7. LAND SOILS AND GEOLOGY

7.1 Introduction

7.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to provide a description and assessment of the residual direct and indirect actual, and potential effects of the peat extraction activities and all ancillary works at the Ballivor, Carranstown, Bracklin, Lisclogher and Lisclogher West bogs (the 'Application Site') on the soil and geological environment, from 1988 to the present day. This chapter will also assess the potential impacts of the proposed rehabilitation plans for the Application Site following the cessation of peat extraction activities and all ancillary works in 2020.

The Application Site is located within the Ballivor Bog Group and is situated between the towns of Raharney and Delvin, Co. Westmeath and Ballivor, Co. Meath.

As stated in Chapter 4, July 1988 is the baseline environment as this is the year in which the EIA Directive (Directive 85/337/EEC) was required to be transposed into Irish Law. There is no legal requirement to complete a remedial environmental impact assessment report (rEIAR) on any of the activities occurring at the Application Site prior to the required transposition of the EIA Directive. Nevertheless, for completion, we provide a brief overview of the activities occurring at the Application Site from 1948 and the onset of site preparation works up to July 1988. The baseline land, soils and geological environment in the year 1988 is then described in detail along with a description of activities from 1988 to the cessation of peat extraction activities and all ancillary works in June of 2020, the management of the Application Site since June 2020 and the activities intended to be carried out at the Application Site into the future.

This chapter presents:

- An assessment of impacts of the peat extraction activities and all ancillary works on the land, soils and geological environment;
- The baseline sensitivity of the receiving land, soils and geological environment has been assessed based on the baseline site conditions occurring in 1988;
- The impacts of the receiving land, soils and geological environment have been assessed over 3 no. Phases of the life cycle of the project. These phases include the Peat Extraction Phase (July 1988 – June 2020), the Current Phase post extraction (June 2020 – present day) and the Remedial Phase as described in Chapter 4;
- The monitoring and control measures that were implemented during the Peat Extraction Phase from July 1988 to June 2020;
- The control and monitoring measures during the Current Phase (June 2020 to present day)
- The proposed mitigation measures associated with the proposed Decommissioning and Rehabilitation Plan (Remedial Phase); and,
- The residual effects along with the cumulative effects with relevant projects in the vicinity of the Application Site.

7.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which 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 includes soils, subsoils and geology. We routinely complete impact assessments for land, soils and geology, hydrology and hydrogeology for a large variety of project types including wind farms and renewable energy projects on peatlands.

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

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. For example, Michael has worked on the EIARs for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 120 other wind farm related projects across the country. Michael has also worked on rEIARs for Cleanrath WF, 41 no. Bord na Móna (the Applicant) bogs, and also for a number of quarry sites.

Conor McGettigan (BSc, MSc) is an Environmental Scientist, holding an M.Sc. in Applied Environmental Science (2020) from University College Dublin, graduating with a First-Class Honours degree. Conor has also completed a B.Sc. in Geology (2016) from University College Dublin (First Class Honours). Conor has completed numerous land, soils and geology chapters for several developments on peatlands. Conor has also completed geological and hydrological studies on sensitive peatlands sites, including Clonaslee Bog, the Liffey Head Project, and Keerglen WF and Kilsallagh WF.

7.1.3 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 2.6 of Chapter 2 of the rEIAR. Consultation responses relating to the land, soils and geological environment were received from the Geological Survey of Ireland. A summary of the response is below. Further details are outlined in Section 2.6.2 of Chapter 2 of this rEIAR.

Geological Survey of Ireland

A scoping request was sent to the Geological Survey of Ireland (GSI) on the 2nd of December 2021 and again on the 14th February 2024. A response was received on the 21st of December 2021 and on the 28th of February 2024 which comprised the following:

- List of relevant available datasets,
- Recommend referring to GSI Groundwater and Geothermal Unit run GW Climate project which is a groundwater monitoring and modelling project that aims to investigate the impact of climate change on groundwater in Ireland. This is a follow on from a previous project (GWFlood)
- Requested copy of reports detailing any site investigations carried out.

7.1.4 Relevant Legislation

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

- Planning and Development Acts, 2000-2022;
- Planning and Development Regulations, 2001 (as amended);
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including 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);

- S.I. No. 296/2018 European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018;
- European Communities (Environmental Impact Assessment) Regulations 1989 to 2006; and,
- S.I. No. 4/1995: The Heritage Act 1995, as amended.

7.1.5 Relevant Guidance

The land, soils and geology chapter of this rEIAR was prepared having regard, where relevant, to guidance contained in the following documents:

- Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements;
- Environmental Protection Agency (2003): Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements);
- Environmental Protection Agency (2002): Guidelines on the information to be contained in Environmental Impact Statements);
- Institute of Geologists Ireland (2013): Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017).

7.2 Methodology

7.2.1 Desk Study

A desk study of the Application Site and the surrounding area was completed in late 2021 and early 2022 to collect all relevant geological data for the Application Site and surrounding area. The desk study was checked and updated where required in March 2024. This study included consultation with the following data sources:

- Integrated Pollution Control Licence (IPC) Derrygreenagh Bog Group (Ref: P0501-01) Environmental Protection Agency, Appendix 4-1;
- Bord na Móna Rehabilitation Plans, Appendix 4-2;
    - Ballivor Bog 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan;
    - Bracklin Bog 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan;
    - Carranstown 2022 Cutaway Bog Decommissioning and Rehabilitation Plan;
    - Lisclogher East 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan; and,
    - Lisclogher-West 2023 Cutaway Bog Decommissioning and Rehabilitation Plan.
- Bord na Móna Annual Reports which contain information relevant to the Application Site;

- Annual Environmental Reports 2001-2023 **Appendix 4-3** (note that 2018 to 2023 are also publicly available[1])
- IPC Licence P0501-01 Application 1999 (Available at EPA Headquarters on request);
- Inspection of production records at Ballivor Works;
- Aerial Maps from 1973 to 2020, Appendix 4-4;
- Bord na Móna databases on peat depth and drainage;
- Bord na Móna Lidar data;
- Corine Land Cover and Land Cover Change Maps (www.land.copernicus.eu);
- Environmental Protection Agency soils and subsoils mapping (www.epa.ie);
- Geological Survey of Ireland – Geological databases (www.gsi.ie); and,
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 13 (Geology of Meath). Geological Survey of Ireland (GSI, 2003).

7.2.2 Monitoring and Site Investigation Data

HES completed site inspections and walkover surveys at the Application Site as part of this remedial Environmental Impact Assessment (rEIAR) and to inform the proposed Ballivor Wind Farm planning application. These site investigations comprised of peat probing, geological mapping and detailed walkover surveys completed by HES on 18th May 2020, 15th – 17th September 2020, 05th October 2020, 01st December 2020, 22nd March 2021, 01st April 2021, 20th September 2021, 28th October 2021 and 19th January 2022.

In addition to the site investigations completed by HES, several additional site investigations have been completed at the Application Site to further inform this rEIAR and the proposed Ballivor Wind Farm application. These site investigations included peat probing investigations completed by Fehily Timoney (FT) during walkover surveys on 8th - 10th June and 22nd - 24th June 2021. Ground investigations in the form of trial pits and boreholes were also carried out by FT and Irish Drilling Ltd (IDL) on 17th – 21st August 2020, 1st-16th February 2021, 19th July 2021 and 5th-11th August 2021. In addition, the Applicant undertook trial pitting on the 18th – 19th March 2021.

The combined geological dataset collated by HES, FT, IDL and the Applicant have been used in the preparation of this rEIAR Chapter.

In summary, site investigations to address the land, soils and geology chapter of the rEIAR include the following:

- A total of 457 no. peat probe depths/investigations points were carried out by HES, MKO and FT in Ballivor, Carranstown, Bracklin and Lisclogher Bogs. No peat probing investigations have been completed in Lisclogher West;
- Logging of subsoil exposures across the site where mineral soils and peat profiles are exposed;
- Mineral subsoils and peat were logged according to BS: 5930 and Von Post Scale respectively;
- Ground investigations completed by FT and IDL in the form of 78 no. trial pits, 16 no. boreholes and 5 no. rotary coreholes; and
- Completion of 24 no. trial pits excavated by the Applicant.

Site-specific data obtained by HES was supplemented with recent and historic site-specific data supplied by the Applicant. These data include habitat, soils/land, lidar and topographic maps for the Application Site. The maps are included in the Cutaway Bog Decommissioning and Rehabilitation Plans attached as Appendix 4-2. The Applicant have also provided volumes of peat extracted for the Application Site that are utilised in the preparation of this rEIAR Chapter.

[1] *Annual Environmental Reports 2008-2021 can be found at the following link: https://epawebapp.epa.ie/licsearchdownload/CombinedFileView.aspx?regno=P0501-01&classification=Enforcement*

7.2.3 Impact Assessment Methodology

Using information from the desk study and data from the site investigations, an assessment of the importance of the soil and geological environment within the Application Site is assessed using the criteria set out in

Table 7-1 (NRA, 2008).

Table 7-1 Estimation of Importance of Soil and Geology Criteria (NRA, 2008).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying site is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site). Well drained and/or highly fertility soils. Moderately sized existing quarry or pit Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed Wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying site is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral Resource.

The EPA Guideline criteria (EPA, 2022) for the assessment of likely significant effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable). The descriptors used in this rEIAR are those set out in the EPA (2022) Glossary of effects as shown in Chapter 1 of this rEIAR.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of effects are related to examples of potential likely significant effects on the geology and morphology of the receiving environment, as listed in Table 7-2.

Table 7-2: Impact descriptors related to the receiving environment.

Impact Characteristics		Potential Geological and Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: › The extent or morphology of a cSAC. › Regionally important aquifers. › Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time-dependent impacts on: › The extent or morphology of a cSAC / ecologically important area. › A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). › Extent of floodplains. Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area. Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	Local time-dependent impacts on: › The extent or morphology of a cSAC / NHA / ecologically important area. › A minor hydrogeological feature. › Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends
Positive, Negative or Neutral	Slight	Local perceptible time-dependent impacts not requiring mitigation.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

7.3 Establishing the Baseline Conditions

7.3.1 Site Location

The Application Site is situated on the Meath-Westmeath border, and comprises 5 no. Bord na Móna bogs which are part of the Ballivor Bog Group, which is a subset of the larger Derrygreenagh Bog Group. The bogs comprising the Application Site include Ballivor Bog to the south, Carranstown and Bracklin bogs towards the centre and Lisclogher and Lisclogher West bogs at the northern end of the site. Please see Chapter 4 for a more detailed description of the site location.

7.3.2 Topography

7.3.2.1 Original Topography

The topography across the Application Site prior to the onset of peat extraction activities and all ancillary works (1948) is estimated to be 72 – 89mOD. These estimations have been deduced from the current topography for Lisclogher West, which has never been subject to peat extraction, the relatively uniform low-lying nature of the Application Site and the surrounding landscape, and the presence of benchmark notes on historical 25" OSI mapping (1897 – 1913) and Cassini 6" (1940s) mapping from the area. No detailed elevation survey of these bogs are available from before peat extraction activities and all ancillary works began by the Applicant.

The estimated topographic changes through time for each individual bog are shown in

Table 7-3 below.

Table 7-3: Estimated Topographic Changes at the Application Site

Bog Name	Pre-Extraction (1948))	1988 Topographic Range	2020 Topographic Range (mOD)
Ballivor	72 – 89	74 - 82	69 – 79
Carranstown	72 – 89	72 - 78	69 – 78
Bracklin	72 – 89	75 – 89	71 – 84
Lisclogher	72 – 89	73 - 79	70 – 79
Lisclogher West	72 – 89	77 - 82	74 – 84

7.3.2.2 1988 Baseline Topography

Historically, the topographic profile of the Application Site was higher than that observed today with the topographic changes varying from across the site depending on a particular bogs extraction history (refer to Chapter 4). For example, peat extraction activities and all ancillary works commenced in Ballivor Bog in 1953 while Lisclogher West, despite being drained, was never subject to peat extraction. Therefore, it is reasonable to conclude that Ballivor Bog will have experienced a greater change in topography associated with peat extraction activities than Lisclogher West.

As described in Chapter 4, the topography of the Application Site in 1988, is based on an average depth of milled peat extraction of 0.1-0.2m per year over the 32-year period from 1988 to the cessation of peat extraction activities and all ancillary works in 2020. As seen in

Table 7-3 above, the baseline topography of the Application Site ranges from 69 – 84mOD, with the greatest elevations located at Bracklin bog towards the centre of the site.

All areas of the Application Site will have experienced some decrease in topography since 1988 due to the installation of drainage, and with the exception of at Lisclogher West, the removal of peat during peat extraction activities and all ancillary works. Despite having never been subject to peat extraction activities and all ancillary works, Lisclogher West will likely have experienced some topographic decrease associated with drainage and subsidence. Regan et al. (2019) observed continued subsidence of 4-6mm/year of a bog surface due to groundwater drainage, while Grzywna (2017) also recorded a subsidence rate of 6mm in a drained peatland. Applying a subsidence rate of 6mm/year to Lisclogher West, which was drained between 1973 and 1995, over the 32-year period from 1988 to 2020 it can be estimated that the baseline topography of Lisclogher West was ~0.2m higher that its current elevation.

