of 'Good' and 'High' status respectively.

The risk status of these SWBs is generally 'under review'. The Doonbeg Bay and Shannon Plume coastal waterbodies have been deemed to be 'not at risk' of failing to meet their WFD objectives.

The 3rd Cycle Mal Bay Catchment Report (EPA, 2021) states that excess nutrients remain the most prevalent issue in the Mal Bay Catchment and that the significant pressure affecting the greatest number of waterbodies is forestry. Forestry is listed a significant pressure on the Doonbeg_050 SWB. In relation to forestry the report states that the "*issues associated with forestry include sediment and nutrient loss from a range of forestry activities taking place that include clear felling temporary road building and drainage for example, which have resulted in heavy siltation and excess nutrients in surface water bodies*". Peat drainage and extraction remain a significant pressure on the Doonbeg_050 SWB, with increased sedimentation deemed to be the significant issue. An unknown anthropogenic pressure is also impacting the Doonbeg_050 SWB.

Within the Shannon Estuary North surface water catchment, the status of the SWBs in the vicinity and downstream of the Onshore Site ranges from 'Poor' to 'Good'. The Wood_010 river waterbody in the vicinity of the OGC achieved 'Poor' status in the latest WFD cycle. The Wood_020, Moyasta_010 and Tonavoher_010 river waterbodies are of 'Moderate' status. The Lower Shannon Estuary transitional waterbody and the Mouth of the Shannon coastal waterbody both achieved 'Good' status.

With regards to risk status, the Wood_010 and Wood_020 waterbodies have been deemed to be 'at risk' of failing to meet their respective WFD objectives. The risk status of the Tonavoher_010 SWB is currently 'under review'. The Lower Shannon Estuary and the Mouth of the Shannon SWBs are 'not at risk'.

The 3rd Cycle Shannon Estuary North Catchment Report (EPA, 2021) states that excess nutrients and morphological issues remain the most prevalent issue in this catchment. Agriculture is listed as a significant pressure on the Wood_010 and Wood_020 SWBs. In relation to agriculture, the catchment report states that "*the issues related to farming in this catchment are diffuse phosphate loss to surface waters mainly in areas of poorly draining soils and direct discharges resulting in excess nutrients (elevated phosphate and ammonia) in surface waters. Sedimentation is also an issue in some rivers, due to animal access or extensive poaching*". Forestry is also listed as a significant pressure on the Wood_020 SWB, with the significant issues being a combination of general forestry practices, clear felling and road construction. Urban runoff from Kilrush town, resulting in nutrient and organic pollution, is also impacting the Wood_020 SWB.

*Table 23-14: WFD Surface Water Body Status*

| SWB | Overall Status 2010-2015 | Overall Status 2013-2018 | Overall Status 2016-2021 | 3rd Cycle Risk Status | WFD Pressures |
|---|---|---|---|---|---|
| River Waterbodies | | | | | |
| Doonbeg_050 | Good | Moderate | Good | Under Review | Forestry, Peat & Other |
| Ballard_010 | Unassigned | Moderate | Moderate | Under review | None |
| Moyasta_010 | Unassigned | Good | Moderate | Under Review | None |
| Wood_020 | Poor | Moderate | Moderate | At risk | Agriculture, Forestry, Other & Urban Runoff |
| Wood_010 | Poor | Poor | Poor | At risk | Agriculture |
| Tonavoher_010 | Unassigned | Moderate | Moderate | Under Review | None |
| Transitional Waterbodies | | | | | |
| Doonbeg Estuary | Unassigned | High | Moderate | Under review | None |
| Lower Shannon Estuary | Moderate | Good | Good | Not at risk | None |
| Coastal Waterbodies | | | | | |
| Doonbeg Bay | Unassigned | High | Good | Not at risk | None |
| Mouth of Shannon | Moderate | Good | Good | Not at risk | None |
| Shannon Plume | Unassigned | High | High | Not at risk | None |

## 23.3.12 Designated Sites and Habitats

### 23.3.12.1 Protected Areas

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

The Onshore Site is not located within any designated conservation site, however there are designated sites located immediately adjacent to the OGC route as described below:

- Approximately 1.3km of the OGC in the townland of Carrowmore South is located immediately adjacent to Tullaher Lough and Bog SAC (Site Code: 002343) and pNHA (Site Code: 000070). This designated site is located immediately to the west of the local road within which the OGC is proposed; and,
- Approximately 400m of the OGC between the OCC and Moneypoint, along the N67, is located immediately to the east of the River Shannon and River Fergus Estuaries SPA (Site Code: 004077) and the Lower River Shannon SAC (Site Code: 002165).

Other designated sites downstream of the Onshore Site include:

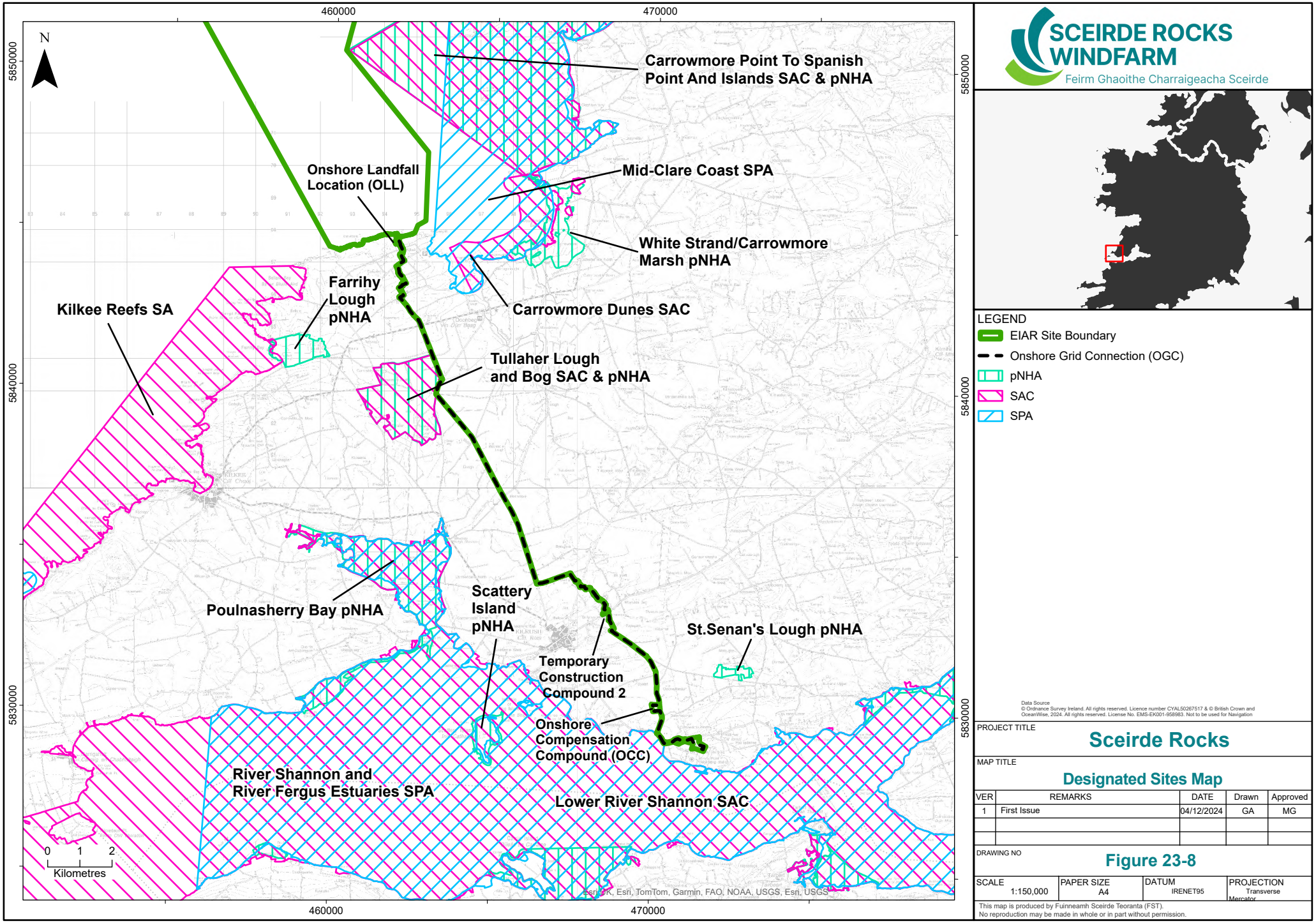
- The Mid-Clare Coast SPA (Site Code: 004182) which is located downstream of the OGC via the Doonbeg River and its tributaries;
- Carrowmore Dunes SAC (Site Code: 002250) which is located downstream of the OGC via the Doonbeg River and its tributaries;
- The White Strand/Carrowmore Marsh pNHA (Site Code: 01007) which is located downstream of the OGC via the Doonbeg River and its tributaries;
- Farrihy Lough pNHA (Site Code: 000200) is located downstream of the OGC in the Ballard_010 river sub-basin. There is no direct mapped hydrological connection between the Onshore Site and this pNHA. Only 200m of the OGC is mapped within this river sub-basin, thereby further limiting the potential for effects to occur;
- Kilkee Reefs SAC (Site Code: 002264) is located downstream of the OGC in the Ballard_010 river sub-basin. There is no direct hydrological connection between the Onshore Site and this SAC;
- The River Shannon and River Fergus Estuaries SPA (Site Code: 004077) is located downstream of the OGC and OCC in the Shannon Estuary North surface water catchment; and,
- The Lower River Shannon SAC (Site Code: 002165) is located downstream of the OGC and OCC in the Shannon Estuary North surface water catchment.

A map of local designated sites is shown as Figure 23-8 below.

#### 23.3.12.2 Wetlands

There are a number of wetlands recorded by the Wetlands Survey Ireland in the area of the Onshore Site (www.wetlandsurveysireland.com). The mapped wetlands include sites which have been surveyed by Wetlands Ireland and sites which have not been surveyed. In the vicinity of the Onshore Site, the only surveyed wetlands sites are at Monmore Bog and Tullaher Bog which correspond to the location of the Tullaher Lough and Bog pNHA/SAC as described above.

There are several additional unsurveyed mapped wetlands in the vicinity of the OGC. These include several cutover bogs (Doonmore South, Carrowmore South, Carrowmore South Bog and Cutover Complex, Tullaher South Cutover Complex, Einmore Cutover, Moanmore Lough and Bog, Durha Ballykett Golf Course Pond and Kilcarrol West.




SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

- EIAR Site Boundary
- Onshore Grid Connection (OGC)
- pNHA
- SAC
- SPA



PROJECT TITLE

**Sceirde Rocks**

MAP TITLE

**Designated Sites Map**

| VER | REMARKS | DATE | Drawn | Approved |
|---|---|---|---|---|
| 1 | First Issue | 04/12/2024 | GA | MG |
| | | | | |
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**Figure 23-8**

| SCALE | PAPER SIZE | DATUM | PROJECTION |
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| 1:150,000 | A4 | IRENET95 | Transverse Mercator |

## 23.3.13 Water Resources

### 23.3.13.1 Groundwater Resources

The GSI do not map the presence of any National Federation registered Group Water Schemes (GWS) or Public Water Schemes (PWS) or an associated Source Protection Area within the Onshore Site or in the surrounding lands.