7.3.2.3 Current Topography

The current topography of the Application Site is relatively flat with an elevation range of between approximately 69 and 86mOD (metres above Ordnance Datum). Topography at the site has been modified through the peat extraction activities and all ancillary works and associated drainage works. Today the highest elevations are found at headlands and remnant peat banks which create a boundary berm, forming a basin effect within the former extraction areas of the bogs. These remnant peat banks and headlands provide an approximation (albeit drained and subsided) of the original ground elevations which existed across the Application Site prior to the commencement of any peat extraction activities and all ancillary works.

The Applicant's lidar map for Ballivor Bog (refer to Ballivor Bog 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan included in Appendix 4-2) shows the current topography at Ballivor Bog. Currently the highest elevations at Ballivor Bog are found along its northern and southwestern margins where the topography ranges from ~75-79mOD. Ground elevations in the interior of the bog, which has been subject to historic peat extraction activities and all ancillary works, range from ~69-73mOD.

The Applicant's lidar map for Carranstown Bog (refer to Carranstown Bog 2022 Cutaway Bog Decommissioning and Rehabilitation Plan included in Appendix 4-2) shows the current topography at Carranstown Bog. Currently the highest elevations at Carranstown Bog are found in the west, with maximum elevations ranging from ~68-75mOD. The topography slopes gently to the east, with the lowest elevations recorded in the northeast of Carranstown Bog (~69mOD).

The Applicant's lidar map for Bracklin Bog (refer to Bracklin Bog 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan included in Appendix 4-2) shows the current topography at Bracklin Bog. Currently the highest elevations at Bracklin Bog are located at Bracklin West where ground elevations range from ~71-86mOD. Ground elevations are lower in the east of Bracklin Bog where the topography ranges between ~71-78mOD.

The Applicant's lidar map for Lisclogher Bog (refer to Lisclogher East 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan included in Appendix 4-2) shows the current topography at Lisclogher Bog. Currently the highest elevations at Lisclogher Bog are found along the headlands located at its northern, western and southern margins (~78mOD). The lowest topography is located towards the centre of the bog where elevations range from ~70-72mOD.

The Applicant's lidar map for Lisclogher West (refer to Lisclogher West 2023 Cutaway Bog Decommissioning and Rehabilitation Plan included in Appendix 4-2) shows the current topography at Lisclogher West. Ground elevations at Lisclogher West range from ~74mOD in the southeast to ~82mOD in the northwest.

7.3.3 Land (Land take)

7.3.3.1 Land - Historical Change Summary

The primary change to land during the peat extraction activities and all ancillary works process occurs during the initial drainage of the bog and the removal of vegetation in advance of peat extraction activities and all ancillary works. Drainage ditches drain the upper surface of the bog by lowering the local peat water table (full details on the drainage implemented at the Application Site are provided in Chapter 4). At this time, ancillary features will also be constructed including railway lines, machine passes, canteens, work sites, welfare facilities, mobile fuel tanks, fixed fuel tanks and peat loading facilities. After the site is drained vegetation will be removed from the bog surface, leaving only bare peat fields between the drains. During the operational phase of the peat extraction activities and all ancillary works process only minimal soils/land change occurs and may involve a change in the type of peat extraction activities and all ancillary works *i.e.* sod or milled peat extraction. During peat

extraction activities and all ancillary works minor topographic changes have occurred annually due to the removal of peat from active extraction areas. The peat extraction activity and all ancillary works does also prevent rehabilitation of the underlying peatland.

Land take and any land changes within the Application Site have been investigated using available aerial photographs dating from 1973 to the most recently available photographs (2020). The Applicant's Annual Reports were also consulted to help develop the timeline of changes across the Application Site. The observed changes in land and land take for the individual bogs comprising the Application Site are discussed in the following paragraphs and in Table 7-4 and Table 7-5.

The first drainage and initiation of peat extraction activities and all ancillary works occurred in Ballivor Bog in 1948 and 1953 respectively. At this time Ballivor Bog would have experienced a relatively abrupt land cover change (land take) from raised bog to commercial peat extraction. The earliest available aerial photograph dating from 1973 shows the west of Ballivor Bog to be under sod peat extraction, with an area of remnant bog existing in the east which has already been drained through the use of drainage ditches. An aerial photograph dating from 1995 shows the northeast, east and south of the bog under milled peat extraction. At this time, the west of the bog remained under sod peat extraction. Subsequent aerial photographs from 1995 to present do not record any major land changes at Ballivor Bog with the exception of some revegetation (regrowth) in the southwest of the bog. This indicates that sod peat extraction has ceased for some time in this area. Peat extraction activities and all ancillary works ceased at Ballivor Bog in June 2020.

Carranstown Bog appears as undeveloped bog (with turbary cutting along the northeastern and southeastern edges) in the 1973 aerial photograph. According to the Applicant's Annual Reports drainage and site preparation works at Carranstown Bog predate 1988. However, while drainage was installed in the easter portion of Carranstown prior to 1988, the removal of vegetation occurred at a later date in this area (1988-1995). Peat extraction activities and all ancillary works had been initiated in the western portion of Carranstown bog by 1988, while peat extraction activities and all ancillary works had begun prior to 1995 in the eastern portion of Carranstown bog. According to the Applicant's Cutaway Bog Decommissioning and Rehabilitation Plan for Carranstown Bog (2022) the bog has been used for sod peat in the past but has been developed for milled peat for some time. An aerial photograph dating from 1995 shows Carranstown Bog to be under milled peat extraction. No major land changes are recorded in subsequent aerial photographs with the exception of increased vegetation growth along drainage channels in recent years. Peat extraction activities and all ancillary works ceased at Carranstown Bog in June 2020.

Site preparation works were undertaken in the main area of Bracklin Bog beginning in 1950, with 1957 being the first year of commercial peat extraction at Bracklin. The earliest aerial photographs of Bracklin date from 1973 and show some sod peat extraction in the main bog area with undeveloped bog remaining in the western portion of Bracklin bog. According to the Applicant's Draft Cutaway Bog Decommissioning and Rehabilitation Plan for Bracklin Bog (2024) the main bog area was formerly used for sod peat and was never subject to milled peat extraction. Peat extraction activities and all ancillary activities in the main bog area had ceased by 2000. The western portion of Bracklin bog has been used for milled peat extraction with drainage and ditching preceding 1988, when milled production fields in the southern portion of the bog are identifiable from aerial photographs. However, the northwestern portion of Bracklin bog had been drained but not yet cleared of vegetation by this time. In 2000, signs of vegetation recovery can be identified in the main bog area with sod production ceasing here between 1995 and 2000. The western portion of Bracklin bog remained under milled peat extraction up until June 2020.

The Applicant's records indicate that site preparation works were implemented at Lisclogher Bog in 1950, with 1960 being the first year of commercial peat extraction. The earliest available aerial photograph of Lisclogher Bog, dating from 1973, shows that the bog was already under sod peat extraction at this time. Milled peat extraction activities and all ancillary works was ceased at Lisclogher Bog in March 2003, while third party sod peat extraction continued in the northeast of the bog until

2020. The most recent aerial photographs (2000-2020) show that Lisclogher Bog has begun to become recolonised with vegetation.

The earliest available photograph, dating from 1973, shows Lisclogher-West as undeveloped bog, with some minor turbary cutting along the bog edges. Based on aerial photographs Lisclogher West was drained at some time between 1973 and 1995. However, this bog was never subject to peat extraction activities and all ancillary works. The absence of peat extraction activities and all ancillary works has meant that Lisclogher-West has retained many of its natural raised bog features, although there has been significant degradation, and the remnant bog is relatively dry with deep field drains. No land changes will have occurred at Lisclogher Bog since the site preparation works (1973 – 1995).

Table 7-4: First Drainage and First Production Years of the Ballivor Bog Group

Bog Name	Bog Area (ha)	Commencement of Site Preparation works (removal of vegetation and drainage insertion)	Extraction Began
Ballivor	638	1948 - 1953	1953
Carranstown	304	West: 1974 – 1987 East: Drainage between 1974 – 1987; clearance postdating 1989–1995	West: Prior to 1988 (western side) East: By1995
Bracklin	772	Main Bracklin Bog Area: 1950 Bracklin West: drained prior to 1988, vegetation clearance in southern portion only by 1988	Main Bracklin Bog Area: 1959 Between 1989 and 1995 at northern portion of Bracklin West By 1988* at southern portion of Bracklin West
Lisclogher	479	1950	1960
Lisclogher West	238	Minor works commenced in 1973 Main Drainage installed between 1973 and 1988 Drainage was complete post 1988*	N/A

**Land - indicated by aerial photography*

7.3.3.2 Pre-Extraction

It is assumed that prior to the onset of drainage and peat extraction activities and all ancillary works that the Application Site was predominantly comprised of undeveloped raised bog with probable minor turbary cutting along bog edges.

Table 7-6 below details the land/land cover use changes over the Peat Extraction Phase, Current Phase, and Remedial Phase.

Table 7-5: Land / Landcover change through time

Bog Name	Pre-Extraction Land	1973	1988 (Baseline)	1995	2000	2000-2020
Ballivor	High raised bog, with likely minor turbary cutting along bog edges	Area of sod peat extraction in the west Remnant bog in the northeast which shows some ditching for milled peat extraction	Sod and milled peat extraction	Milled peat extraction in the northeast, east and south Sod peat extraction in the centre and west	No change Same as in 1995	No change Same as in 1995
Carranstown	High raised bog, with likely minor turbary cutting along bog edges	Remnant bog, with turbary cutting along northeast and southeast bog edges	Milled peat extraction in the west Remnant bog in the east, drainage already inserted for milled extraction, no vegetation clearance yet	Milled peat extraction	No change, same as 1995	Drainage channels appear to have become overgrown with vegetation Significant growth of forestry around bog perimeter through same period.
Bracklin	High raised bog, with likely minor turbary cutting along bog edges	Sod peat extraction Bracklin West is remnant bog with some ditches for milling identifiable	Predominantly sod peat extraction Southern portion of Bracklin West in milled peat extraction Northern portion of Bracklin West drainage already inserted for milled peat extraction. No vegetation clearance yet	Peat extraction activities and all ancillary works has ceased across the majority of the bog Bracklin West (north and south) is under milled peat extraction	Signs of vegetation recovery across some of the bog Bracklin West remains in milled peat extraction	Drainage channels appear to have become overgrown with vegetation Significant growth of forestry around bog perimeter through same period. Bracklin West remains in milled peat extraction
Lisclogher	High raised bog, with likely minor turbary cutting along bog edges	Sod peat extraction Some areas of remnant raised bog in the north	Sod peat extraction	Sod and milled peat extraction fields	Milled peat extraction fields Signs of vegetation recovery	Drainage channels appear to have become overgrown with vegetation

Bog Name	Pre-Extraction Land	1973	1988 (Baseline)	1995	2000	2000-2020
Lisclogher West	High raised bog, with likely minor turbary cutting along bog edges	Remnant bog, with turbary cutting along bog edges	Remnant bog	Some drainage for milled peat extraction Vegetation still present	No change Same as in 1995	No change Same as in 1995

7.3.3.3 Land - 1988 Baseline

As described in Chapter 4, by 1988 the landuse and landcover at the Application Site was well established as being industrial peat extraction activities and all ancillary works. At this point in time, 4 no. bogs (Ballivor, Bracklin, Carranstown and Lisclogher) had been drained to facilitate peat extraction activities and all ancillary works, with both milled and sod peat extraction being established in these bogs. Furthermore, railway infrastructure was present across these 4 no. bogs to allow for the movement of materials across the Application Site. In contrast, Lisclogher-West had not been fully drained by 1988 and remained as raised bog.

The main entrance to the Application Site at this time was located north and south off the Ballivor – Raharney (R156) road. The Ballivor Works depot, located in the north of Ballivor Bog, and outside of the Application Site boundary, was also present at this time comprising a peat processing plant, canteen, storage sheds and maintenance buildings.

The following paragraphs provide further detail on the baseline (1988) land / landcover at the Application Site.

Satellite imagery and Annual Reports provided by the Applicant indicate that by 1988, Ballivor Bog was undergoing sod and milled peat extraction. The rail infrastructure required for the peat extraction activities and all ancillary works was already in situ, having been laid on Ballivor Bog during the 1950s. The railway line extended from the Ballivor Works (the Works), located in the north of the bog, southwards into the bog interior. The Works comprised several peat processing buildings, canteen and welfare facilities, waste storage areas, carparking facilities and a refuelling area. At this point, Ballivor Bog had already been drained and the Applicant's Annual Reports note that 2 no. pumps were in operation at this time. The bog included 7 no. artificial silt ponds, and 7 no. surface water emission points which remain today. Therefore, the main landcover type at Ballivor Bog in 1988 was cutover peat with several small areas of remnant uncut bog remained along edges of the bog.

Meanwhile, the majority of peat extraction activities and all ancillary works had ceased in Bracklin Bog by 1988 with the exception of milled peat extraction in the southwestern portion (refer to Chapter 4). At this time the rail infrastructure and drainage required for peat extraction activities and all ancillary works would already have been in place during the 1950s and 1960s. The bog included 6 no. artificial silt ponds, and 5 no. surface water emission points which remain today. Landcover at this time in Bracklin Bog would have comprised largely of bare peat fields with some areas of remnant uncut bog around the edges of the bog. Meanwhile the northern section of Bracklin West was yet to be cleared of vegetation.

Aerial imagery from 1988 indicates that drainage and extraction for milled peat was underway in the western portion of Carranstown Bog. At this time Carranstown Bog was linked to Ballivor Bog to the south and Bracklin Bog to the north via railway infrastructure. The western portion of Carranstown Bog included 5 no. artificial silt ponds, and 4 no. surface water emission point. While drainage has been inserted into all of Carranstown Bog by 1988, vegetation clearance had yet to be undertaken in the eastern portion of Carranstown.

By 1988, the centre of Lisclogher Bog has been drained and sod peat extraction was underway. The extremities of the bogs were not subject to peat extraction activities and all ancillary works and comprised mainly remnant bog, wet flush areas, and bog woodland. A section of birch woodland was located at the southern end of the bog, located in a small valley between two sections of remnant bog. Railway infrastructure was *insitu*, connecting the bog to Bracklin to the west, across a local road.

In accordance with aerial imagery, some drainage had been inserted at Lisclogher West by 1973, and thus 1988. However, in order to assess a precautionary scenario associated with the Project, it is assumed that drainage was inserted in Lisclogher West from 1988 onwards. No large scale peat extraction was taking place at Lisclogher West. Therefore, the bog landcover in 1988 comprised

mainly natural raised bog with raised bog features such as raised bog, conifer plantation, birch woodland, mixed broadleaf, scrub, poor fen and flush areas particularly at the bog borders. As the bog was not brought into peat extraction it is assumed that the existing topography is representative of the topography in 1988.

7.3.3.4 Land – Current Condition

Corine land cover maps (2018) show that the Application Site is located predominantly on peat bogs, with some areas of transitional woodland scrub, agricultural pastures, and broad leaved mixed forests along its margins. The present day landuse and land cover surrounding the Application Site comprises primarily of agricultural lands with small areas of woodland and coniferous forestry. A scattered pattern of rural dwellings and farmhouses are located along the local road network which surrounds the Application Site. Corine (2018) map land cover in the wider area as predominantly agricultural pastures with some pockets of non-irrigated arable land. The closest mapped urban centres are the villages of Ballivor to the east and Raharney to the west. Corine also map a mineral extraction site to the southwest of Ballivor Bog in the townland of Riverdale.

The following paragraphs discuss the current land cover at each of the 5 no. bogs comprising the Application Site.

Ballivor Bog has a total area of 638ha and had an area of 473ha which was subject to peat extraction activities and all ancillary works until June 2020. Therefore, following the cessation of peat extraction activities and all ancillary works, the landuse/land cover in this former extraction area (~473ha) changed from peat extraction activities and all ancillary works to areas of bare peat which are available for re-vegetation. The surface of Ballivor Bog is currently drained by a series of northwest-southeast orientated drains spaced at approximately 15m intervals. Railway infrastructure was laid in the bog (since the 1950s), terminating at the Works building located in the north of Ballivor Bog, just off the Ballivor-Raharney (R156) road. The Works area housed several peat processing buildings, canteen and welfare facilities, waste storage areas, carparking facilities and a refuelling area. The Applicant's current habitat map (refer to Ballivor Bog 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan included in Appendix 4-2) shows the existing land cover at Ballivor. Much of the centre and northeast of the bog is characterized by areas of bare peat. The lack of vegetation in these areas indicates that they were the most recent areas of Ballivor Bog from which peat was being extracted i.e. there has not been enough time for vegetation to colonise these areas post extraction. Meanwhile, areas in the northwest and southwest of Ballivor Bog contain a mosaic of heath, heath and scrub and pioneer open cutaway habitats. Maps of the Applicant's historic peat extraction activities and all ancillary works areas (refer to Section 4.4 in Chapter 4 of the rEIAR) show that extraction ceased in these areas of Ballivor around 1988. Therefore given the time which has elapsed since peat extraction activities and all ancillary works was ongoing, vegetation has had time to re-establish itself in these areas. Ballivor Bog is fringed by cutaway and cutover bog in the northeast and remnant bog with some areas of "birch woodland" in the southwest.

Carranstown Bog has a total area of 304ha and had a peat extraction activity and all ancillary works area of 80ha which was subject to peat extraction activities and all ancillary works until June 2020. A total of 117 hectares were drained but not subject to peat extraction activities and all ancillary works. Therefore, following the cessation of peat extraction activities and all ancillary works, the landuse/land cover in this former extraction area (~80ha) changed from peat extraction activities and all ancillary works areas to areas of bare peat which are available for re-vegetation. Carranstown is currently drained by a series of northwest-southeast orientated drains. A railway line dissects the Application Site from the R156 in the south in a north-westerly direction, joining Carranstown to Bracklin Bog to the north. The Applicant's current habitat map for Carranstown Bog (refer to Carranstown Bog 2022 Cutaway Bog Decommissioning and Rehabilitation Plan included in Appendix 4-2) shows that much of the bog comprises of bare peat fields. Note that approximately three quarters of the bog was in milled peat extraction up to June 2020 and there has not been enough time for vegetation to colonise these areas post extraction. Meanwhile, to the east and west there are areas of heath, heath and scrub, and woodland.

Bracklin Bog has a total area of 772ha and had a peat extraction activities and all ancillary works area of 351ha which was subject to peat extraction activities and all ancillary works until 2003. Recent production was concentrated in a small section in the west of the bog, referred to as Bracklin West. Therefore, following the cessation of peat extraction activities and all ancillary works, the landuse/land cover in Bracklin West changed from peat extraction activities and all ancillary works areas to areas of bare peat which are available for re-vegetation. The bog is drained by a series of northeast-southwest orientated drains. Bracklin Bog is served by a railway line which extends to the north and west across Bracklin Bog. The Applicant's current habitat map for Bracklin (refer to Bracklin Bog 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan included in Appendix 4-2) shows that much of the main bog area currently comprises of a mosaic of heath, scrub, woodland, and pioneer open cutaway habitats. Maps of the Applicant's historic peat extraction activities and all ancillary works areas (refer to Section 4.4 in Chapter 4 of the rEIAR) show that extraction ceased in this main area of Bracklin prior to 2004. Therefore, given the time which has elapsed since extraction, vegetation has had time to re-establish itself in these areas. The western area of Bracklin currently comprises of bare peat fields, indicative of the recent peat extraction activities and all ancillary works in this area of the Application Site. Meanwhile, the south of Bracklin Bog contains some areas of birch woodland with areas of remnant high bog recorded along the northern margins of Bracklin Bog.

Lisclogher Bog has a total area of 479ha and sod peat extraction was underway across 378 hectares of the bog. While third party peat extraction activities and all ancillary works was ongoing in the northeast of the bog until 2020, milled peat extraction had ceased there in March 2003. Lisclogher is drained by a series of east-west orientated drains. The Applicant's 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan for Lisclogher East Bog (refer to Appendix 4-2) states that the drainage system is beginning to break down with many drains becoming blocked and filling with water. A railway line extends from Bracklin Bog to the south into the interior of Lisclogher Bog. The Applicant's current habitat map for Lisclogher shows that much of the bog is comprises a mosaic of pioneer open cutaway habitats, scrub and heath habitats. Vegetation has had time to recolonise much of Lisclogher, with the maps of the Bord na Móna historic peat extraction activities and all ancillary works areas showing that extraction ceased across much of Lisclogher by 2003. Some fingers of bare peat extend from the railway line to the east and west. These bare peat areas represent the former third party and private peat cutting which was facilitated on Lisclogher Bog up until 2020.

Lisclogher West has a total area of 228ha. Drainage infrastructure was installed in Lisclogher West Bog during 1988 and subsequent years across an area of approximately 22ha, as deduced from available aerial imagery. Lisclogher West was never subject to peat extraction. The existing remnant bog is relatively dry due to the presence of a series of northwest-southeast orientated drains. No railway line or production centres are present within Lisclogher West. The Applicant's current habitat map for Lisclogher West (refer to Lisclogher West 2023 Cutaway Bog Decommissioning and Rehabilitation Plan included in Appendix 4-2) shows that majority of the site is classified as containing bog habitats, fringed to the north and south by woodland.

7.3.4 Peat/Soils and Subsoils

7.3.4.1 Current Environment

The published soils map (www.epa.ie) for the area shows that cutover/cutaway peat is mapped exclusively over the Application Site. Please note that this map is a predictive map whereby key soil forming factors vegetation and topography are mapped and a set of rules applies to these datasets to predict the soils that may occur at any given location. Therefore, while the soil map shows cutover peat at Lisclogher West, we know from inspection of Annual Bord na Móna and site walkovers that this area of the Application Site has not been cut (i.e. not subject to peat extraction).

Soils in the surrounding lands are predominantly basic deep well drained mineral soils (BminDW) with smaller areas of basic deep poorly drained mineral soils (BminPD), poorly drained soils with a peaty

topsoil (BminPDPT) and basic shallow well drained soils (BminSW). Mineral alluvium (AlluvMin) is found along local watercourses surrounding the Application Site.

The published subsoils map (www.gsi.ie) shows cut over raised peat (Cut) underlies the Application Site (however as described above Lisclogher West has not been subject to peat extraction). Other subsoil types mapped in the wider area include Glacial Tills derived from Limestone (TLs) and Gravels derived from Limestone (GLs). An area of Till derived from cherts (TCh) is mapped to the southeast of Lisclogher Bog.

A summary of the soils and subsoils in each bog are included in Table 7-6. A map of the local subsoil cover is attached as Figure 7-1.

Table 7-6: Summary of soils and subsoils at the Application Site

Bog Name	Soils	Subsoils
Ballivor	Cutover peat surrounded by basic deep well drained mineral soils with localised pockets of basic deep poorly drained mineral soils, basic shallow poorly drained mineral soils and lacustrine deposits. Mineral alluvium occurs along nearby watercourses. An area of made ground is recorded in the north of the bog in the vicinity of the Bord na Móna works depot.	Cutover peat surrounded by Till derived from limestones, Alluvium along streams/rivers. Some Gravels derived from limestones are located to the southeast and southwest but are remote from bog boundaries.
Carranstown	Cutover peat surrounded by deep well drained mineral soils with localised pockets of basic deep poorly drained mineral soils and poorly drained soils with a peaty topsoil. Mineral alluvium is found along nearby watercourses.	Cutover peat surrounded by Tills derived from limestones and Alluvial deposits along streams/rivers.
Bracklin	Cutover peat surrounded by deep well drained mineral soils with localised pockets of basic deep poorly drained mineral soils and poorly drained soils with a peaty topsoil. An area of shallow well drained soils is mapped to the south of the bog. Mineral alluvium occurs along nearby watercourses.	Cutover peat surrounded by Tills derived from limestones, Alluvium along streams/rivers and some local limestone derived Gravels to the southwest. Some Till derived from chert is mapped to the east but remote from the bog boundary.
Lisclogher	Cutover peat surrounded by deep well drained mineral soils with localised pockets of basic deep poorly drained mineral soils, poorly drained soils with a peaty topsoil. An area of shallow well drained soils are mapped to the north and acid poorly drained soils to the southeast. Mineral alluvium occurs along nearby watercourses.	Cutover peat surrounded by limestone derived Till to the north and east. Alluvium deposits along streams/rivers. Local Gravels to the north and Till derived from Cherts to the southeast.
Lisclogher West	Peat (uncut) surrounded by deep well drained mineral soils with localised pockets of poorly drained soils with a peaty topsoil. Mineral alluvium occurs along nearby watercourses.	Peat (uncut) surrounded by limestone derived Tills with localised Gravel deposits to the south.