The closest mapped PWS is the Glin PWS. This PWS is located on the opposite side of the Shannon Estuary and approximately 10km southeast of the OGC.

A search of private well locations (accuracy of 1 – 50m only) was undertaken using the GSI well database (www.gsi.ie). However, all wells mapped by the GSI in the vicinity of the OLL, OGC and OCC have location accuracies of 100m to 1km. In summary these wells are typically recorded as having agricultural and domestic uses with yields ranging from 26 to 176$m^3$/d. One well in the townland of Carrowmore South, with a locational accuracy of 500m is listed as having industrial uses and a yield of 502$m^3$/day. Several wells with a location accuracy of 20m are mapped in the vicinity of the OGC near Moneypoint and have yields of 29 to 110$m^3$/day.

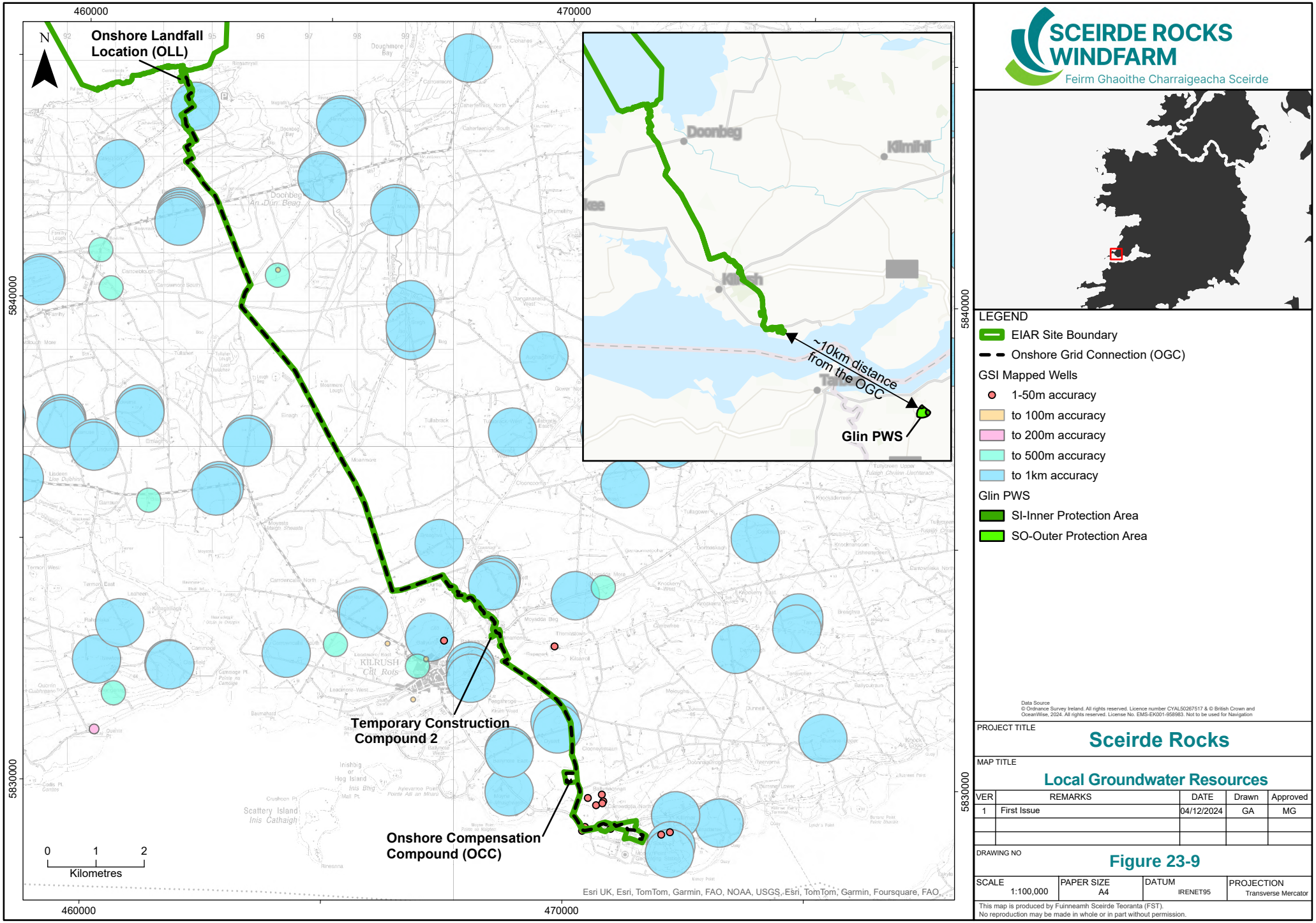
There are no mapped wells within 50m of the OCC or OLL. We accept that the GSI database does not include all potential water wells. As such, and in order to be conservative, for the purposes of assessment (as completed in Section 23.5.2.9 we assume that there is a groundwater well source at each local house location as identified in Chapter 6 of this EIAR: Population & Human Health.

A map of nearby mapped groundwater wells is included as Figure 23-9.

### 23.3.13.2 Surface Water Resources

The 3rd Cycle Mal Bay Catchment Report (EPA, 2021) states that there are 3 no. SWBs in the Mal Bay catchment which have been identified as Drinking Water Protected Areas (DWPAs). However, none of these DWPAs are located downstream of the Onshore Site.

The 3rd Cycle Shannon Estuary North Catchment Report (EPA, 2021) states that there are 6 no. SWBs in the Shannon Estuary North catchment which have been identified as Drinking Water Protected Areas (DWPAs). However, none of these DWPAs are located downstream of the Onshore Site.




SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde



LEGEND

- EIAR Site Boundary
- Onshore Grid Connection (OGC)

GSI Mapped Wells

- 1-50m accuracy
- to 100m accuracy
- to 200m accuracy
- to 500m accuracy
- to 1km accuracy

Glin PWS

- SI-Inner Protection Area
- SO-Outer Protection Area



PROJECT TITLE

**Sceirde Rocks**

MAP TITLE

**Local Groundwater Resources**

| VER | REMARKS | DATE | Drawn | Approved |
|---|---|---|---|---|
| 1 | First Issue | 04/12/2024 | GA | MG |
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**Figure 23-9**

| SCALE | PAPER SIZE | DATUM | PROJECTION |
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## 23.3.14 Receptor Sensitivity and Importance

Due to the nature of grid connections and associated infrastructure (electrical substations) being mostly near surface construction activities, effects on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater at the Onshore Site would be from cementitious materials, hydrocarbon spillage and leakages during construction works. These are common potential risks on all construction sites (such as road works and industrial sites), which can be addressed by way of mitigation. All potential contamination sources are to be carefully managed at the Onshore Site during the construction and operation and maintenance phases of the Project, and mitigation measures are prescribed to deal with these potential minor impacts.

The following groundwater receptors are identified for inclusion in the impact assessment:

- The Locally Important Aquifers underlying the Onshore Site. These aquifers can be considered as being of 'Medium' importance (refer to Table 23-3);
- The WFD status of the Miltown Malbay and Kilrush GWBs underlying the Onshore Site; and,
- Local private groundwater abstractions in the lands surrounding the Onshore Site.

Surface waters are the main sensitive receptors associated with the Onshore Site, due to the shallow nature of the proposed works and the local hydrological regime which is characterised by high runoff rates and low rates of groundwater recharge. The primary potential pathway for contamination of downstream surface waters is via elevated concentrations of suspended solids.

The following surface water receptors are identified for impact assessment:

- All local watercourses draining the Onshore Site. These watercourses are largely 1st and 2nd order streams and include some tributaries of the Doonbeg River and the Wood River. The Wood River can be considered as being of 'High' importance (refer to Table 23-2) based on its assigned Q-ratings; and,
- The WFD status of all river waterbodies downstream of the Onshore Site.

Note that the downstream transitional and coastal waterbodies are not included in the assessment due to the minor nature of the onshore works, the large volumes of water within these SWBs and the saline nature of these waters. The Onshore Site has no potential to impact these transitional or coastal waterbodies.

In terms of designated sites, the following are included in the impact assessment due to their proximal location to the Onshore Site:

- Tullaher Lough and Bog SAC (Site Code: 002343) and pNHA (Site Code: 000070);
- River Shannon and River Fergus Estuaries SPA (Site Code: 004077);
- Lower River Shannon SAC (Site Code: 002165);
- Farrihy Lough pNHA (Site Code: 00200); and,
- Wetlands along the OGC.

The Mid-Clare Coast SPA (Site Code: 004182), the Carrowmore Dunes SAC (Site Code: 002250), the White Strand/Carrowmore Marsh pNHA (Site Code: 01007) and the Kilkee Reefs SAC (Site Code: 002264) have been screened out of the hydrological/hydrogeological impact assessment associated with the Onshore Site due to their distant location from the Onshore Site, and the large volume of saline waters associated with the coastal waterbodies within which these designated sites are located.

## 23.4 Characteristics of the Onshore Site

The Project is described in full in Chapter 5: Project Description of this EIAR.

The onshore components associated with the Project include the OLL, the OCC and the OGC.

### 23.4.1 Proposed Drainage Management

The protection of the watercourses within and surrounding the Onshore Site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the Onshore Site. The Onshore Site's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the Onshore Site, and downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the Onshore Site. There will be no direct discharges from construction areas to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones around the existing natural drainage features have been used to inform the layout of the Onshore Site.

During the construction phase all runoff from works areas (i.e. dirty water) will be attenuated and treated to a high quality prior to being released.

#### 23.4.1.1 Proposed Surface Water Drainage Management at the Onshore Compensation Compound

During the operation and maintenance phase the OCC all rainwater falling at the OCC will be collected, attenuated and treated prior to discharge to the Ballynote East stream.

The proposed operation and maintenance phase drainage system at the OCC is summarised as follows:

- Stormwater will be collected from all hardstand areas (buildings and bunded areas)
  - Buildings will be drained via rainwater downpipes to an underground system before attenuation and discharge; and,
  - Water from the bunded areas will fall to a sump where it will be connected to the underground system and will pass through a Full retention oil separator before attenuation and discharge.
- The proposed access tracks and car parking areas will be constructed with the use of permeable asphalt which will allow water to filter through into an underlying drainage base and then to ground. Impermeable asphalt will be placed at the site entrance due to the perceived increased durability required, with a suitably sized filter drain capturing runoff from this area and will act as a soakaway and will discharge to ground;
- The remaining compound and any runoff from the access track will drain via natural infiltration through the compound stone and 6F2 material.
- All water from the bunded areas will pass through a hydrocarbons interceptor prior to discharge. The full retention petrol/oil interceptor will be chosen to accommodate the required peak flow;
- Sumps will be used throughout the drainage system to facilitate settlement of suspended solids;
- Water will be attenuated within the site using suitably sized attenuation tanks;
- Sewers have been designed to cater for the 100-year plus 20% climate change rainfall event;
- Discharge from the site will be into an existing stream and will have a peak discharge rate of 12l/s (equivalent to peak existing greenfield runoff rates);

- Discharge will be controlled via a hydrobrake and will be restricted to existing greenfield runoff rates; and,
- Rip-Rap aprons will be located at the outlet to prevent erosion.