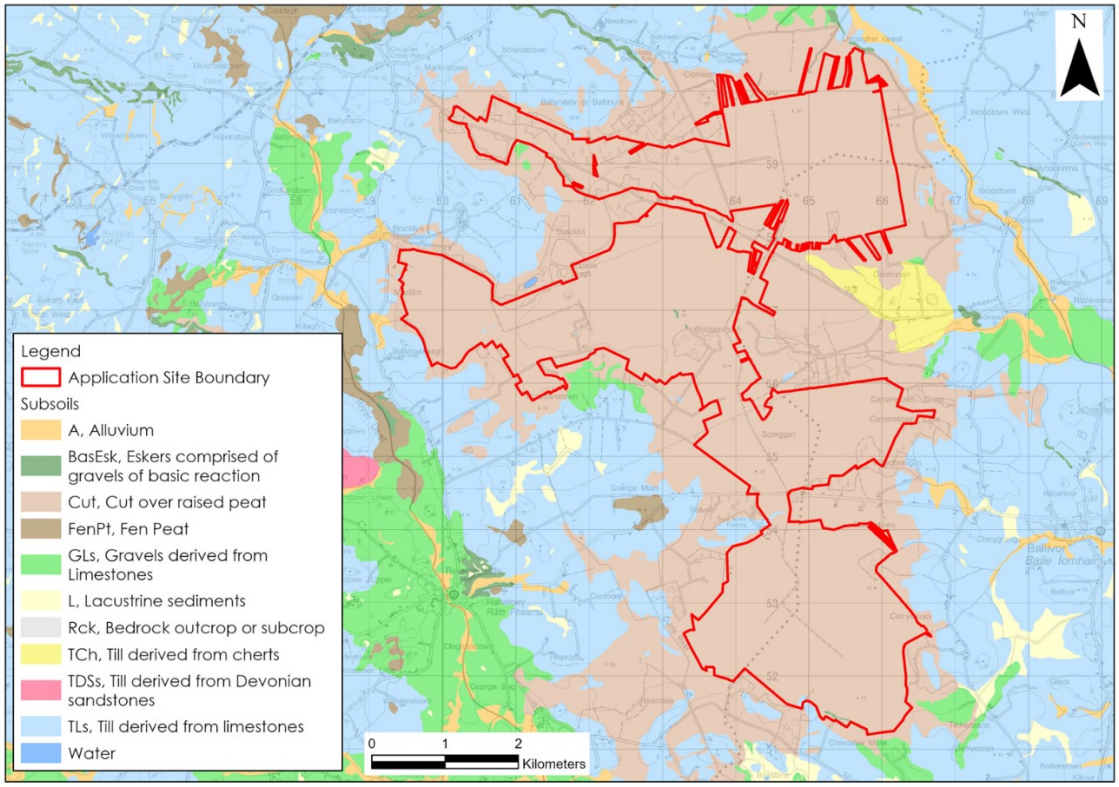

Figure 7-1: Local subsoils map

The soils and subsoils present at the Application Site have been verified during site walkover surveys and during intrusive site investigations completed as part of site investigations for the proposed Ballivor Wind Farm.

The presence of subsoil peat on-site has been confirmed by peat probing investigations conducted by HES in September 2020 and March 2021. Peat depth probing has also been completed by FT and MKO, and the entire dataset (457 no. peat probes) is discussed here.

Peat depth intervals recorded across the Application Site are shown on the bar chart presented as Figure 7-2. Overall peat depths ranged from 0.4 to 5.7m with an average of 1.93m (n= 457, σ = 0.96m). The subsoils encountered typically comprised of clay, sandy or gravelly mineral soils. Peat depth information for the individual bogs comprising the site is summarised in

Table 7-7. Peat depths at all site investigation points (HES, FT and MKO) in Ballivor Bog ranged from 0.4 – 5.0m with an average of 1.95m. Further north the peat depths in Carranstown ranged from 0.5 – 3.4m with an average of 1.55m. Peat depths ranged from 0.49 – 5.7m in Bracklin with an average peat depth of 2.07m. Peat depths in Lisclogher Bog ranged from 0.53 – 5.5m with an average peat depth of 1.95m. No peat probing investigations were conducted in Lisclogher West as no peat extraction was carried out in this area of the Application Site. Recorded peat depths across the Application Site is provided in Figure 7-3 below.

Table 7-7: Summary peat depths across the Application Site (HES, FT and MKO)

Bog Name	No. Peat Probes	Range (m)	Average (m)	Summary Subsoil Lithology
Ballivor	186	0.4 – 5.0	1.95	Clay or gravelly mineral soil
Carranstown	63	0.5 – 3.4	1.55	Clay or gravelly mineral soil

Bog Name	No. Peat Probes	Range (m)	Average (m)	Summary Subsoil Lithology
Bracklin	123	0.49 – 5.7	2.07	Sandy/gravelly mineral soil
Lisclogher	85	0.53 – 5.5	1.95	Sandy/gravelly mineral soil
Lisclogher West	-	-	-	-

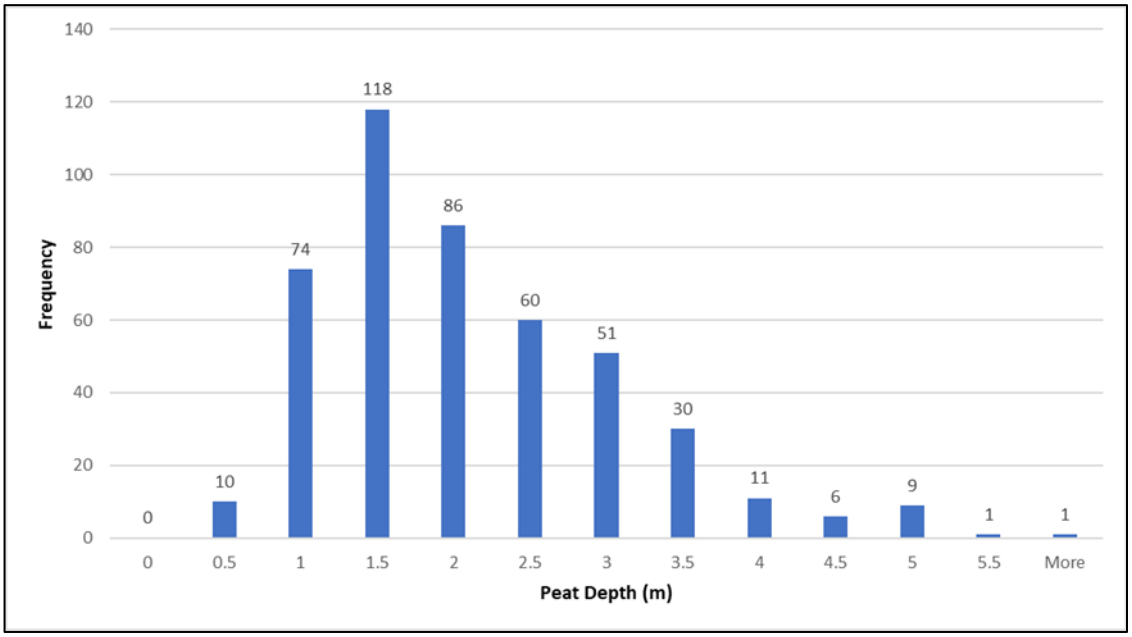

Figure 7-2: Residual Peat Depths at the Ballivor Bog Group (excluding Lisclogher West) (HES, FT and MKO peat probes))

Additionally, the Applicant has conducted peat probing investigations as part of the ecological reporting which formed the basis of the Cutaway Bog Decommissioning and Rehabilitation Plans (refer to Appendix 4-2). The surveying was completed over the time period from 2010 to 2016. The Cutaway Bog Decommissioning and Rehabilitation Plans include peat depth maps for each of the bogs within the Application Site. The ecological survey report for both Ballivor and Carranstown bogs state that peat depths are predominantly in excess of 2.6m (Note that the report for Ballivor Bog states that only one third of the bog was surveyed). The ecological survey notes that the surface of Carranstown is covered in red or Sphagnum peat. Meanwhile the report for Bracklin states that the main peat type left is an acidic red peat with mixed gravel till exposed at several places. No additional information is supplied in the ecological reports for Lisclogher East or Lisclogher West.

A total of 102 no. trial pits have been completed across the Application Site as part of the site investigations for the proposed Ballivor Wind Farm (trial pit and boreholes investigations were carried out by FT and Irish Drilling Ltd (IDL) on 17th – 21st August 2020, 1st-16th February 2021, 19th July 2021 and 5th-11th August 2021; In addition, Bord na Móna undertook trial pitting on the 18th – 19th March 2021). Trial pit depths extended to a maximum of 6mbgl (metres below ground level). Peat was encountered in all trial pits (with the exception of those completed in the south of Bracklin Bog) with peat depths ranging from 0.1 to 4.9mbgl. Ground conditions generally consisted of peat overlying glacial tills comprising of slightly sandy gravelly silt/clay and/or silty sands and gravels with come cobbles and boulders. Trial pit logs are included in Appendix 7-1.

A total of 16 no. cable percussion boreholes and 5 no. rotary coreholes were also completed as part of the site investigations for the proposed Ballivor Wind Farm. Borehole depths ranged from 1.70 to

11mbgl. Ground conditions generally comprised of peat overlying glacial till overlying possible bedrock. Summary data for the boreholes are included in Appendix 7-2.

All site investigation locations (TPs, BHs and RCs) are shown on Figure 7-4 to Figure 7-6.

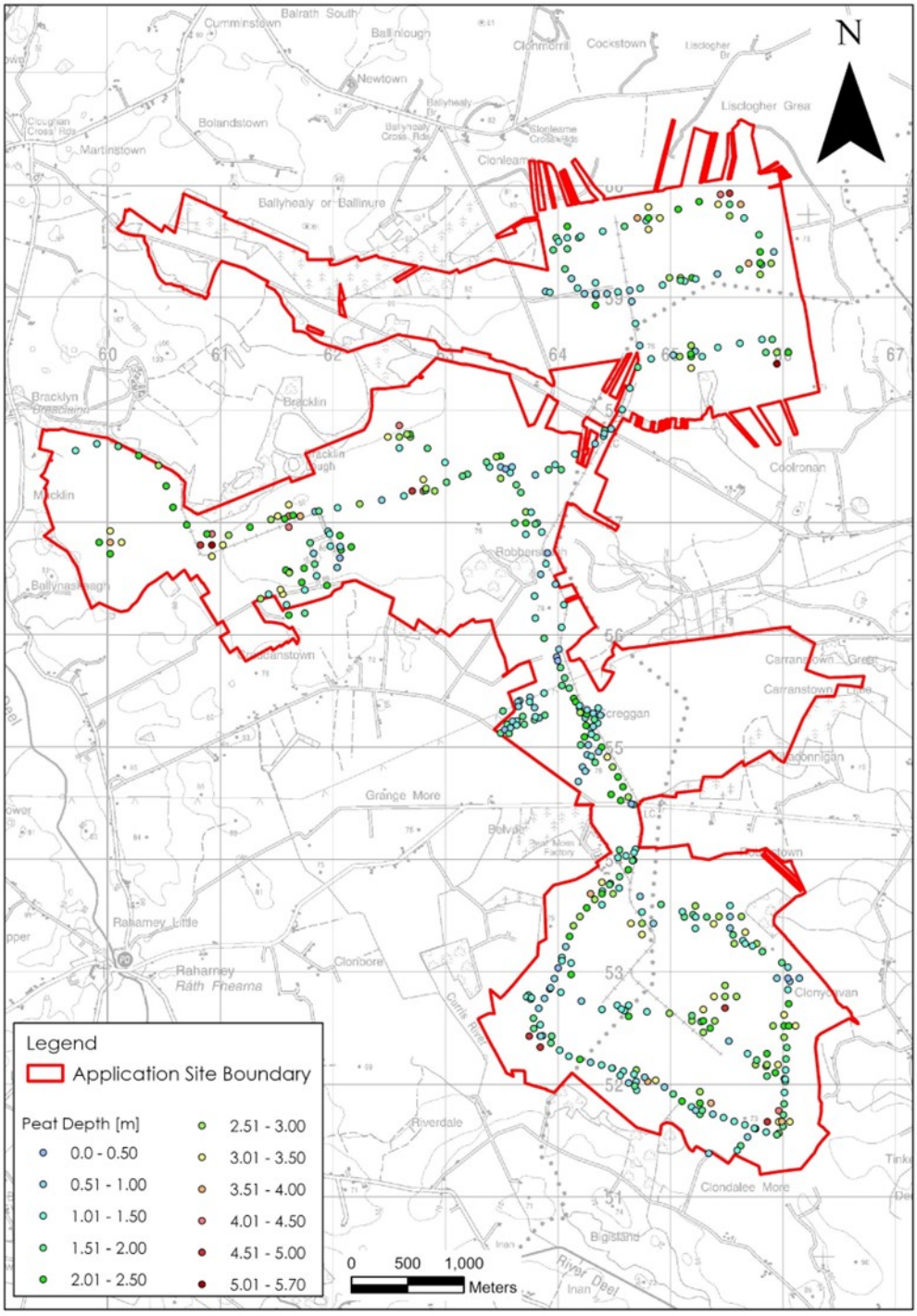

Figure 7-3: Recorded peat depths across the Application Site (HES, FT and MKO peat probes)