The drainage report which details the stormwater drainage system at the OCC is included as Appendix 5-15: Substation Drainage Report & Drawings.

#### 23.4.1.2 Foulwater Management at the Onshore Compensation Compound

The foul drainage design includes the installation of 3 no. 5m$^3$ wastewater holding tanks.

This volume is more than adequate to cater for the expected maintenance visits and usage of the substation building including a suitable buffer for any unforeseen visits.

An alarm will be fitted to the wastewater holding tanks to advise the maintenance management that the system is close to capacity such as 80%. This is so that the system can be emptied to prevent the risk of it overflowing.

#### 23.4.1.3 Water Supply at the Onshore Compensation Compound

There is no existing water supply serving the OCC site. It is proposed that a bored well will supply water to the OCC.

# 23.5 Likely Significant Effects and Associated Mitigation Measures

## 23.5.1 Do Nothing Scenario

If the Project was not developed, the existing land use practices of low intensity agriculture and transport along the public road corridor would continue at the Onshore Site.

If the Project were not to proceed, the opportunity to capture the available renewable energy resource and connect it to Ireland's electricity grid would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment and investment and to diversify the local economy would also be lost.

## 23.5.2 Construction Phase - Likely Significant Effects and Mitigation Measures

### 23.5.2.1 Potential Effects from Vegetation Clearance

The OGC near Moneypoint is routed through a vegetated area contained conifers and scrub to the north of Moneypoint Substation. Hedge removal and minor tree removal is therefore a minor component of the proposed works.

Potential effects during vegetation clearance occurs mainly from:

- Exposure of soil and subsoils due to vehicle tracking, and skidding or forwarding extraction methods resulting in a source of suspended sediment which can become entrained in surface water runoff and enter surface watercourses;
- Entrainment of suspended sediment in watercourses due to vehicle tracking through watercourses;
- Release of sediment attached to timber in stacking areas; and,
- Nutrient release.

Potential effects on all watercourses downstream could be significant if not mitigated. However, no natural watercourses are mapped in the vicinity of the area vegetated areas to be cleared and the proposed areas for clearance are very small. Therefore, there is limited potential for effects on downstream watercourses.

**Pathways:** Drainage and surface water discharge routes.

**Receptors:** Surface watercourses and associated water-dependant ecosystems downstream of the OGC near Moneypoint.

**Pre-Mitigation Potential Effect:** Indirect, negative, moderate, temporary, likely effect on surface watercourses and associated water-dependent ecosystems. The potential pre-mitigation effect is considered to be Not Significant.

**Proposed Mitigation Measures:**

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods for vegetation clearance which are set out as follows:

- Prior to the commencement of works all existing drains that intercept the area to be cleared area will be temporarily blocked downgradient through the use of check dams/silt fences;
- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- All machinery will be operated by suitably qualified personnel;
- Where possible, existing drains will not be disturbed during the clearance works;
- Machines will traverse the site along specified off-road routes (referred to as racks);
- The location of racks will be chosen to avoid wet and potentially sensitive areas;
- Brash mats will be placed on the racks to support the vehicles on soft ground, reducing peat and mineral soil disturbance and erosion and avoiding the formation of rutted areas, in which surface water ponding can occur;
- Sediment traps and silt fences will be installed in advance of any clearance works and will provide surface water settlement for runoff from work areas and will prevent sediment from entering downstream watercourses;
- In areas particularly sensitive to erosion it will be necessary to install double or triple sediment traps;
- Drains and silt traps will be maintained throughout all clearance works, ensuring that they are clear of sediment build-up and are not severely eroded;
- Cleared vegetation will be stacked in dry areas, and outside of hydrological buffer zones. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water runoff;
- Refuelling or maintenance of machinery will not occur within 50m of an aquatic zone or within 20m of any other hydrological feature. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required; and,
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

**Post-Mitigation Residual Effect:** The potential for the release of suspended solids to watercourse receptors during hedgerow and tree removal is a risk to water quality and the aquatic quality of the receptor. Proven best practice measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. Taking into consideration the proposed mitigation measures and the small scale of the proposed hedgerow and tree removal works, the residual effect will be negative, imperceptible, indirect, temporary, likely effect on downstream watercourses and associated water-dependent ecosystems. This effect is considered Not Significant.

**Significance of Effects:** For the reasons outlined above, No Significant effects on the surface water quality will occur.

### 23.5.2.2 Potential Effects from Earthworks Resulting in Suspended Solids Entrainment in Surface Waters

Construction phase activities including OCC construction, temporary construction compound construction, transition joint bay construction, and underground cabling works will require varying degrees of earthworks resulting in excavation of soil, peat and mineral subsoil where present. Potential sources of sediment-laden water include:

- Drainage and seepage water resulting from excavations;
- Stockpiled excavated material providing a point source of exposed sediment; and,
- Erosion of sediment from emplaced site drainage channels.

These activities can result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies. Potential effects on all watercourses downstream of the Onshore Site could be significant if not mitigated against.

**Pathways:** Drainage and surface water discharge routes.

**Receptors:** Surface waters (1st and 2nd order streams) in the vicinity and downstream of the Onshore Site and associated water-dependent ecosystems.

**Pre-Mitigation Potential Effect:** Negative, significant, indirect, temporary, likely effect on downstream watercourses and water-dependent ecosystems. The pre-mitigation potential effect is considered to be Significant.

**Proposed Mitigation Measures:**

Mitigation by Avoidance

The key mitigation measure during the construction phase is the avoidance of sensitive hydrological features where possible, by application of suitable self-imposed, industry best practice buffer zones (i.e. 50m to main watercourses).

All of the key Onshore Site areas are located outside of the delineated 50m watercourse buffer zones with the exception of the following:

- Existing watercourse crossings along the OGC;
- The OCC is within the 50m buffer associated with the Ballynote East Stream which lies to the north;
- ~210m of the OGC is within the 50m buffer associated with the Ballynote East Stream on its approach to the OCC; and,
- ~400m of the OGC along the N67 lies to the east and within 50m of the Lower Shannon Estuary (although it is noted that this section of the OGC is located on the opposite side of the N67 to this waterbody, with the N67 located at a higher level than the works and acts as a barrier between the proposed works and the estuary).

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

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

Mitigation by Design:

**Onshore Landfall Location and Onshore Compensation Compound**:

- Source controls:
  - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with gravel, filter fabrics, and other similar/equivalent or appropriate systems.

- Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas.

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

- Treatment systems:
  - Temporary sumps and ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.

It should be noted that some existing manmade agricultural field drains exist in these areas, and these will be integrated and enhanced as required and used within the proposed drainage system. The integration of the existing drainage network and the proposed drainage network is relatively simple. The key elements being the upgrading and improvements to existing water treatment elements, such as in line controls and treatment systems, including silt traps, settlement ponds and buffered outfalls.

The main elements of interaction with existing drains will be as follows:

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction, and attenuation for flow management) of runoff from the proposed site drainage into the existing site drainage network. This will reduce the potential for any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works / hedgerow/tree removal is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area;
- Runoff from individual hardstanding areas will be not discharged into the existing drain network but discharged locally at each hardstand location through settlement ponds and buffered outfalls onto vegetated surfaces;
- Buffered outfalls will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the Onshore Site; and,
- Drains running parallel to the existing roads requiring widening will be upgraded, widening will be targeted to the opposite side of the road. Velocity and silt control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt fences will be used during the upgrade construction works. Regular buffered outfalls will also be added to these drains to protect downstream surface waters.

**Onshore Grid Connection**

The majority of the OGC routes are >50m from any nearby watercourse. Sections within 50m of watercourses are confined to existing bridge and culvert watercourse crossings, and short sections along the N67 and on the approach to the OCC. It is proposed to limit any works in any areas located within 50m of any watercourse/waterbody including the stockpiling of excavated soils and subsoils.

As detailed in Section 23.3.1.2, there are a total of 11 no. EPA mapped watercourse crossings along the OGC. In addition, there are several crossings over drains which do not form part of the EPA blueline database.

No in-stream works are required at any of these crossings, however due to the proximity of the streams to the construction work at the crossing locations, there is a potential for surface water quality impacts during trench excavation work. Mitigation measures are outlined below.

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

Temporary silt fencing / silt trap arrangements will be placed within existing drainage features along public/private roads to remove any suspended sediments from the works area. The trapped sediment will be removed and disposed at an appropriate licenced facility.

All excess material emanating from trenches within the public road will be disposed of at an appropriate licenced facility.

**Pre-commencement Temporary Drainage Works**

Prior to the commencement of road upgrades (or new tracks along the OGC in 3rd party lands and hardstand installs associated with the OCC or works at the OLL) the following key temporary drainage measures will be installed:

- All existing dry agricultural and forestry drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using forestry check dams/silt traps;
- Clean water interceptor drains will be installed upgradient of the works areas;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone.

**Silt Fences:**

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids such as those present in the subsoils/sandstone and shale tills that overlie the majority of the Onshore Site. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be placed within drains down-gradient of all construction areas inside the hydrological buffer zones.

**Silt Bags:**

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, the majority of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats. Sediment entrapment mats, consisting of coir or jute matting, will be placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

**Settlement Ponds:**

Settlement ponds will be used during the construction of the OCC.

Stormwater runoff rates for these areas, based on the 10-year return period rainfall event, were calculated for each catchment. These flows were then used to design the settlement ponds. The settlement ponds are designed for 11hr or 24hr retention times used to settle out medium silt (0.006mm) and fine silt (0.004mm) respectively (EPA, 2006)5.

**Level Spreaders and Vegetation Filters:**

Level spreaders and buffered outfall will be used during the construction of the OCC.

The purpose of level spreaders is to release treated drainage flow in a diffuse manner, and to prevent the concentration of flows at any one location thereby avoiding erosion. Level spreaders are not intended to be a primary treatment component for development surface water runoff. They are not stand alone but occur as part of a treatment train of systems that will reduce the velocity of runoff prior to be released at the level spreader. In the absence of level spreaders, the potential for ground erosion is significantly greater than not using them.

Vegetation filters are essentially end-of-line polishing filters that are located at the end of the treatment train. In fact, vegetation filters are ultimately a positive consequence of not discharging directly into watercourses which is one of the mitigation components of the drainage philosophy. This makes use of the natural vegetation of the site to provide a polishing filter for the OCC drainage prior to reaching the downstream watercourses.

Again, vegetation filters are not intended to be a single or primary treatment component for treatment of works area runoff. They are not stand alone but are intended as part of a treatment train of water quality improvement/control systems (i.e. source controls → check dams → silt traps → settlement ponds → level spreaders → silt fences → vegetation filters).

**Water Treatment Train:**

A final line of defence will be provided by a water treatment train such as a "Siltbuster". If the discharge water from construction areas fails to be of a high quality during regular inspections, then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train (sequence of water treatment processes) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This will apply for all of the construction phase.

**Pre-emptive Site Drainage Management**

The works programme for the entire construction stage of the development will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of soil/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 Project to inform 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;

[5] *Environmental Protection Agency (2006): Environmental Management in the Extractive Industry (Non-Scheduled Minerals).*

- 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.

Excavation works will be suspended if forecasting suggests either of the following is likely to occur:

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

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

- All active excavations will be secured and sealed off;
- Temporary or emergency drainage will be installed to prevent back-up of surface runoff; and,
- No works will be completed during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

**Management of Runoff from spoil management areas:**

It is proposed that excavated soils and subsoil (spoil) at the OCC location will be stored in spoil management areas, within the site or used for landscaping. The management area is to be located in a designated area and will be enclosed by an interceptor drain.

Proposed surface water quality protection measures regarding the spoil management area are as follows:

In relation to the spoil management areas:

- During the initial construction, silt fences, straw bales and biodegradable matting will be used to control surface water runoff from the work areas;
- An interceptor drain will be installed around the designated spoil storage area to ensure that there is no runoff which would potentially carry suspended sediment;
- Where applicable the vegetative topsoil layer of the spoil management areas will be rolled back to facilitate placement of excavated spoil up to a maximum height of 1.0 metres, following which the vegetative-top soils layer will be reinstated.
- Where reinstatement is not possible, spoil management areas will be sealed with a digger bucket and seeded as soon possible to reduce sediment entrainment in runoff.

**Timing of Site Construction Works:**

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

**Monitoring:**

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

Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed. Checks will be carried out on a daily basis.

During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and Environmental Quality Standards (EQSs) will be undertaken for each primary watercourse, and specifically following heavy rainfall events (as per the CEMP included in Appendix 5-16 of this EIAR).

**Allowance for Climate Change**

Climate change rainfall projections are typically for a mid-century (2050) timeline. The projected effects of climate change on rainfall are therefore modelled towards the end of the life cycle of the Onshore Site. It is likely that the long-term effects of climate change on rainfall patterns will not be observed during the lifetime of the Project. As outlined in the above sections we have designed settlement ponds for a 1 in 10 year return flow. This approach is conservative given that the Project will likely be built over a much shorter period (12-18 months), and therefore this in-built redundancy in the drainage design more than accounts for any potential short term climate change rainfall effects.

However, the settlement ponds are designed for 1 in 10 years flows with built in redundancy (+20%) to account for climate change effects on rainfall.

**Post-Mitigation Residual Effects:**

The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect will be negative, imperceptible, indirect, short term, likely effect on water quality, and water-dependant ecosystems downstream of the OLL and OCC.

Due to the small scale, spread out and transient nature of the works along the OGC combined with the proposed mitigation measures, the residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality and water dependent ecosystems. This effect is considered Not Significant.

**Significance of Effects:** For the reasons outlined above, No Significant effects on the surface water quality will occur.

### 23.5.2.3 Potential Effects from Excavation Dewatering and Potential Effects on Surface Water Quality

Some minor groundwater/surface water seepages may occur in OCC excavations, and construction compound excavations, and this will create additional volumes of water to be treated by the runoff management system. Inflows will require management and treatment to reduce suspended sediments. No contaminated land was noted at these locations and therefore pollution issues arising from such sources will not occur.

With respect to the OGC, some minor groundwater/surface water seepages will also occur in shallow trench excavations, and this will create additional volumes of water to be treated by the drainage management system. Inflows will require management and treatment to reduce suspended solids. No contaminated land was noted along the OGC; therefore, pollution issues are not anticipated in this respect.

**Pathway:** Overland flow and site drainage network.

**Receptors:**

OCC and OLL: All surface waters (1st and 2nd order streams) in the vicinity and downstream of works areas and associated water-dependent ecosystems.

OGC: All watercourses (1st and 2nd order streams) in the vicinity and downstream of the works areas and associated water-dependent ecosystems.

**Pre-Mitigation Potential Effect:** Indirect, negative, significant, temporary, unlikely effect on surface water quality and water-dependent ecosystems. The pre-mitigation potential effect is considered to be Significant.

**Proposed Mitigation Measures:**

Management of groundwater seepages and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by the Environmental Clerk of Works will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if needed.

**Post-Mitigation Residual Effect:** The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on local surface watercourses and associated water-dependent ecosystems. This effect is considered Not Significant.

**Significance of the Effects:** For the reasons outlined above, No Significant effects on the surface water quality will occur.

### 23.5.2.4 Potential Effects on Groundwater Levels During Excavation Works

No significant groundwater level effects are predicted from the construction of the majority of the OGC, the OCC or the construction compounds due to the shallow nature of the excavations (i.e. 0 -~1.2m). HDD is proposed along some sections of the OGC; however, any minor dewatering works will be of a short duration and transient in nature and impacts will be very localised and of a very small magnitude due to the scale of the works and the low permeability of the local subsoils and bedrock geology. Any minor effects on groundwater levels will be contained within the Onshore Site.

The excavations at the OLL will also not affect local groundwater levels with the maximum winter groundwater level recorded as being ~4.2 to 6.8mbgl at this location (refer to Section 23.3.8.1.1). The TJB at the OLL will be ~2.5m deep and will be above the winter groundwater table at this location. There may be some minor inflows of surface water that require treatment.

**Pathway:** Groundwater flowpaths.

**Receptor:** Groundwater levels within the underlying Miltown Malbay and Kilrush GWBs and local private groundwater wells.

**Pre-Mitigation Potential Effect**: Negative, indirect, temporary, imperceptible unlikely effects on local groundwater levels within the Onshore Site. The pre-mitigation potential effect is considered to be Not Significant.

**Mitigation Measures / Impact Assessment:**

The Onshore Site is underlain by Locally Important Aquifers and contains bedrock which is generally unproductive. Local groundwater will have short flowpaths and will discharge into nearby surface water streams and rivers.

The hydrogeological setting of the Onshore Site means that no significant groundwater dewatering is expected to be required. Moreover, direct rainfall and surface water runoff will be the main inflows that will require water volume and water quality management. For the avoidance of doubt. we would generally define dewatering as a requirement to permanently drawdown the local groundwater table by means of over pumping, e.g. as would be required for the operation of a bedrock quarry in a valley floor.

Relevant environmental management guidelines from the EPA quarry 2006 guidance document – "Environmental Management in the Extractive Industry" in relation to groundwater issues will be implemented during the construction phase.

**Post-Mitigation Residual Effect:** Due to hydrogeological setting of the Onshore Site and the nature of the proposed works, the potential for water level drawdown impacts at receptor locations is considered negligible. The residual effect will be a negative, imperceptible, direct, short term, unlikely effect on groundwater levels. This effect is considered Not Significant.

**Significance of Effects:** For the reasons outlined above, No Significant effects on groundwater levels will occur.

### 23.5.2.5 Potential Effects from the Release of Hydrocarbons during Construction and Storage

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk.

Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms.

**Pathway:** Groundwater flowpaths and site drainage network.

**Receptors:**

OCC and OLL: All surface waters (1st and 2nd order streams) in the vicinity and downstream of works areas and associated water-dependent ecosystems and underlying groundwater quality.

OGC: All watercourses (1st and 2nd order streams) in the vicinity and downstream of the works areas and associated water-dependent ecosystems and underlying groundwater quality.

**Pre-Mitigation Potential Effect:**

Negative, indirect, slight, short-term, unlikely effect on local groundwater quality downstream of the Onshore Site. The pre-mitigation potential effect on groundwater quality is considered to be Not Significant.

Indirect, negative, significant, short term, unlikely effect on surface water quality downstream of the Onshore Site. The pre-mitigation potential effect on surface water quality is considered to be Significant.

**Proposed Mitigation Measures:**

Mitigation by Avoidance:

- No refuelling of construction vehicles or plant will take place within the 50m of a watercourse;
- No maintenance of construction vehicles or plant will take place along the proposed route, except in emergency circumstances; and,
- Fuels or chemicals will not be stored along the OGC route.

Mitigation by design:

- All plant will be inspected and certified to ensure that they are leak free and in good working order prior to use at the Onshore Site.
- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser:
  - The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located;
  - The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages;
  - The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site;
  - Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Onsite refuelling will be carried out by trained personnel only;
- A permit to fuel system will be put in place;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- All fuel storage areas will be bunded appropriately for the duration of the construction phase. The temporary construction compounds will contain bunded refuelling and containment areas. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;

- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- The electrical control building (at the substation) will be bunded appropriately to 110% of the volume of oils that will be stored, and to prevent leakage of any associated chemicals to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages is included within the Construction and Environmental Management Plan (Appendix 5-16). Spill kits will be available to deal with any accidental spillage in and outside the re-fuelling area.

**Post-Mitigation Residual Effect:** The potential for the release of hydrocarbons to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of hydrocarbons have been proposed above and will break the pathway between the potential source and each receptor. The residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on local groundwater quality; and a negative, imperceptible, indirect, short term, unlikely effect on surface water quality. This effect is considered Not Significant.

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

### 23.5.2.6 Potential Effects from the Release of Cement-Based Products

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293/1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of ± 0.5 of a pH unit. Entry of cement-based products into the site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to the aquatic environment.

Batching of wet concrete on site and washing out of transport and placement machinery are the activities most likely to generate a risk of cement-based pollution. Placed concrete in foundations can also have minor local effects on groundwater quality over time. However, due to the limited surface area of exposed concrete, the anoxic conditions below ground, and the high rate of dilution from the wider groundwater system relative to the small volumes of groundwater that would come in contact with the concrete, the potential for impacts are low.

**Pathway:** Site drainage network.

**Receptors:**

OCC and OLL: All surface waters (1st and 2nd order streams) in the vicinity and downstream of works areas, associated water-dependent ecosystems and underlying groundwater quality.

OGC: All watercourses (1st and 2nd order streams) in the vicinity and downstream of the works areas, associated water-dependent ecosystems and underlying groundwater quality.

**Pre-Mitigation Potential Effect**: Indirect, negative, moderate, short term, likely effect on surface watercourses, water-dependent ecosystems and underlying groundwater quality. The pre-mitigation potential effect is considered to be Not Significant.

**Proposed Mitigation Measures:**

- No batching of wet-concrete products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning will be undertaken at lined concrete washout ponds;
- Weather forecasting will be used to plan dry days for pouring concrete; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of any sudden rainfall event.