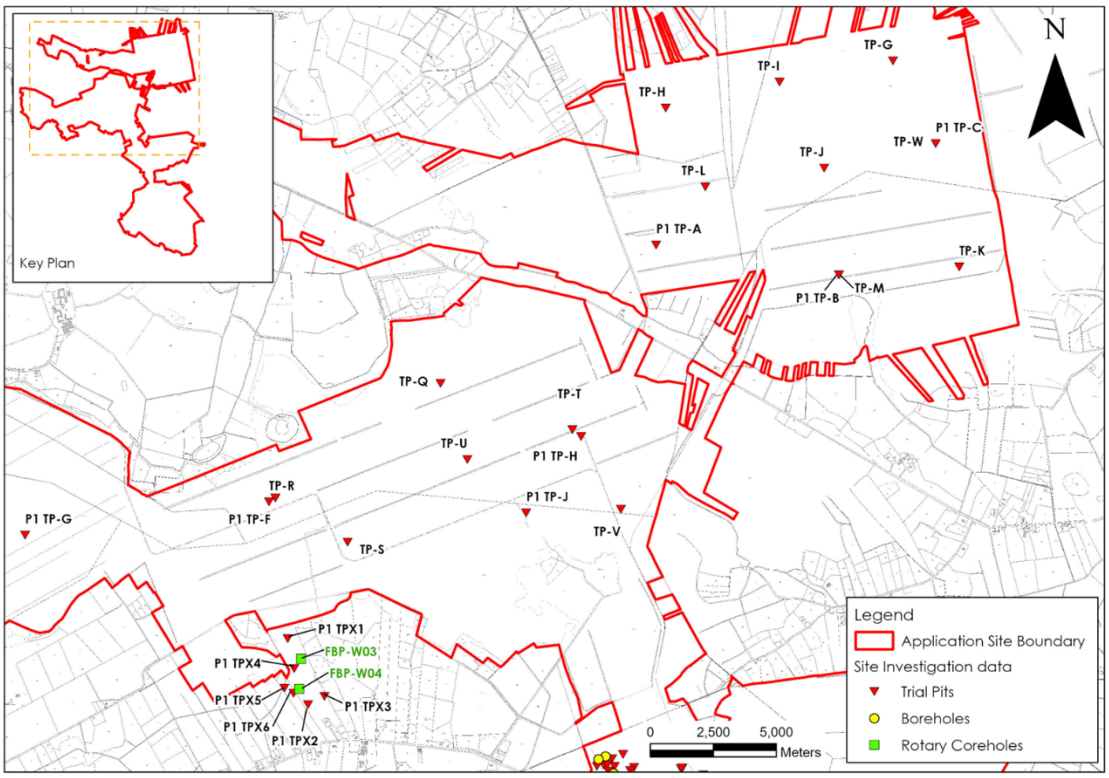

Figure 7-4: Site Investigation Locations (Trial Pits and Boreholes) in Bracklin and Lisclogher Bogs

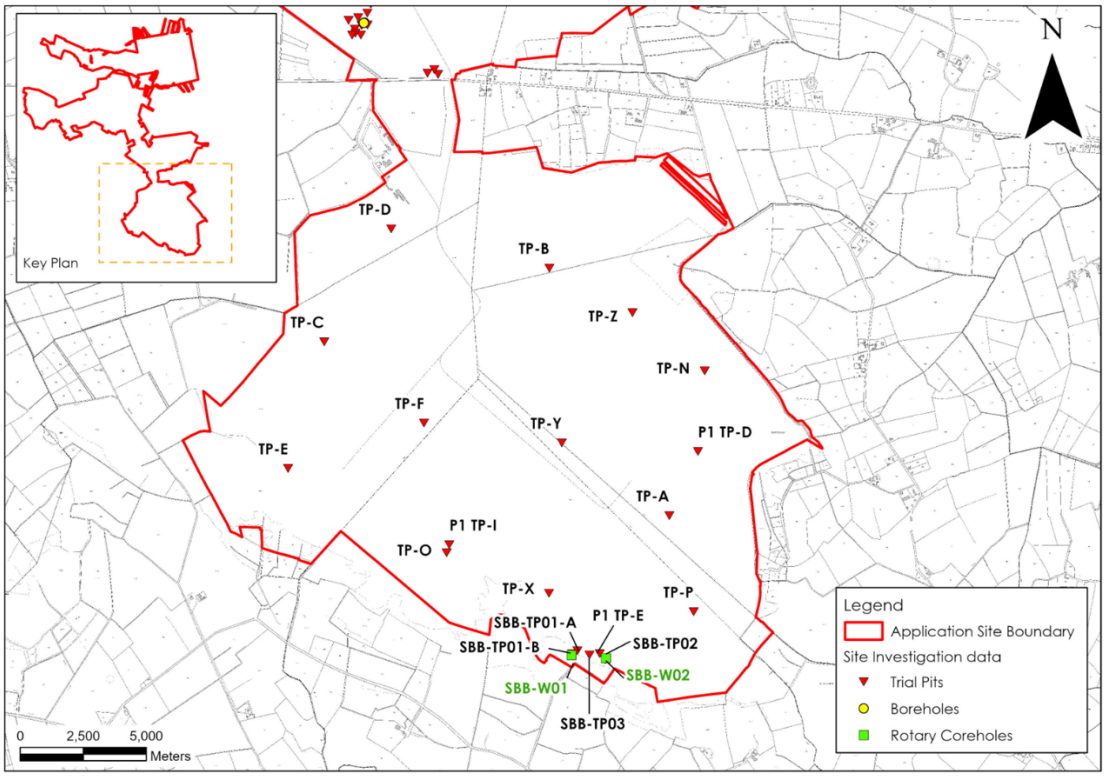

Figure 7-5: Site Investigation Locations (Trial Pits and Boreholes) in Ballivor Bog

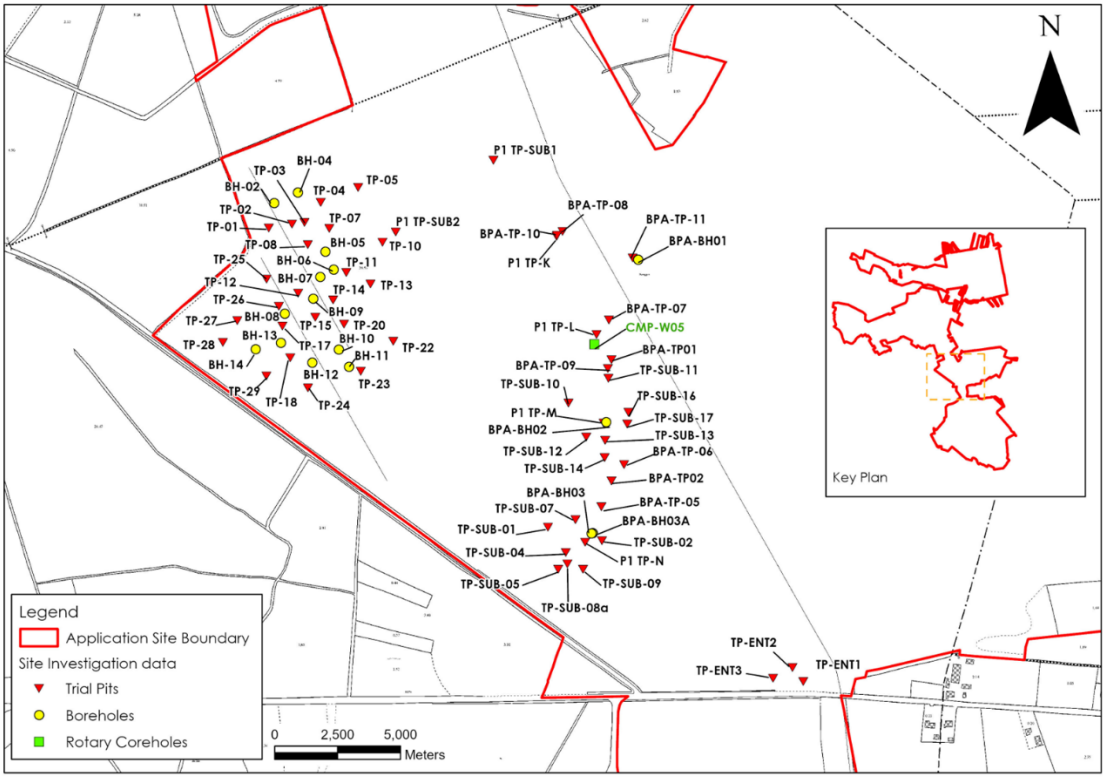

Figure 7-6: Site Investigation Locations (Trial Pits and Boreholes) in Carranstown Bog

7.3.4.2 Peat Extraction

Ballivor Bog was the first bog at the Application Site from which peat was extracted, with peat harvesting commencing in 1953. Peat extraction activities and all ancillary works commenced at the remaining bogs, with the exception of Lisclogher West, at various times and at various scales over the following decades as outlined in Section 7.3.3.1. Peat extraction activities and all ancillary works formally ended at the Application Site in the summer of 2020.

Annual sales figures and volumes of peat tonnage extracted have been provided by Bord na Móna for the period 1953 to June 2020 (Section 4.3.3 in Chapter 4) and July 1988 to June 2020 (Section 4.5.1.1 in Chapter 4).

The volumes of peat removed from the Application Site varied from year to year with a general and gradual increase (but weather dependent as seen by the fluctuations) with time as more of the Application Site became available for peat extraction activities and all ancillary works. As seen in Figure 7-7, peak peat extraction activities and all ancillary works occurred from the mid-1980s to the early 2000s. According to the Applicant's records the total volume of peat extracted from the Application Site during the Peat Extraction Phase was 4,027,213 tonnes. The greatest volume of peat produced in any given year was 117,755 tonnes, removed in 1989.

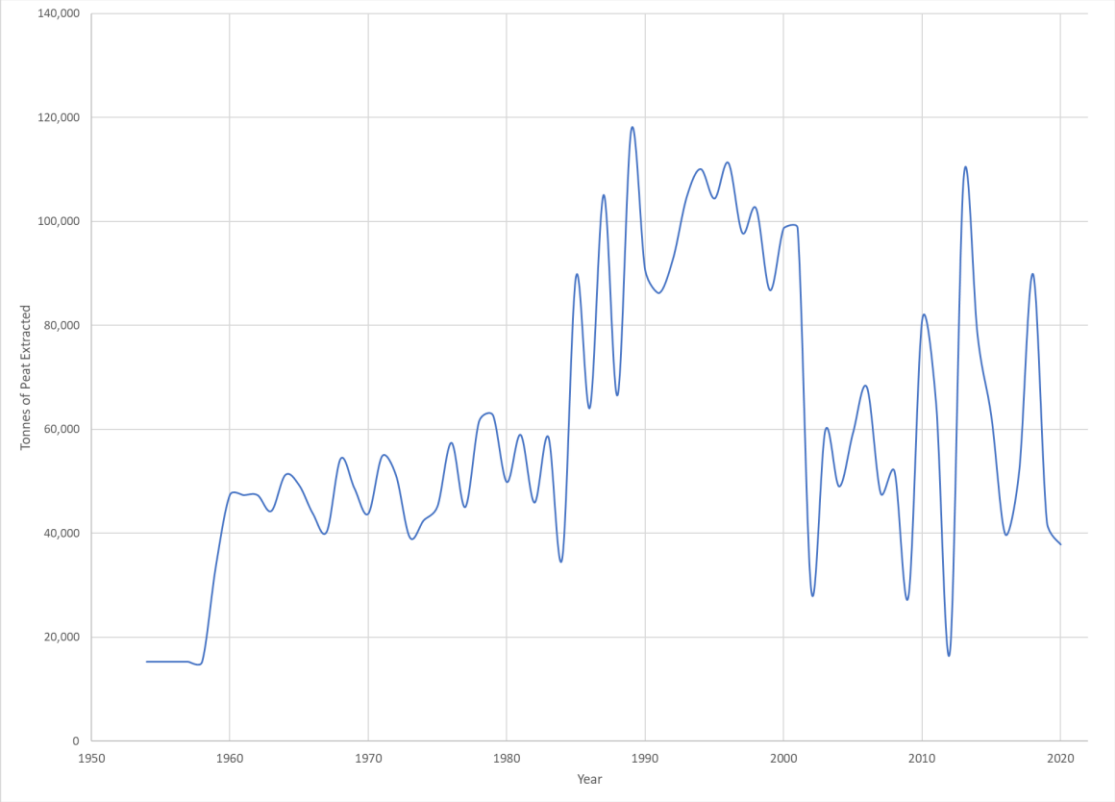

Figure 7-7: Peat Volume (tonnes) extracted from the Application Site (1954 – 2020)

7.3.4.2.1 Peat Extraction 1953-June 1988

Bord na Móna records indicate that approx. 1,626,398 tonnes (sod and milled) were extracted from the Ballivor Bog Group for the period 1953 – June 1988 inclusive. Peat extraction volumes are not available for 1953. On the basis that peat extraction activities and all ancillary works only commenced at the Application Site in 1953, it is assumed that the volumes generated were not significant and not comparable to the volumes generated in subsequent years.

Ballivor Bog was the only bog from which peat was being extracted up until 1957 when peat extraction activities and all ancillary works was initiated at Bracklin Bog. Lisclogher Bog followed quickly, with peat extraction activities and all ancillary works commencing in 1960.