**Post-Mitigation Residual Effect:** The potential for the release of cement-based products or cement truck wash water to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of cement-based products or cement truck wash water have been proposed above and will break the pathway between the potential source and each receptor. Based on the prescribed mitigation measures and the limited volume of poured concrete, the residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on surface and groundwater quality. This effect is considered Not Significant.

**Significance of the Effect:** For the reasons outlined above, No Significant effects on surface water quality will occur.

### 23.5.2.7 Potential Effects from Wastewater Disposal

Release of effluent from on-site temporary wastewater treatment systems has the potential to impact on groundwater and surface water quality if site conditions are not suitable for an on-site percolation unit. Impacts on surface water quality could affect fish stocks and aquatic habitats.

There will be no requirement for the storage of wastewater along the OGC.

**Pathway:** Groundwater flowpaths and site drainage network.

**Receptors:** Surface waters (1st and 2nd order streams) in the vicinity and downstream of the OLL, associated water-dependent ecosystems and the underlying groundwater quality.

**Pre-mitigation Effect:**

Negative, significant, indirect, temporary, unlikely effect to surface water quality. The pre-mitigation potential effect on surface water quality is considered to be Significant.

Negative, slight, indirect, temporary, unlikely effect on local groundwater quality. The pre-mitigation potential effect on groundwater quality is considered to be Not Significant.

**Proposed Mitigation Measures:**

- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at the construction compounds, will be regularly maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use from the site to be discharged at a suitable off-site treatment location; and,
- No water or wastewater will be sourced on the site, nor discharged to the site.

**Post-Mitigation Residual Effects:** The potential for contamination resulting from wastewater disposal is a risk to surface and groundwater quality. This is a risk common to all construction sites containing welfare facilities. Proven and effective measures to mitigate the release of wastewater on site have been proposed above and will break the pathway between the potential source and each receptor. The residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on surface water or groundwater quality. This effect is considered Not Significant.

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

### 23.5.2.8 Potential Effects from Morphological Changes to Surface Watercourses along the OGC

The OGC includes a total of 11 no. EPA mapped watercourse crossings. Most of these are at existing bridge and culvert crossings. There are several other crossings over non-EPA mapped surface water features.

The potential proposed crossing methods are as follows:

- Option 1 – Crossings over Bridges using Standard Trefoil Formation: Where adequate cover exists within a bridge, a standard trefoil arrangement will be used where the ducts pass over the bridge without any contact with the top of the bridge watercourse. No in-stream works or bridge alterations are required.
- Option 2 – Flatbed Formation over Bridges: Where sufficient cover cannot be achieved using the standard trefoil arrangement, the ducts will be laid in a shallower trench. It may be necessary to locally raise the level of the existing road. No in-stream works are required.
- Option 3 - Horizontal Directional Drilling (HDD) under Bridges and Watercourses: HDD is required due to there being insufficient cover and depth in the bridge to cross within the bridge deck. This method is only employed where standard installation methods, detailed above, are not possible.

**Pathways**: Runoff and surface water flowpaths.

**Receptors**: All watercourses (1st and 2nd order streams) along the OGC and associated water-dependent ecosystems.

**Pre-Mitigation Potential Effect**: Negative, moderate, indirect, temporary, likely effect on downstream surface water flows and surface water quality. The pre-mitigation potential effect is considered to be Not Significant.

**Proposed Mitigation Measures:**

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

- All existing roadside drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using check dams/silt traps;
- Culverts, manholes and other drainage inlets will also be temporarily blocked;
- A double silt fence perimeter will be placed along the road verge on the down-slope side of works areas that are located inside the watercourse 50m buffer zone.

The following mitigation measures are proposed for the OGC crossing works:

- No stockpiling of construction materials will take place along the OGC;
- No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works will not take place at periods of high rainfall, and will be scaled back or suspended if heavy rain is forecast;
- Machinery deliveries will be arranged using existing structures along the public road;
- All machinery operations will take place away from the stream and ditch banks, apart from where crossings occur, although no instream works are proposed or will occur;
- Any excess construction material will be immediately removed from the area and sent to a licenced waste facility;
- No stockpiling of materials will be permitted in the constraint zones;
- Spill kits will be available in each item of plant required to complete the stream crossing; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.

Please note that mitigation measures for HDD are detailed in Section 23.5.2.10.

**Post-Mitigation Residual Effect**: The potential for the release of suspended solids and other contaminants to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect will be a negative, imperceptible, direct, long term, likely effect on surface water flows and surface water quality. This effect is considered Not Significant.

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

### 23.5.2.9 Potential Effects on Local Groundwater Wells

The biggest risk to groundwater wells will be from groundwater contamination due to the accidental release of hydrocarbons and cement-based products as a result of construction activities within the Onshore Site.

No effects on groundwater levels / quantity will occur due to the shallow nature of the proposed works and the local hydrogeological regime.

There are no downgradient public or group scheme groundwater supply sources that can be impacted by the Onshore Site. Due to the remote location of the Onshore Site, there are a limited number of sensitive receptors which are located in the immediate vicinity of the OLL and the OCC.

- The closest sensitive receptor to the OLL is approximately 250m to the south and is upgradient in terms of groundwater flow direction;
- There are no sensitive receptors located downgradient (i.e. north) of the Onshore Landfall Location;
- The closest sensitive receptor to the OCC Location is approximately 230m to the south and is upgradient in terms of groundwater flow direction;
- The closest downstream sensitive receptor to the OCC Location is approximately 350m to the south; and,
- There are no sensitive receptors within 30-300m (length of groundwater flowpaths – refer to Section 23.3.8) of the OCC or OLLs which have the potential to be impacted by the Project.

Due to the shallow nature of the proposed work along the OGC, no effects on private groundwater well supplies will occur.

**Pathway:** Groundwater flowpaths.

**Receptor:** Down-gradient groundwater supplies (groundwater wells).

**Pre-Mitigation Effect:** Negative, imperceptible, indirect, long-term, unlikely effect on down gradient water supplies. The pre-mitigation potential effect is considered to be Not Significant.

**Mitigation Measures / Impact Assessment**:

There are no local groundwater well supplies in the immediate vicinity of OLL or the OCC. There may be private well supplies within ~20m of the OGC but due to the nature of the works there is no potential for effects to occur.

All local sensitive receptors are located significant distances from OCC and OLL. Given, the presence of hydrological barriers and the short groundwater flowpaths (~30m minimum and~300m maximum), there is no potential for effects on any local well supplies at these sensitive receptors.

Regardless, if private wells are located downslope of the Onshore Site or not (or if wells are installed in the future), the potential for impact is negligible for the following conclusive reasons:

- The Onshore Site is underlain by aquifers of low permeability;
- Groundwater flowpaths are therefore typically very short (~30m minimum and~300m maximum);
- Consequently, the majority of groundwater flows within the OLL emerge as seeps along the adjacent coastline;
- The majority of groundwater flow at the OCC will emerge as baseflow along streams/rivers and leave the local area as surface water flows and not groundwater flows;
- Therefore, the potential to impact on local wells (whether they are downslope or not) is very low as groundwater flowpaths between the project infrastructure and potential source typically do not exist due to the large setback distance;
- Nevertheless, mitigation is provided in the EIAR to deal with typical construction phase groundwater hazard such as oils and fuels; and,
- Therefore, based on the hydrogeological assessment of the site with regard to groundwater user risk and the proposed mitigation measures, it can be robustly determined that the potential to impact on local wells/water supply sources is negligible.

**Post-Mitigation Residual Effects**: For the reasons outlined in the impact assessment above (separation distances, and prevailing geology, topography and groundwater flow directions), we consider the residual effect to be negative, imperceptible, indirect, long-term, unlikely effect in terms of quality or quantity on local groundwater abstractions. This effect is considered Not Significant.

**Significance of Effects**: For the reasons outlined above, No Significant effects on existing groundwater supplies will occur.

### 23.5.2.10 Potential Effects Associated with Surface Water Quality During Direction Drilling at Watercourse Crossings along the OGC

Surface water quality effects on local watercourses may occur during drilling and groundworks associated with potential directional drilling along the OGC. HDD is proposed at a total of 19 no. different crossing locations along the OGC route, including over a total of 4 no. EPA mapped watercourses (Moyne, Wood and Doonbeg streams and the Moyasta River), as well as at other

crossings at non-EPA mapped drains, ditches, and other features. The types of watercourse crossings, including those that will be achieved by HDD, are listed in Table 5-27 of Chapter 5: Project Description.

It is proposed that directional drilling under the bridges or watercourses will be undertaken to prevent direct impacts on the watercourse. However, there is a risk of indirect impacts from sediment laden runoff during the launch pit and reception pit excavation works. There is also the unlikely risk of fracture blow out and contamination of the watercourse with drilling fluid.

**Pathway**: Surface water and groundwater flows.

**Receptor**: All watercourses (1st and 2nd order streams) in the vicinity of the OGC and associated water-dependent ecosystems.

**Pre-Mitigation Potential Effect**: Negative, moderate, indirect, temporary, likely effect on surface water quality. The pre-mitigation potential effect is considered to be Not Significant.

**Proposed Mitigation Measures**:

Proposed mitigation measures at watercourse crossings:

- Although no in-stream works are proposed, the drilling works at the 4 no. EPA mapped watercourse crossings will only be done over a dry period between July and September (as required by IFI for in-stream works) to avoid the salmon spawning season and to have more favourable (dryer) ground conditions. Other crossings at manmade drains/ditches are not natural watercourses and as such seasonal restrictions will not apply. Nevertheless, all other mitigation for the protection of surface water quality detailed in the following bullet points will be implemented at these crossings;
- The crossing works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance;
- There will be no storage of material / equipment or overnight parking of machinery inside the 15m buffer zone;
- Before any ground works are undertaken, double silt fencing will be placed upslope of the watercourse channel along the 15m buffer zone boundary;
- Additional silt fencing or straw bales (pinned down firmly with stakes) will be placed across any natural surface depressions / channels that slope towards the watercourse;
- Silt fencing will be embedded into the local soils to ensure all site water is captured and filtered;
- The area around the bentonite batching, pumping and recycling plant will be bunded using terram (as it will clog) and sandbags in order to contain any spillages;
- Drilling fluid returns will be contained within a sealed tank / sump to prevent migration from the works area;
- Spills of drilling fluid will be cleaned up immediately and stored in an adequately sized skip before been taken off-site;
- If rainfall events occur during the works, there will be a requirement to collect and treat small volumes of surface water from areas of disturbed ground (i.e. soil and subsoil exposures created during site preparation works);
- This will be completed using a shallow swale and sump down slope of the disturbed ground; and water will be pumped to a proposed percolation area at least 50m from the watercourse;
- The discharge of water onto vegetated ground at the percolation area will be via a silt bag which will filter any remaining sediment from the pumped water. The entire percolation area will be enclosed by a perimeter of double silt fencing;
- Any sediment laden water from the works area will not be discharged directly to a watercourse or drain;

- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecast;
- Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter is discharged to the watercourse;
- If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied;
- On completion of the works, the ground surface disturbed during the site preparation works and at the entry and exit pits will be carefully reinstated and re-seeded or resurfaced at the soonest opportunity to prevent soil erosion;
- The silt fencing upslope of the river will be left in place and maintained until the disturbed ground has re-vegetated;
- There will be no batching or storage of cement allowed at the watercourse crossing;
- There will be no refuelling allowed within 50m of the watercourse crossing; and,
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing.