Based on figures supplied by the Applicant relating to peat tonnage extracted (1953 – June 1988), Table 7-8 presents a summary of the weight of peat extracted (in tonnes), calculated volumes of peat extracted and an estimate of the overall removed depth of peat. A bulk estimate of 1.2 m^3/tonne was used to calculate volumes of peat removed.

During this time period (1953 to June 1988) ~1,951,677m^3 of peat was removed. The peat milling process involves the top 10-15mm of the peat extraction field surface being removed during any given harvests. In a typical year, a total of 12 no. harvests (weather dependent) would be completed, which would equate to 12 – 18cm of peat being removed each year. When this is applied to the 34-year period from 1953 – June 1988, it can be estimated that ~3.9 – 5.9m of peat was removed from any production field which was utilised throughout this period. However, it is unlikely that certain fields were utilised throughout this period and therefore the depth of peat removed is likely to be less than 4m.

Table 7-8: Peat Extraction Volumes from 1954 to 1987

Peat Extraction (First Year of Extraction)	Peat Weight 1954 - -1987 (Tonnes)	~Peat Volume (m^3)
Ballivor (1953) Bracklin (1957) Lisclogher (1960) Carranstown west (some date preceding 1988) Lisclogher West (extraction never commenced)	1,626,398	1,951,677

7.3.4.2.2 Peat Extraction July 1988 – June 2020

Bord na Móna records indicate that approx. 2,400,815 tonnes (sod and milled) were extracted from the Ballivor Bog Group for the period July 1988- June 2020 inclusive.

As outlined in Chapter 4 and Section 7.3.3.1, Ballivor Bog remained in production until 2020. Sod peat extraction ceased at Bracklin Bog in 2003; however, Bracklin West has been used for milled peat extraction from around 1995 until 2020. In the west of Carranstown Bog, the first peat extraction activities and all ancillary works had been initiated by 1988, while peat extraction had begun prior to 1995 in the eastern portion and continued until 2020. Milled peat extraction continued at Lisclogher until 2003.

Based on figures supplied by Bord na Móna relating to peat tonnage extracted (July 1988 – June 2020), Table 7-9 presents a summary of the weight of peat extracted (in tonnes), calculated volumes of peat extracted and an estimate of the overall removed depth of peat. A bulk estimate of 1.2 m^3/tonne was used to calculate volumes of peat removed.

During this time period, the greatest volume of peat removed in any given year occurred in 1989 when ~141,306m^3 of peat was removed.

As stated above, in a typical year with suitable weather conditions, ~12 – 18cm of peat would be removed during milled peat extraction. When this is applied to the 32-year period from July 1988 – June 2020, it can be estimated that ~3.8 – 5.7m of peat was removed from any production field which was utilised throughout this period. However, it is unlikely that certain fields were utilised throughout this period and therefore the depth of peat removed is likely to be less than 4m.

Table 7-9: Peat Extraction Volumes from 1988 to 2020

Peat Extraction Bogs (Years)	Peat Weight July 1988 – June 2020 (Tonnes)	~Peat Volume (m^3)
Ballivor (1988 - 2020) Bracklin (1988 – 1990s Bracklin West (~1995 – 2020)) Lisclogher (1988 - ~2000) Carranstown (1988 - 2020)	2,400,815	2,880,975

7.3.5 Bedrock Geology

The GSI map the bedrock underlying the Application Site to be Dinantian Pure Unbedded Limestones (DPUL) of the Waulsortian Limestone Formation, Dinantian Upper Impure Limestones (DUIL) of the Tober Colleen Formation and the Lucan Formation and Dinantian Lower Impure Limestones (DLIL) of the Ballysteen Formation.

The Waulsortian Limestone Formation underlies the vast majority of Ballivor Bog, all of Carranstown Bog, the southern section of Bracklin Bog and the east of Lisclogher Bog and the west of Lisclogher West. The Waulsortian Limestone Formation comprises massive, unbedded lime mudstones and are dominantly pale-grey in colour. The Tober Colleen Formation underlies the central area of Bracklin Bog and section in the centre of Lisclogher Bog and in the west of Lisclogher West. the Tober Colleen formation is described by the GSI as dark-grey, calcareous, commonly bioturbated mudstones and subordinate thin micritic limestones. The Lucan Formation underlies an area to the southwest of Ballivor Bog, and the east of Lisclogher West and the west of Lisclogher Bog. The Lucan Formation is noted to comprise of dark limestones and shales. The Ballysteen Formation underlies the western portion of Bracklin Bog and is comprised of irregularly bedded and nodular bedded argillaceous bioclastic limestones, interbedded with fossiliferous calcareous shales.

The Application Site is crosscut by several northeast – southwest orientated faults. 2 no. faults of this orientation are mapped to underlie Ballivor Bog with a third mapped in the southeast of Carranstown Bog. A large fault of similar orientation is also mapped to cut across Lisclogher and Bracklin bogs. This fault is in turn crosscut by a later north/northwest to south/southeast orientated fault which underlies the west of Bracklin Bog and the western section of Lisclogher West.

There is no record on GSI mapping of any bedrock outcrop within the Application Site or in the surrounding lands.

No bedrock was encountered in any of the trial pits completed at the Application Site which extended to a maximum depth of 4.9mbgl. The 16 no. cable percussion boreholes and 5 no. rotary coreholes extended to depths ranging from 1.7 to 11mbgl and were terminated due to obstruction (possibly due to bedrock or large boulders in the underlying glacial till) (Appendix 7-II). Depth to bedrock at the Application Site is expected to be in excess of 5m across the site due to the thickness of subsoil peat.

A bedrock geology map of the area is attached as Figure 7-8.

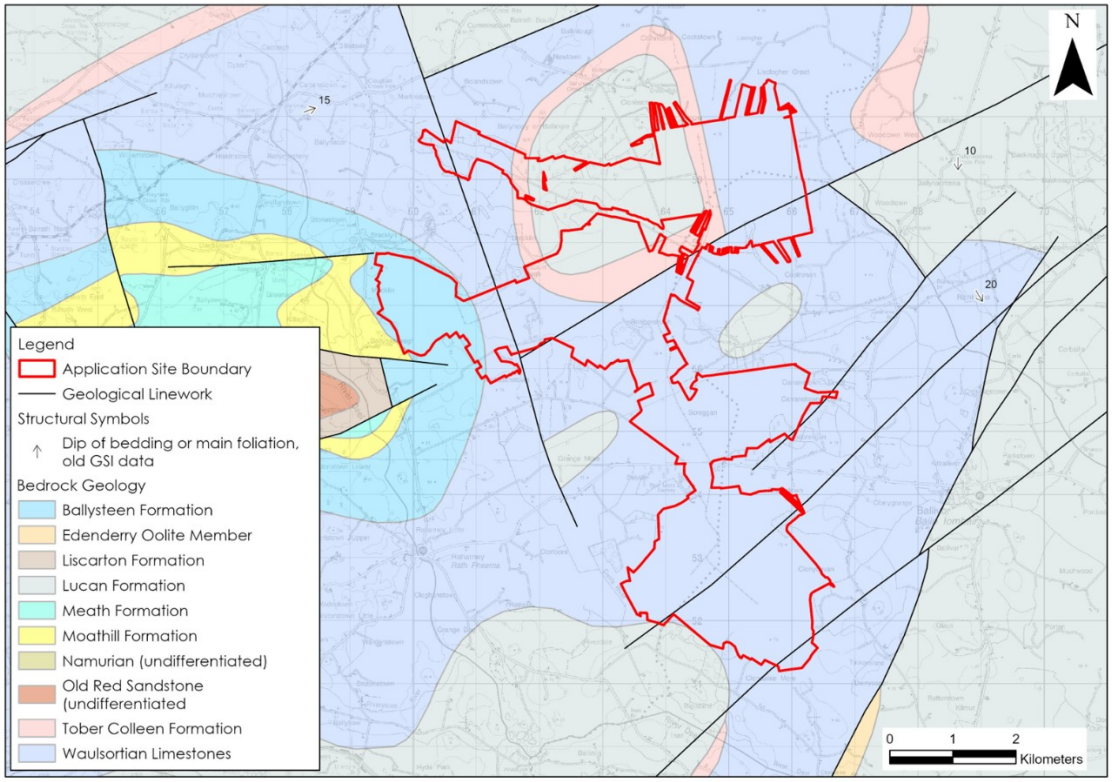

Figure 7-8: Bedrock Geology map

7.3.6 Soil Contamination

According to the EPA online mapping (www.epa.ie), there are no licenced waste facilities or dump sites within the Application Site or its immediate environs. The closest EPA mapped waste locality is Annaskinnan Landfill located approximately 5.6km southwest of Ballivor Bog.

The EPA map several Industrial Emissions Licensing (IEL) facilities and IPC facilities in the vicinity of the Application Site. An IPC Licence (P0501-01) was granted to the Applicant on 28/04/2000 for the extraction of peat at the Ballivor Bog Group. Condition 7 referred to Waste Management whereby all hazardous waste materials (oils, oil filters, batteries etc) were required to be disposed of by licenced waste contractors.

An IEL licence (P0984) also exists at Clondrisse Pig Farm located ~600m north of Bracklin Bog.

There is no record on GSI mapping of the presence of any historic quarries or pits within the Application Site. Several historic quarries dating from the 1830s are mapped along the R156 to the east of the Application Site and in the lands surrounding the village of Ballivor. The GSI also record a quarry dating from the early to mid-20th century to the west of the existing Bord na Móna depot situated to the north of Ballivor Bog, located ~90m from the Application Site boundary. Historic gravel pits and quarries are also recorded ~300m southeast of Ballivor Bog, ~50m south of Bracklin Bog and ~800m southeast of Lisclogher Bog.

During the site walkover surveys completed as part of the site investigations for the proposed Ballivor Wind Farm, no areas of particular contamination concern were identified within the Application Site. Some minor fly-tipping was noted along the edge of access tracks.

7.3.7 Economic Geology

The GSI Online Minerals Database accessed via the Public Data Viewer (www.gsi.ie) shows a small number of historic quarries and pits in the lands surrounding the Application Site as described above in Section 7.3.6. The GSI does not record the presence of any active quarries or pits in the Application Site or in the surrounding lands. The closest mapped active quarry is located approximately 10km east of the Application Site near the village of Rathmoylan. The closest GSI mapped active sand and gravel pit is located approximately 8km south of the site near Clonard.

The GSI also record the presence of 1 no. mineral locality within the Application Site. This is located in Lisclogher Bog with the key mineral identified being marl. In the townland of Riverdale to the southwest of Ballivor Bog the GSI note the occurrence of sand and gravel deposits describing the site as an active pit with high quality sand.

The GSI online Aggregate Potential Mapping Database (www.gsi.ie) shows that the crushed rock aggregate potential of the Application Site ranges from Low to Very High. The areas of very high potential are located in the centre of Carranstown and Bracklin bogs. The limestone bedrock underlying the Application Site could be classified as “Medium” importance. The bedrock could be used on a “sub-economic” local scale for construction purposes. The bedrock has not been used in the past at the site for this purpose, likely because of the covering of peat and glacial till overburden in the area.

The majority of the Application Site is not located within an area mapped for granular aggregate potential (i.e. potential for gravel reserves). The overlying peat deposits at the site could be classified as “Low” importance as the peat is not designated in this area and is significantly degraded in most places at the Application Site as a result of industrial peat extraction activities and all ancillary works and drainage. Refer to

Table 7-1 for definition of these criteria.

Table 7-10: Summary of Bedrock Geology and Geological Resources

Bog Name	Bedrock Geology	Geological Resource Potential
Ballivor	Calcareous, with bog mainly underlain by Waulsortian Limestone. Faulting in the area has a NW-SE orientation.	Low to Medium
Carranstown	Calcareous, with bog mainly underlain by Waulsortian Limestone. Faulting in the area has a NE-SW orientation	Low to Medium
Bracklin	Calcareous, with bog underlain by Waulsortian Limestone to south, and Tober Colleen Formation and Lucan Formation to north. Faulting in the area has NW-SE and NE-SW orientations	Low to Medium
Lisclogher	Calcareous, with bog underlain by Waulsortian Limestone to east, and Tober Colleen Formation and Lucan Formation to west. Faulting in the area has a NE-SW orientation	Low to Medium
Lisclogher West	Calcareous, with bog underlain by Waulsortian Limestone to west, and Tober Colleen Formation and Lucan Formation to east. Faulting in the area has a NW-SE orientation	Low to Medium

7.3.8 Geological Heritage Sites

There are no geological heritage sites near the Application Site (www.gsi.ie). The closest geological heritage site, the Ballycor Mushroom Rocks (Site Code: WH001) is located approximately 7km west of the Bracklin Bog.

A map of local geological heritage sites is attached as Figure 7-9.