Fracture Blow-out (Frac-out) Prevention and Contingency Plan:

- The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage;
- One or more lines of silt fencing will be placed between the works area and the adjacent river;
- Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility;
- Adequately sized skips will be used where temporary storage of arisings are required;
- The drilling process / pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse;
- This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur then drilling will be immediately stopped;
- Any frac-out material will be contained and removed off-site;
- The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix; and,
- If the risk of further frac-out is high, a new drilling alignment will be sought at the crossing location.

**Post-Mitigation Residual Effect**: Due to the avoidance of instream works, the works being mainly carried out in the corridor of a public road along with the proposed mitigation measures the residual effect will be a negative, imperceptible, indirect, temporary, likely effect on surface water in the downstream watercourses. This effect is considered Not Significant.

**Significance of Effects**: For the reasons outlined above, No Significant effects on surface water quality will occur.

### 23.5.2.11 Potential Effects Due to Duct Installation in Peatland Areas

2 no. sections of the OGC are proposed to pass through peatlands. The construction of the OGC in these areas could have the potential to impact on the adjacent peatlands, peatland hydrology, and downstream surface water quality.

Due to the presence of peat deposits, in order to emplace the OGC (in the ground), it would be necessary to excavate out substantial volumes of subsoil peat in order to reach a solid formation and

then backfill the excavation to create a solid formation for the underground cables. The excavation of large volumes of peat would have the potential to result in surface water quality effects (entrainment of suspended solids in surface waters from peat storage areas) and would impact on local bog hydrology/hydrogeology.

**Pathway**: Surface water and groundwater flows/levels.

**Receptor**: Downstream watercourses and bog hydrogeology.

**Pre-Mitigation Potential Effect**: Negative, moderate, indirect, temporary, likely effect on surface water quality and bog hydrogeology. The pre-mitigation potential effect is considered to be Not Significant.

**Proposed Mitigation Measures**:

A key mitigation is the utilisation of suitable construction methodologies in these 2 no. sections of the OGC which will significantly reduce the potential for effects.

In order to inform a suitable construction methodology, these 2 no. sections of the OGC (Section 01 and Section 02) have been subject to comprehensive and multi-phased site investigations designed to determine the nature and thickness of the peat deposits and underlying subsoils.

Section 01 which is located to the north of the OCC has peat depths of ~2mbgl. Due to the shallow peat depths along this section of the OGC, conventional trench installation is deemed to be the most appropriate construction methodology. Furthermore, the local road is surrounded on both sides by deep roadside drains which separate the works from the surrounding bog, meaning that there is no potential for the works to impact on the local bog hydrogeology (the peat within the road is isolated from the peat in the surrounding areas).

Section 02 has deeper peat depths of ~4mbgl. Due to the presence of deep peat, it is proposed to utilise HDD along this section of the OGC. It is proposed that the cable will be installed using HDD in the mineral subsoils below the peat layer. It is proposed to be installed at depths of ~8mbgl which is 4m below the bottom of the peat. This significantly reduces the potential for effects on the local bog hydrogeology. The cable will be held in underlying mineral subsoils and in places in the underlying bedrock (geophysical surveys indicate that the depth to rock ranges from 2.5 to 7mbgl in the south of this section of the OGC). Furthermore, by utilising HDD in this section of the OGC, a longitudinal excavation will be avoided reducing the impact on the existing road. The only areas in which disturbance to the road structure would take place is at the Joint Bay Locations whereby a Cofferdam Construction approach could be utilised. This significantly reduces the potential for the entrainment of suspended solids in runoff. The HDD will be completed in this section as follows:

- At each joint bay location, a sheetpile cofferdam will be installed and the peat removed and replaced with rockfill.
- The cofferdam technique of installing the rockfill jointing area will cut off any drainage of the surrounding peat.
- The directional drilling machine will set up at a launch pit (to be established at the Joint Bay locations). The drill will then bore under the peat from one joint bay to another.
- The drill head will enter the mineral soil within the confines of the rockfill area and will progress at a minimum of 4m below the peat clay interface.
- The drilling head of the boring tool has a series of nozzles that feed a liquid bentonite mix along the bore direction, which provides both lubrication and support to the bore.
- Once the bore reaches the far side, the duct is then attached to the drill head and the duct is pulled back along the infrastructure of the bore to the original drilling point.
- Any bentonite mix is deposited within the bore shaft and is collected at either end of the bore within the dedicated launch/receiver pits; all excavated material and excess bentonite will be removed from site and brought to an authorised waste facility.

- Once the duct is in place under the peat sections and the transition section completed, the normal process of road trenching can continue from either side of the HDD sections.

The use of HDD will significantly reduce to disturbance to the peat deposits, ensuring that there are no significant effects on the adjacent peatlands.

**Post-Mitigation Residual Effect**: Due to careful consideration of appropriate construction methodologies along the OGC, along with the proposed mitigation measures, the residual effect will be a negative, imperceptible, indirect, temporary, likely effect on surface water in the downstream watercourses and on bog hydrology/hydrogeology. This effect is considered Not Significant.

**Significance of Effects**: For the reasons outlined above, No Significant effects will occur.

### 23.5.2.12 Potential Effects on Hydrologically Connected Designated Sites

The following designated sites are located in close proximity to the Onshore Site:

- The Tullaher Lough and Bog SAC (Site Code: 002343) and pNHA (Site Code: 000070) are located immediately to the west and downstream of approximately 1.8km of the OGC; and,
- The River Shannon and River Fergus Estuaries SPA (Site Code: 004077) and the Lower River Shannon SAC (Site Code: 002165) are located immediately to the west and downstream of approximately 400m of the OGC near Moneypoint.

The greatest potential for effects is on the Tullaher Lough and Bog SAC/pNHA. The potential for effects on the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC is limited given the scale of these designated sites, the large volume of water within the River Shannon Estuary and the saline nature of the water in the estuaries. However, for completeness both of these designated sites which are located in close proximity to the Onshore Site will be included in the impact assessment.

Furthermore, Farrihy Lough pNHA (Site Code: 000200) is mapped within the Ballard_010 river sub-basin and downstream of ~200m of the OGC. This NHA will be included in the impact assessment.

All other downstream designated sites have been screened out of the assessment due to their distant location from the Onshore Site, the large volumes of water within the associated coastal waterbodies and the saline nature of the waters. Given the scale of the Onshore Site, there is no potential for effects on the following designated sites:

- The Mid-Clare Coast SPA (Site Code: 004182);
- Carrowmore Dunes SAC (Site Code: 002250);
- White Strand/Carrowmore Marsh pNHA; and,
- Kilkee Reefs SAC (Site Code: 02264).

**Pathway:** Surface water flowpaths.

**Receptor:** Down-gradient water quality with the Tullaher Lough and Bog SAC/pNHA, River Shannon and River Fergus Estuaries SPA, the Lower River Shannon SAC and Farrihy Lough pNHA.

**Pre-Mitigation Potential Effect:**

Indirect, negative, slight, short term, likely effect on Tullaher Lough and Bog SAC/pNHA. The pre-mitigation potential effect is considered to be Not Significant.

Indirect, negative, imperceptible, short term, unlikely effect on River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. The pre-mitigation potential effect is considered to be Not Significant.

Indirect, negative, slight, short-term, likely effect on Farrihy Lough pNHA. The pre-mitigation potential effect is considered to be Not Significant.

**Mitigation Measures / Impact Assessment:**

Tullaher Lough and Bog SAC/pNHA

Due to the nature and scale of the works along the OGC the potential for effects is limited. The works will be transient and short-term in nature, and all works adjacent the SAC/pNHA will be located within the carriageway of the existing public road network.

The SAC/pNHA is located in the Doonbeg_050 river sub-basin and the bog is drained by the EPA mapped Carrowmore South Stream which flows northwards from Tullagher Lough, crossing the local road within which the underground cabling is proposed, before eventually discharging into the Doonbeg River. The OGC is therefore, located downgradient of this SAC/pNHA. Groundwater flow direction will mimic surface water flows and will also flow to the north.

Furthermore, during site walkover surveys deep roadside drains were noted to be present along this section of the OGC. These roadside drains hydraulically isolate the road carriageway from the SAC/pNHA. These roadside drains have drained the local groundwater table and form part of the baseline environment. The road would not exist without these roadside drains. As a result, no additional dewatering or drainage will occur along this section of the OGC during trench excavations. As such, The Project has no potential to alter groundwater levels within the adjacent bog.

However, it is proposed that the section of the OGC adjacent to the SAC/pNHA will be constructed using HDD due to the presence of deep peat deposits. The use of HDD techniques at this location will allow the installation to take place below 4m the peat subsoils and at a depth of 8mbgl. This will avoid a longitudinal excavation in this area and would therefore reduce the potential for effects on the SAC/pNHA. The mitigation measures for HDD are prescribed in Section 23.5.2.10.

The mitigation measures prescribed above in Section 23.5.2.2 (suspended solids), Section 23.5.2.5 (hydrocarbons), Section 23.5.2.6 (cement-based products) and Section 23.5.2.8 (watercourse crossings) will ensure that there is no deterioration in local surface water quality or groundwater quality.

Therefore, due to the location of the works downstream of the designated site, the nature and scale of the proposed works, the presence of deep roadside drains, and the prescribed mitigation measures, there is no potential for significant water level or water quality effects on Tullaher Lough and Bog SAC/pNHA.

River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC

Due to the nature and scale of the works along the OGC near Moneypoint, the potential for effects is limited. The works will be transient and short-term in nature, and all works adjacent to the SPA/SAC will be located adjacent to the N69 public road network. The works are proposed on the opposite side of the road to these designated sites. Furthermore, the large volumes of saline water in the adjacent waterbody will provide a significant dilution effect.

Furthermore, the mitigation measures prescribed above in Section 23.5.2.2 (suspended solids), Section 23.5.2.5 (hydrocarbons), Section 23.5.2.6 (cement-based products) and Section 23.5.2.8 (watercourse crossings) will ensure that there is no deterioration in surface water quality or groundwater quality.

Farrihy Lough pNHA

Due to the nature and scale of the works along the OGC within the Ballard_010 sub-basin the potential for effects is limited. The works will be transient and short-term in nature and only ~200m of works are mapped within this sub-basin. All works will be located within the carriageway of the existing public road network. Furthermore, there is no direct hydrological connection mapped between the Onshore Site and this pNHA.