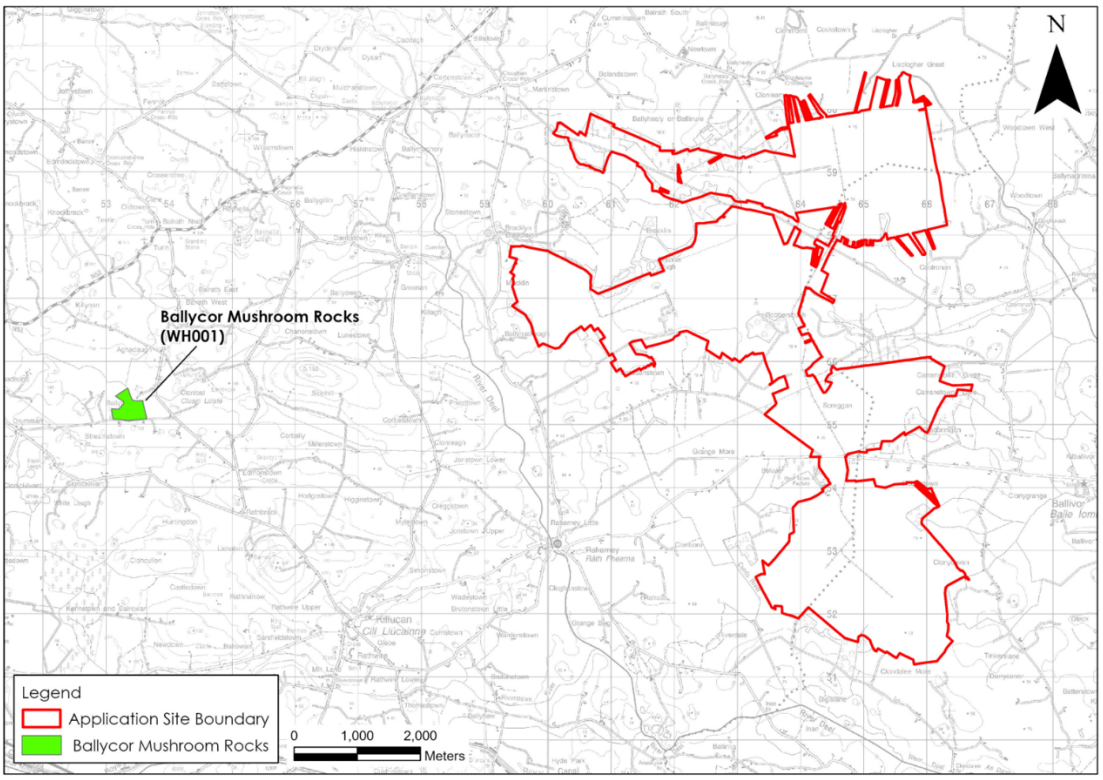

Figure 7-9: Geological Heritage Areas

7.3.9 Peat Stability

The Applicant's records do not document the occurrence of any historic landslides at the Application Site. Similarly, the GSI's online database (www.gsi.ie) does not report any historic landslides within the Application Site or in the surrounding lands. The closest landslide event recorded by the GSI occurred in 1999, and is mapped at Girley Bog, Chamberlainstown, approximately 10km northeast of Lisclogher Bog.

The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring at this site as **Low**. This is due to the sites lowland setting and flat topography. Peat failures and landslides are more likely to occur in upland setting where there is sloping ground and high rainfall rates.

A qualitative assessment of geohazards at each of the 5 no. bogs has been completed and is presented in Table 7-11. The assessment reviews any local historical failures, residual slopes within each bog, and residual peat depths at each bog. The assessment presents an evaluation of slope failure risks associated with each bog unit. We note that all of the bogs are drained, and peat extraction activities and all ancillary works has now ceased. All of the bogs have very low ground slope levels within the extraction areas, they occur within low-lying enclosed basins, and these in combination with the historical and continued drainage reduces the peat failure risks significantly.

Table 7-11: Summary of Geohazards

Bog Name	Local Geohazards	Ground Slopes (°) (5%ile/80%ile)	Average Residual Peat Depths (m)	Slope Failure Risks
Ballivor	None recorded	0 / 8.11	2.55	Negligible
Carranstown	None recorded	0 / 11.1	1.94	Negligible
Bracklin	None recorded	0 / 11.21	3.02	Negligible
Lisclogher	None recorded	0 / 7.43	2.57	Negligible
Lisclogher West	None recorded	0 / 10.18	Unknown	Negligible

7.4 Characteristics of the Development

7.4.1 Peat Extraction Phase (July 1988 – June 2020)

A full description of the development and all works completed at the Application Site post-dating July 1988 is provided in Chapter 4.

By 1988, peat extraction activities and all ancillary works were well established at Ballivor, Carranstown, Bracklin, and Lisclogher. By this time drainage had already been inserted and railway infrastructure had been laid on all bogs with the exception of Lisclogher West.

Lisclogher West itself was drained between 1988 and 1995, with 6 no. silt ponds and 6 no. surface water emission points inserted into the bog. However, peat was never extracted from Lisclogher West.

Elsewhere across the Application Site peat extraction activities and all ancillary works continued at different times and at different levels of intensity from July 1988 to June 2020. In addition, some bog rehabilitation works including drain blocking have been undertaken at Carranstown bog during this period. A total of 2,880,975m^3 of peat has been extracted from the Application Site since 1988. Peat has been extracted using two different methods, milled and sod, outlined briefly below and described fully in Chapter 4. In general, milled peat is extracted from deep peat layers while sod moss extraction occurs at the bog margins and from the upper peat layers.

During this time period milled peat extraction occurred at Ballivor, Carranstown, Bracklin and Lisclogher bogs. Records indicate that the Derrygreenagh Bog Group, of which the Ballivor Bog Group and thus the Application Site is a subset, supplied peat to the Rhode ESB Power Station, Croghan Briquette Factory, Kilberry and Cúil na Móna when required. Information regarding which bogs supplied which specific end user, quantities of supply, frequency of travel and travel routes are not available. From 1985, peat from the Application Site was also distributed in bulk from the peat loading facility at Ballivor Works to the horticulture industry overseas via Dublin Por. Milled peat extraction requires good solar drying condition and can occur anytime from April onwards once suitable drying conditions are present. There are 4 no. stages involved in the process of milled peat extraction outlined below:

1. **Milling** - During the milling process the top 10-15 mm of the surface of each field was broken into peat crumbs by powered milling drums towed behind agricultural tractors. This layer of crumbed or milled peat is called a crop and has a moisture content of about 80% when milled.

2. **Harrowing** - After milling, the peat crop was dried. To assist in this drying, the loose peat was harrowed, or turned over. The harrow consisted of a series of spoons which are towed behind an agricultural tractor. The spoons on the harrow were fitted with special base plates which prevented the scraping of wet particles from below the milled peat layer. Harrowing was usually required 2 to 5 times per peat crop, depending drying conditions, the water table level in the peat production fields, the initial moisture content of the peat at milling, and peat quality. If rain interrupted the drying process, more harrowing may have been needed.
3. **Ridging** - When the milled material was dried to a moisture content of between 45% and 55%, it was gathered into ridges in the centre of each peat production field. The ridger consisted of a pair of blades towed in an open V behind an agricultural tractor. The open V blades rest on the bog and channel the loose crop into a triangular ridge in the centre of each peat production field.
4. **Harvesting** - Harvesting is the final stage of the milled peat production process. Each individual ridge was lifted mechanically by a machine called a harvester, transferred and dropped on top of the adjoining field's ridge, until five ridges had been accumulated into a single large ridge. This ridge forms the final lift into the peat storage stockpile.

As part of the development of the bogs for milled peat extraction, parallel surface water drains were created at intervals of 15m, with the section of bog between the drains referred to as production fields. The fields are slightly convex to facilitate runoff and to prevent surface water ponding. The drains fall towards the headland, located at the ends of the production fields. The drains are piped across the headland, allowing machinery to pass from one field to the next. The drainage network then continues to a series of silt ponds prior to discharging to a local watercourse. By 1988, milled drainage had already been implemented across much of the Application Site with the exception of Lisclogher West.

Meanwhile sod moss extraction was undertaken by the Applicant at both Lisclogher and Ballivor bogs during this period. In addition to these, third party sod peat extraction activities and all ancillary works has occurred at Lisclogher Bog from the 1990s until 2020. Sod moss is the term used to describe peat produced in block form for horticultural use. The sod moss is extracted mechanically with specially equipped excavators. The sods are cut from mini face-banks or the margins of trenches that are gradually widened and left on the bog to dry for approximately 12 months, reducing moisture content from 90% to 50% - 60%. Once the required moisture content is reached the sod moss is stockpiled at the edge of bog prior to transportation for processing. One layer is typically cut at a time until the horticultural peat is exhausted.

The peat extraction activities and all ancillary works areas were served by a railway line which was moved around the Application Site as different areas came in and out of production. During this period several buildings and other infrastructures were constructed at the Application Site to support peat harvesting operations. These included a Welfare Centre constructed in the townland of Grange More (1988), an extension to the pre-existing storage facilities (1990) and the construction of an ESB sub-station (2005). These developments supported the existing processing plant, loading bay and workshop located at the Ballivor Works. In addition to these, grants for the laying of 2 no. grass strips (2013) and the erection of a guyed wind monitoring mast (2015/2016) were also received at the Application Site.

In terms of environmental monitoring, control and monitoring measures have been implemented at the site since April 2000. Please refer to Chapter 4 and Appendix 4-1 for full details.

7.4.2 Current Phase (June 2020 – Present Day)

The Current Phase of the Project includes all activities carried out at the Application Site from the cessation of peat extraction activities and all ancillary works in the June of 2020 to the present day.

During this period, activities at the Application Site have been limited to the removal of stockpiled peat with no peat extraction activities or ancillary works occurring. From mid-2020 to mid-2021 the

operations at the Application Site reduced to transferring stockpiled peat to the Ballivor Works for processing prior to transportation to Kilberry Horticulture Works in Co. Kildare the Edenderry Power Plant and Derrinlough Briquette Factory, both in Co. Offaly. The Ballivor Works ceased operation mid-2021. From mid-2021, stockpiles of peat were removed from across the Application Site, transferred to a conveyor via tipple trucks and subsequent transport to either Kilberry Horticulture Works, Edenderry Power Plant, and/or the Derrinlough Briquette Factory. Final stockpiles at Ballivor Bog were removed in June 2022 and the last of the stockpiles at Bracklin, Lisclogher and Carranstown bogs were removed by the end of 2023.

The drainage infrastructure, silt ponds and surface water discharge locations continue to be in operation and to be maintained as per the IPC Licence requirements. The silt ponds are maintained in accordance with Condition 6 of the IPC Licence, which states that all drainage from boglands is discharged via appropriately designed silt ponds which are desilted twice a year. The silt arising from these operations is either stockpiled a safe distance from drainage features or spread onto production fields.

Environmental monitoring continued during the Current Phase of the Project in accordance with IPC licence conditions.

The Peatland Climate Action Scheme (PCAS) is a programme of enhanced peatland rehabilitation measures, which is in addition to the IPC licence requirement (does not form part of this substitute consent application) and is being is being applied at specific locations across the Applicant's landbank that are identified as suitable for the prescribed enhancement measures. PCAS measures to rewet peat including intensive and targeted drain blocking have commenced in Carranstown East, Lisclogher West and Bracklin West (refer to Chapter 4 Section 4.8.2 for further details in relation to PCAS) during the Current phase of the Project.

7.4.3 Remedial Phase

It is currently proposed to implement rehabilitation plans at each of the bogs comprising the Application Site. Rehabilitation has already commenced on a section of Carranstown Bog. These rehabilitation plans are required in order to fulfil the requirements of Condition 10.2 of the IPC Licence No. P0501. Each Cutaway Bog Decommissioning and Rehabilitation Plan, as per Condition 10 of the IPC Licence will be subject to agreement with the EPA. To date, Carranstown 2022 Cutaway Bog Decommissioning and Rehabilitation Plan and Lisclogher-West 2023 Cutaway Bog Decommissioning and Rehabilitation Plan have been approved by the EPA, Ballivor Bog 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan, Bracklin Bog 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan, and Lisclogher East 2024 Draft Cutaway Bog Decommissioning and Rehabilitation Plan will be reviewed with the EPA and approved by same prior to their implementation.

The objective of the rehabilitation plans is to stabilise and rehabilitate the peat bog within the Application Site. The plans use bespoke interventions designed to firstly stabilise the environment and secondly to rehabilitate the site as much as possible by placing the existing peatland environments on a path towards naturally functioning peatlands.

The proposed cutaway bog decommissioning and rehabilitation plans at the Application Site will be undertaken using standard best practices (refer to Appendix III of the Cutaway Bog Decommissioning and Rehabilitation Plans included as Appendix 4-2).