Furthermore, the mitigation measures prescribed above in Section 23.5.2.2 (suspended solids) and Section 23.5.2.5 (hydrocarbons) will ensure that there is no deterioration in surface water quality or groundwater quality.

**Post-Mitigation Residual Effect:** Construction activities pose a threat to designated sites hydrologically linked and adjacent to the Onshore Site. The potential for effects are limited due to the short-term and transient nature of the proposed works and the existing prevailing drainage regimes along the OGC. Furthermore, proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the works areas will be equivalent to baseline conditions and will therefore have no impact on surface water quality and/or the status or ecology of the protected species and habitats within the designated sites. The residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on adjacent designated sites. This effect is considered Not Significant.

**Significance of Effects**: No Significant effects on designated sites will occur.

### 23.5.2.13 Potential Effects on WFD Status/Objectives

The EU Water Framework Directive (2000/60/EC) requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the Directive is not compromised.

The WFD status for GWBs and SWBs underlying and downstream Onshore Site are defined in Section 23.3.11.1 and Section 23.3.11.2 respectively.

A detailed WFD Compliance Assessment Report has been completed in combination with this EIAR Chapter and is included in Appendix 23-2.

**Pathway:** Surface water flowpaths.

**Receptor:** WFD status of downstream surface water bodies (Doonbeg_050, Ballard_010, Moyasta_010, Wood_010, Wood_020 and Tonavoher_010 SWBs) and underlying GWBs (Miltown Malbay and Kilrush GWBs).

**Pre-Mitigation Potential Effect:** Indirect, negative, imperceptible, short term, likely effect on surface water and groundwater bodies. The pre-mitigation potential effect is considered to be Not Significant.

**Proposed Mitigation Measures:**

Mitigation measures relating to the protection of surface water drainage regimes and surface water quality within the Onshore Site have been detailed in Section 23.5.2.1 (hedgerow and tree removal), Section 23.5.2.2 (suspended solids), Section 23.5.2.5 (hydrocarbons), Section 23.5.2.6 (cement-based products) and Section 23.5.2.7 (wastewater). Additional mitigation measures have also been proposed along the OGC in relation to HDD (Section 23.5.2.823.5.2.10).

Similarly, mitigation measures for the protection of groundwater quantity and quality have been detailed in Section 23.5.2.4 (groundwater levels), Section 23.5.2.5 (hydrocarbons), Section 23.5.2.6 (cement-based products), Section 23.5.2.7 (wastewater).

The implementation of these mitigation measures will ensure the protection of downstream SWBs and underlying GWBs.

**Post-Mitigation Residual Effects**: Mitigation for the protection of surface and groundwater during the construction phase of the Onshore Site will ensure the qualitative and quantitative status of the receiving waters will not be significantly altered by the Onshore Site.

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Onshore Site. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWBs and downstream SWBs are protected from any potential deterioration.

No residual effect on Groundwater Body WFD status will occur.

No residual effect on Surface Water Body WD status will occur.

**Significance of Effects**: For the reasons outlined above, No Significant effects on WFD GWBs and SWBs status, risk or future objectives will occur as a result of the Onshore Site.

### 23.5.2.14 Potential Effects on Wetlands

There are a number of wetlands recorded by the Wetlands Survey Ireland along the OGC as detailed in Section 23.3.12.2 above.

Any potential effects on these wetlands are limited due to the short-term and transient nature of the works proposed along the OGC. Furthermore, many of these wetlands are already drained and are described as cutover bog. The shallow works within an existing road carriageway would have limited potential to impact these mapped wetlands.

**Pathway:** Surface water flowpaths.

**Receptor:** Local wetland habitats along the OGC

**Pre-Mitigation Potential Effect:** Indirect, negative, imperceptible, short term, unlikely effect on local wetlands. The pre-mitigation potential effect is considered to be Not Significant.

**Proposed Mitigation Measures:**

Mitigation measures relating to the protection of surface water drainage regimes and surface water quality within the Onshore Site have been detailed in Section 23.5.2.1 (hedgerow and tree removal), Section 23.5.2.2 (suspended solids), Section 23.5.2.5 (hydrocarbons), Section 23.5.2.6 (cement-based products) and Section 23.5.2.7 (wastewater). Additional mitigation measures have also been proposed along the OGC in relation to HDD (Section 23.5.2.823.5.2.10).

Similarly, mitigation measures for the protection of groundwater quantity and quality have been detailed in Section 23.5.2.4 (groundwater levels), Section 23.5.2.5 (hydrocarbons), Section 23.5.2.6 (cement-based products), Section 23.5.2.7 (wastewater).

The implementation of these mitigation measures will ensure the protection of water quality within local wetlands.

There is no potential for groundwater level effects due to the shallow nature of the works along the OGC.

**Post-Mitigation Residual Effects**: Mitigation for the protection of surface and groundwater during the construction phase of the Onshore Site will ensure the qualitative and quantitative status of local wetlands will not be significantly altered by the Onshore Site. This effect is considered Not Significant.

**Significance of Effects**: For the reasons outlined above, No Significant effects on local wetlands will occur as a result of the Onshore Site.

## 23.5.3 Operation and Maintenance Phase Likely Significant Effects and Mitigation Measures

### 23.5.3.1 Potential Effects Due to Progressive Replacement of Natural Surface with Lower Permeability Surfaces

Progressive replacement of the vegetated surface with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the site and increase flood risk downstream of the Onshore Site.

In an unmitigated scenario and in the absence of any suitably designed stormwater drainage system, the OCC and associated compound would be impermeable and during storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on aquatic ecosystems. However, due to the small footprint of the OCC, even in the absence of a suitably designed stormwater drainage system, any increase in runoff will be relatively small.

The construction compounds at the OLL are temporary and will be removed once construction works are complete. Therefore, they have no potential to increase surface water runoff during the operation and maintenance phase. However, even in an unmitigated scenario, any increase in runoff will be small due to the small footprint of the OCC.

There will be no potential for significant changes to runoff rates along the OGC route, as the works are predominantly located within the carriageway of the existing roads. New access tracks will be built over some off-road sections of the route in 3rd party lands. The potential for effects on surface water quantity is limited due to the very small footprint of these areas.

**Pathway:** Site drainage network.

**Receptor:** Surface waters (1st and 2nd order streams) in the vicinity and downstream of the OCC and associated water-dependent ecosystems.

**Pre-Mitigation Potential Effect:** Negative, slight, indirect, permanent, moderate probability effect on all downstream surface water bodies. The pre-mitigation potential effect is considered to be Not Significant.

**Mitigation Measures:**

Over the edge drainage will be implemented on the new gravel tracks to be constructed along the OGC at the limited locations where the route passes through 3rd party lands and there isn't already an access track in place.

A stormwater drainage system has been designed for the operation and maintenance phase of the Onshore Site at the OCC (refer to Section 23.4.1.1). All stormwater from the buildings and bunded

areas will be directed to an underground system where it will be attenuated prior to discharge. Discharge from the attenuation tank will be via a hydrobrake and discharge will be limited to existing greenfield runoff rates. The drainage system has been suitably designed to cater for a 100-year plus 20% climate change rainfall event. The proposed access and compound area will be constructed with permeable material which will allow infiltration and recharge to ground.

**Post-Mitigation Residual Effect:** Proven and effective measures to attenuate runoff and mitigate the risk of flooding will be employed. The residual effect will be a neutral, indirect, long term, likely effect on down gradient streams/rivers. This effect is considered Not Significant.

**Significance of Effects:** No Significant effects on downstream flood risk will occur during the operation and maintenance phase of the Onshore Site.

### 23.5.3.2 Potential Effects on Surface Water Quality Due to Discharge From OCC

During the operation and maintenance phase, there are several sources of contamination at the OCC which have the potential to negatively impact local surface water and groundwater quality. Runoff from hardstand areas can potentially contain elevated concentrations of contaminants such as hydrocarbons and suspended solids. Any leakage of oils from the transformers or the release of untreated wastewater would also have the potential to affect downstream water quality.

**Pathway**: Site drainage network.

**Receptor**: Downstream surface water.

**Pre-Mitigation Potential Effect**:

Negative, slight, indirect, likely, temporary effect on downstream surface water quality. The pre-mitigation potential effect is considered to be Not Significant.

**Mitigation Measures**

The proposed operation and maintenance phase drainage system at the OCC is detailed in Appendix 5-15 of the EIAR and has been designed to ensure the protection of downstream surface watercourses.

The proposed drainage system at the OCC will ensure that there is no discharge of untreated or unattenuated stormwater. All water from the bunded areas will pass through a hydrocarbon interceptor prior to discharge. Sumps will also be used throughout the drainage system to facilitate the settlement of suspended solids. Rip-rap aprons will be located at the outlet to prevent erosion and the entrainment of suspended solids.

A foulwater drainage system has also been designed for the OCC. This system comprises of suitably sized tanks which will be fitted with a high-level alarm so that the tank can be emptied and prevents the risk of overflowing. There will be no discharge of wastewater at the site.

Additional mitigation in relation to hydrocarbons are detailed in Section 23.5.2.5.

**Post Mitigation Potential Residual Effect**: With the implementation of the mitigation measures and the proposed drainage system at the OCC there will be no residual effect on surface water quality during the operation and maintenance phase.

**Significance of Effects**: For the reasons outlined above, and with the implementation of the listed mitigation measures, No Significant effects on downstream surface water quality will occur.

### 23.5.3.3 Potential Effects from Runoff Resulting in Contamination of Surface Waters During Maintenance Works

During the operation and maintenance phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed and will typically be limited to OCC and joint bay locations along the OGC. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.

These minor activities could, however, result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies. Potential effects could be significant if not mitigated against.

During such maintenance works there is a small risk associated with release of hydrocarbons from site vehicles, although it is not envisaged that any significant refuelling works will be undertaken on site during the operation and maintenance phase.

**Pathways:** Drainage and surface water discharge routes.

**Receptors:** Surface waters (1st and 2nd order streams) in the vicinity and downstream of the OCC and associated water-dependent ecosystems.

**Pre-Mitigation Potential Effect:** Negative, slight, indirect, temporary, likely effect on downstream surface water quality. The pre-mitigation potential effect is considered to be Not Significant.

**Proposed Mitigation Measures:**

Mitigation measures for sediment control are the same as those outlined above for the construction phase.

Mitigation measures for control of hydrocarbons during maintenance works are similar to those outlined in Section 23.5.2.5.

**Post-Mitigation Residual Effects**: With the implementation of the Onshore Site drainage measures as outlined above, and based on the post-mitigation assessment of runoff, the residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality. This effect is considered Not Significant.

**Significance of Effects**: For the reasons outlined above, No Significant effects on the surface water quality will occur.

### 23.5.3.4 Potential Effects from the Release of Hydrocarbons

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

**Pathway:** Groundwater flowpaths and site drainage network.

**Receptor:** Groundwater and surface waters (1st and 2nd order streams) in the vicinity and downstream of the Onshore Site.

**Pre-Mitigation Potential Effect:**

Indirect, negative, slight, short term, unlikely effect on local groundwater quality. The pre-mitigation potential effect on groundwater quality is considered to be Not Significant.

Indirect, negative, significant, short term, unlikely effect on surface water quality. The pre-mitigation potential effect on surface water quality is considered to be Significant.

**Proposed Mitigation Measures**:

- Onsite re-fuelling of machinery will not be carried out during the operation and maintenance phase of the development. All plant/machinery will be refuelled offsite;
- Fuels stored on site will be minimised and any diesel or fuel oils stored on-site will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity;
- The OCC will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- Any plant used during the operation and maintenance phase will be regularly inspected for leaks and fitness for purpose; and,
- Spill kits will be available to deal with accidental spillages.

**Post-Mitigation Residual Effects:** The potential for the release of hydrocarbons to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of hydrocarbons have been proposed above and will break the pathway between the potential source and each receptor. The residual effect will be a negative, indirect, imperceptible, short term, unlikely effect on surface water quality and groundwater quality. This effect is considered Not Significant.

**Significance of Effects:** For the reasons outlined above, No Significant effects on surface water or groundwater quality are anticipated during the operation and maintenance phase of the Onshore Site.

### 23.5.3.5 Potential Effects from Water Supply at OCC

It is proposed to install a groundwater well at the OCC in accordance with the Institute of Geologists Ireland, *Guide for Drilling Wells for Private Water Supplies* (IGI, 2007). The well will be flush to the ground and covered with a standard manhole. An in-well pump will direct water to a water tank within the roof space of the control building.

The proposed groundwater well and associated extraction has the potential to effect local groundwater levels in the surrounding lands.

**Pathway:** Groundwater flowpaths

**Receptor:** Groundwater levels

**Pre-Mitigation Potential Effect:** Direct, negative, imperceptible, permanent, likely effect on local groundwater levels which is Not Significant.

**Impact Assessment**

The abstraction rate for the proposed groundwater well at the OCC will be comparable to a domestic well, with a well supplying a single household typically abstracting less than $1m^3$/day. The well is proposed in a locally important aquifer which is moderately productive only in local zones. This aquifer forms part of the Kilrush GWB which is comprised of poorly productive bedrock. Therefore, due to the nature of the bedrock aquifer and the proposed extraction rate, no effects on local groundwater levels will occur.

For these reasons no mitigation measures are required.

**Post-Mitigation Residual Effects:** Due to the scale of the proposed abstraction and the nature of the bedrock aquifer, we consider the residual effect to be direct, negative, imperceptible, permanent, likely effect on local groundwater levels. This effect is considered Not Significant.

**Significance of Effects:** For the reasons given above, No Significant effects on surface water quality or quantity, or groundwater quality will occur.

### 23.5.3.6 Potential Effects on WFD Status/Objectives

There is no direct discharge from the Onshore Site to downstream receiving waters. Mitigation for the protection of surface water during the operation and maintenance phase of the Onshore Site will ensure the qualitative status of the receiving SWBs will not be altered by the Project.

Similarly, there is no direct discharge to groundwaters associated with the Onshore Site. Mitigation for the protection of groundwater during the operation and maintenance phase of the Onshore Site will ensure that the qualitative status of the receiving GWB will not be altered by the Project.

A WFD Compliance Assessment has been completed for the Onshore Site and is included in Appendix 23-2. In addition, a WFD Compliance Assessment has been completed for the Offshore Site and is included in Appendix 8-1. The WFD Compliance Assessment for the Onshore Site concludes that the Onshore Site, alone or in combination with other developments:

- will not cause a deterioration in the status of all surface and groundwater bodies;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of and not likely to compromise the ability of any waterbody to meet the objectives of the Water Framework Directive (2000/60/EC) as amended and its transposing legislation;
- does not degrade the ecological quality of the protected sites associated with the connected waterbodies nor jeopardise the goals and/or targets set out for these protected sites; and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC).

A full assessment of the potential effects of the operation and maintenance phase of the Onshore Site on the status of the receiving waterbodies is included in WFD Compliance Assessment Report attached as Appendix 23-2. There will be No Significant effects on the WFD status of downstream SWBs od underlying GWBs.

## 23.5.4 Decommissioning Phase Likely Significant Effects and Mitigation Measures

The potential effects associated with decommissioning will be similar to those associated with construction but of significantly reduced magnitude.

The Rehabilitation Schedule is presented in Appendix 5-18. Some of the effects relating to the Onshore Site will be avoided by leaving elements of the Project in place where appropriate, for example:

- The above ground components of the OCC building and compound will be removed fully from site. For the underground components, such as the foundations and non-electrical infrastructure, the Best Environmentally Practicable Option (BEPO)least disruptive option would be is for these to remain in situ;
- The planted area adjacent to the OCC, as presented in the Landscape Management Plan in Appendix 27-1, will remain in situ. The remainder of the OCC site will be reinstated to its original form with a grassed surface;
- For the OGC, the ducts and joint bay infrastructure will remain in situ and can be used for future cable installation if required. The joint bays will be opened up and the cables will be cut. Once cut, the cables are pulled through the ducting and removed. The joint bays are then backfilled and reinstated to the relevant road standards, or to original condition for those located on private lands; and,
- Onshore access tracks within private lands will remain in situ and can be provided for alternative future use by the landowners.

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant. Refer to Sections 23.5.2.2, 23.5.2.5, 23.5.2.7, 23.5.2.8, and 23.5.2.10. No Significant effects on the hydrological and hydrogeological environment will occur during the decommissioning phase of the Onshore Site.

## 23.5.5 Risk of Major Accidents and Disasters

Due to the relatively flat topography and the absence of peat across much of the Onshore Site, it is considered that the risk of a peat failure is very low.

Flooding can also result in downstream major accidents and disasters. However, due to the small scale of the onshore elements of Project, the very small permanent development footprint, and with the implementation of the prescribed mitigation measures the increased flood risk associated with the Onshore Site is low (refer to Section 23.3.6 above).

No Significant effects on the hydrological and hydrogeological environment will occur as a result of major accidents or disasters associated with the hydrological or hydrogeological aspects of the Onshore Site.

## 23.5.6 Human Health Effects

Potential health effects arise mainly through the potential for surface and groundwater contamination which may have negative effects on public and private water supplies. There are no mapped public or group water scheme groundwater protection zones in the area of the Onshore Site. Furthermore, no private wells are located in close proximity to the OCC or the OLL (refer to Section 23.3.13.1). Some private well supplies may be located in close proximity to the OGC, however, no effects will occur due the minor and transient nature of the works. Notwithstanding this, the prescribed mitigation measures ensures that the potential for effects on the hydrogeological will not be significant.

Flooding of property can cause inundation with contaminated flood water. Flood waters can carry waterborne disease and contamination/effluent. Exposure to such flood waters can cause temporary health issues. A detailed Flood Risk Assessment has also shown that the risk of the Onshore Site contributing to downstream flooding is very low, as the long-term plan for the Onshore Site is to retain and slow down drainage water within the existing site. On-site drainage control measures will ensure that there is no downstream increase in flood risk.

No Significant effects on human health will occur as a result of the hydrological or hydrogeological aspects of the Onshore Site.

## 23.5.7 Cumulative Effects

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

The main likelihood of cumulative effects is assessed to be hydrological (surface water quality) rather than hydrogeological (groundwater). Due to the hydrogeological setting of the Onshore Site (i.e. low permeability soils and subsoils overlying locally important bedrock aquifers) and the near surface nature of construction activities, cumulative effects with regard to groundwater quality or quantity arising from the Onshore Site are assessed as not likely.

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

A cumulative hydrological study area has been delineated as follows:

- The Tonavoher_010 WFD river sub-basins due to the location of the OCC within this sub-basin;
- The area immediately around the OLL within the Doonbeg_050 WFD river sub-basin. There is no requirement to include this entire sub-basin as the OLL is situated in the northwestern corner of the sub-basin, whereby all drainage is directed to the north and into the sea; and,
- A 200m study buffer zone has been applied to the OGC. This is considered to be an appropriate scale given the nature of the proposed works and the potential effects on the hydrological environment.

### 23.5.7.1 Cumulative Effects with Agriculture

The delineated cumulative study area is a largely agricultural area.

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

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

However, the mitigation measures detailed above in Section 23.5.2, 23.5.3 and 23.5.4 for the construction, operation and maintenance, and decommissioning phases of the Onshore Site will ensure the protection of downstream surface water quality.

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

#### 23.5.7.2 Cumulative Effects with Forestry

A section of the OGC in the vicinity of Moneypoint Powerplant is situated in an area of coniferous forestry.

The most common water quality problems arising from forestry relate to the release of sediment and nutrients to the aquatic environment and impacts from acidification. Forestry felling may also give rise to modified stream flow regimes caused by associated land drainage.

However, the mitigation measures detailed above in Section 23.5.2, 23.5.3 and 23.5.4 for the construction, operation and maintenance, and decommissioning phases of the Onshore Site will ensure the protection of downstream surface water quality.

For these reasons it is considered that there will Not be a Significant cumulative effect associated with commercial forestry activities.

#### 23.5.7.3 Cumulative Effects with Other Development

A detailed cumulative assessment has been carried out for all planning applications (granted and awaiting decisions) within the cumulative assessment area for the Onshore Site as described above.

The planning applications identified within the study area are for new sensitive receptors or renovations of existing sensitive receptors, as well as for the erection of farm buildings. The planning applications listed in Appendix 4-2 of the EIAR have been reviewed based on their type, scale and proximity to the Onshore Site. Based on the scale of the works, their proximity to the Onshore Site and the temporal period of likely works, no cumulative effects will occur as a result of the Onshore Site (construction, operation and maintenance, and decommissioning phases).

### 23.5.8 Post Consent Monitoring

No monitoring is required.

### 23.5.9 Conclusion

The impact assessment presented in this EIAR chapter is summarised as follows:

- The impact assessment is underpinned by a comprehensive desk study and extensive site-specific geological and hydrological dataset which has been accrued for the Onshore Site;
- The comprehensive geological site investigations included a total of 458 no. site investigation points accompanied by geophysical surveys along some sections of the OGC;
- The hydrological and hydrogeological monitoring completed as part of the baseline assessment included drainage mapping, flow monitoring, surface water quality sampling and groundwater level monitoring;
- The Hydrology and Hydrogeology impact assessment for the Onshore Site that with the implementation of the prescribed mitigation measures that there will be no significant effects on the hydrological and hydrogeological environment;

- Similarly, with the implementation of the prescribed mitigation measures, there will be no effects on designate sites or protected areas in the vicinity or downstream of the Onshore Site;
- Furthermore, the Onshore Site has been found to be fully compliant with the WFD and will not prevent any waterbody from achieving its WFD objectives; and,
- A cumulative impact assessment has found that there will be no cumulative effects on the hydrological or hydrogeological environment.