Each individual bog comprising the Application Site has its own unique history of peat extraction activities and all ancillary works operations, therefore the most appropriate rehabilitation approach is bog-specific reflecting local ecological and hydrological factors. For example, the rehabilitation of the milled peat extraction area in Bracklin West will be different to that of Lisclogher West, from which peat was never extracted. Consequently, each bog has its own exclusive Cutaway Bog

Decommissioning and Rehabilitation Plan. The key intervention to be applied is the rewetting of the bogs through measures such as drain blocking. This will encourage natural colonisation of cutaway areas and will establish a more suitable hydrological/hydrogeological regime for the development of bog habitats.

The rehabilitation plans comprise short-term planning actions, short-term practical actions and long-term actions. The initial short-term planning actions will involve seeking approval of the rehab plans from the EPA. In addition, detailed site plans of how the various rehabilitation measures will be applied will be developed for each bog and a review of all issues and constraints which may impact how the proposed rehabilitation plans will be completed. The short-term planning actions will also ensure that all activities associated with the rehab plans will be completed in accordance with the requirements of the IPC Licence. Several short-term actions will be completed in the first 2 years following EPA approval of the rehab plans. These actions will include intensive drain blocking and monitoring of the rehabilitation measures. Silt ponds will continue to function during this phase. Longer term actions (>3 years) include the evaluation of the success of the short-term rehabilitation measures and undertake further remediation where necessary. Long-term monitoring, aftercare and maintenance will be completed until the IPC Licence is surrendered. We understand that during this phase of the rehab plans, silt ponds will be assessed and decommissioned if necessary.

Much of the work associated with the rehabilitation plans will occur during the initial stages of the plan. Once drain blocking and other measures have been implemented the operational activities will comprise non-intrusive ecological and hydrological monitoring and may also include minimal maintenance and repair works.

7.5 Assessment of Significant Effects and Control/Mitigation Measures

7.5.1 Do Nothing Scenario

As outlined in the EPA Guidelines (May 2022), the description of 'Do-Nothing Effects' relates to the environment as it would be in the future should the project not be carried out. As discussed in Section 3.2.1 in Chapter 3, the assessment period of this rEIAR commenced in 1988, a time at which peat extraction was already well-established at the Application Site. In the context of this rEIAR, the Project has been ongoing since the baseline assessment year of 1988. As outlined in Section 3.2.1 in Chapter 3, peat extraction activities commenced at the Application Site in 1948 with the installation of drainage.

The 'Do-Nothing' option is defined as the Project (as described in Section 4.2 of Chapter 4) having ceased at the Application Site in 1988.

In the event of the cessation of the Project at the Application Site in 1988, it is assumed that those lands which by that point had not been subject to the installation of drainage and peat extraction would have remained as a relatively intact raised bog with varying raised bog habitats (such as bog woodland, fen, sphagnum mosses).

Subsequently. other land-use practices may also have taken place on the Application Site such as agricultural or commercial forestry, or other commercial or non-commercial uses. Alternative land uses are discussed in Chapter 3 – Alternatives. Under this 'Do-Nothing' option, the IPC licence and associated ongoing decommissioning and planned rehabilitation would not have occurred.

For those lands which as of 1988 had been subject to the installation of drainage in preparation for peat extraction but not peat extraction itself, it is assumed in the 'do-nothing' scenario that drainage would have remained insitu. Maintenance works to keep established drainage channels clear would have ceased as of 1988 in the 'do-nothing' scenario. It is likely that these areas would have been subject to

natural recolonisation of the bog surface. Minor third party turbary activities likely would have occurred along the intact bog edges as was common practise at sites such as the Application Site.

Peat extraction was underway at the Application Site prior to the required date for the transposition of the EIA Directive in 1988. If peat extraction and related activities ceased from 1988 onwards, then the various residual effects, described throughout this rEIAR, would not have occurred.

However, consideration must be given to the following:

- The legislative mandate given to Bord na Móna in the form of the Turf Development Act 1946, as amended) to acquire and develop peatlands; and
- The uncertainty with respect to the planning status of the activity did not arise until 2019 and was not evident in 1988.

Therefore, this 'Do-Nothing' option was not the chosen option. Peat extraction and all ancillary works have occurred at the Application Site from July 1988 onwards. A decision to cease peat extraction at the Application Site was taken in 2020 and the Application Site needs to be considered in the context of regularising (without prejudice) the planning status of the lands to facilitate future development (subject to planning consent as required). The Application Site has and will continue to revegetate, and there will be a change from areas of cutover peatland to revegetated peatland. These are described in the individual chapters of the rEIAR.

In the event that Substitute Consent is not granted in effect, the "do nothing" option represents the current situation as at the date of the application for Substitute Consent. As part of Bord na Móna's statutory obligations under IPC licence requirements, Cutaway Bog Decommissioning and Rehabilitation Plans will continue to be implemented for the Application Site separate to, and independent of, the Substitute Consent application. The implementation of the plans is included in the impact assessment below.

The role of cutaway/cutover peatlands such as the Application Site as a significant potential resource for amenity, tourism, biodiversity enhancement and conservation, improvement in air quality, climate mitigation, renewable energy development and education are part of Bord na Móna's vision for the Application Site. The regularisation of the planning status of the Application Site is a significant facilitator in ensuring the sustainable use and management of these peatlands. If this does not occur, the opportunity to continue employment and alternative use of the Application Site for the potential resources and activities mentioned above will be significantly restricted.

7.5.2 Identification of Impacts

7.5.2.1 Peat Extraction Phase (July 1988 – June 2020)

The Peat Extraction Phase of the Project includes all works undertaken from July 1988 to the cessation of peat extraction activities and all ancillary works in June 2020.

7.5.2.1.1 *Soils/land (Land take)*

Changes to soils/land have been investigated at the Application Site between July 1988 and June 2020 (refer to Section 7.3.3). Due to the nature of peat extraction activities and all ancillary works, the primary land change occurs during the initial site preparation works where drainage is installed and the removal of vegetation in preparation for peat extraction activities and all ancillary works. Peat extraction activities and all ancillary works had replaced (land take) a vast expanse of raised bog at the Application Site with large areas of drained bare peat fields by 1988. The greatest effect of the peat extraction activities and all ancillary works on soils/land would have occurred during the original drainage and removal of vegetation. During these site preparation works the individual bog areas would have experienced a relatively abrupt change in land cover from raised bog prior to drainage to bare

peat fields. Therefore, the greatest land take associated with the peat extraction activities and all ancillary works at the Application Site predated 1988.

However, by 1988 industrial peat extraction activities and all ancillary works was already well established across much of the Application Site. Ballivor Bog was drained in 1948, with peat extraction activities and all ancillary works beginning in 1953. Site preparation works were commenced at Bracklin Bog in 1950, with peat extraction activities and all ancillary works commencing in 1960 on the southern area. Western Carranstown had also been drained and stripped of vegetation between 1974 and 1987, with peat extraction activities and all ancillary works commencing prior to 1988. Eastern Carranstown had been drained only by 1988, with vegetation clearance occurring between 1989 and 1995. Peat extraction activities and all ancillary works had commenced at Lisclogher Bog, prior to 1988, in 1960. Therefore, by 1988 the soils/land at these bogs had already been significantly altered and ancillary structures already in place. In 1988 these areas would have comprised of industrial peat extraction activities and all ancillary works with landcover consisting of drained bare or vegetated peat fields separated by field drains. Any changes in soils/land which post-date the initial drainage and removal of vegetation would have been imperceptible in comparison to the original changes which predate 1988. Slight annual topographic changes (~0.1-0.2m/year) associated with peat extraction activities and all ancillary works will have occurred in the extraction areas at Ballivor, Bracklin, Carranstown and Lisclogher bogs.

In contrast, Lisclogher West remained largely as remnant undeveloped bog in 1988, with the installation of drainage having commenced in 1973, and having been completed by 1995. Significant changes to land would have occurred here when this bog was drained however the change would have been consistent with the emerging trend established by the wider peat extraction activity. Peat extraction activities and all ancillary works first occurred at eastern Carranstown and the northwestern portion of Bracklin by 1995 and any subsequent changes to land would have been limited to slight annual topographic changes associated with peat extraction activities and all ancillary works. Peat was never extracted from Lisclogher West and therefore that bog would have experienced no changes to soils/land subsequent to drainage and the associated loss of vegetation and ground subsidence.

Pathway: Drainage, removal of acrotelm, removal of vegetative surface and extraction of peat.

Receptor: Soils/land.

Impact Assessment: The soils/land changes have been established through past extraction works and associated activities.

Control Measures: No known control measures for land and soils/land exist in the context of the activity being assessed here, other than working on the Applicant's owned land, and implementing peat extraction activities and all ancillary works in an established operational system.

7.5.2.1.2 *Peat Extraction - Land*

Based on peat extraction activities and all ancillary works figures supplied by the Applicant and historical landuse records, all bogs comprising the Application Site, with the exception of Lisclogher West, have been subject to peat extraction activities and all ancillary works at some stage between July 1988 and June 2020.

The peat extraction activities and all ancillary works operations were undertaken at different times and at different levels of intensity throughout the Application Site. The total volume of peat removed at the site from July 1988 to June 2020 is estimated to 2,400,815 tonnes (2,880,975m^3 with an average of 91,267m^3 extracted per year).

During an average year of milled peat extraction ~12 – 18cm of peat has been removed from the peat extraction fields. This equates to ~3.8 – 5.7m of peat during the Peat Extraction Phase. This is likely to be an overestimate as no production field would have remained in production for the entire Peat

Extraction Phase (i.e. certain production fields would have been bypassed at different times and for various reasons). Furthermore, certain years would have had lower yields due to poor weather conditions.

Pathway: Extraction/excavation.

Receptor: Peat and peat subsoils.

Control Measures:

Pre-IPC Licence

As detailed in Section 4.3.5 in Chapter 4 of this rEIAR, with the exception of silt control (which from 1974 was subject to a formal management program as discussed in Section 4.3.5.9 in Chapter 4), formal documentation outlining dedicated measures referred to as control measures practised on site from 1948 - July 1988 are not available. However, based on personal communication with a retired Bord na Móna manager, the following measures below were enacted at the Application Site as part of daily, monthly, and annual bog management and operations and were outlined in the 1999 IPC Licence application.

Due to the nature of the operations ongoing at the site, there were no control measures to prevent or minimise the removal of peat from the site. Best practice procedures and control measures have been implemented to both protect peat from contamination (see Section 7.5.2.1.3) and from erosion by air and water.

The following management measures were implemented for peat sediment control/dust suppression:

- Stockpiles were compacted on either side by large rollers drawn by 65H.P tractors;
- Stockpiles were covered with polythene film gauge sheets and secured in position by spreading an even layer of high moisture content milled peat;
- Avoid extraction during windy weather;
- Keep headlands clean- remove loose peat;
- Drive slow along dusty headlands; and,
- Clean road crossing.

At this time Bord na Móna were also implementing several control measures in order to minimise the impact of peat extraction activities and all ancillary works on surface water quality including:

- Internal drains cleaned on a regular basis in suitable weather. This was completed to remove sludge from the bottom of ditches, allowing them to retain full functionality. The sludge was disposed of by spreading it on the adjacent production fields.
- Drain maintenance was carried out using draglines and excavators, ensuring that these drains were fit for purpose.
- Drain maintenance was carried out mainly prior to and post the harvesting season.
- Visual inspection of surface water pumps daily;
- Operational check of surface water pumps biweekly; and,
- Service of surface water pumps monthly
- Silt ponds were utilised to control the amount of sediment being discharged at outfalls. At this time, silt ponds were designed for an upper limit of 100mg/l suspended sediment.
- Silt ponds were upgraded in the 1990s to cater for the settling of sufficient amount of silt. This often included the construction of a second silt pond adjacent to the first, which was used as a backup and to facilitate desludging of the primary pond.
- Silt ponds were de-sludged twice per annum.

Active IPC Licence

With the implementation of the IPC Licence in 2000, the control measures implemented previously by the Applicant were updated and expanded to include:

- The avoidance of harvesting during windy weather;
- Headlands are kept clean and free of loose peat;
- The covering of stockpiles with polythene film gauge sheets;
- Drains are protected and maintained free of excessive peat;
- Machinery do not drag loose peat into drains;
- Outfalls are controlled to minimise silt discharge; and,
- The avoidance of excavation during windy weather.

These control measures specifically pertain to preventing the erosion of exposed peat by both wind and water and therefore aim to protect both air and water quality (refer to Chapter 5, Chapter 8, and Chapter 9 for full details).

7.5.2.1.3 *Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry*

Accidental spillage during refuelling of machinery and plant (static and mobile) with petroleum hydrocarbons was a pollution risk. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk over time. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects (i.e. contamination of peat, subsoils and pollution of the underlying aquifer) on the geological and water environment.

Discharges from wastewater systems (septic tanks) at office buildings, and at welfare facilities and workshops could potentially have caused surface water and groundwater contamination. Activities and features associated with peat extraction activities and all ancillary works include railway lines, machine passes, canteen structures, work sites, welfare facilities, mobile fuel tanks, fixed fuel tanks, peat loading facilities, and end user sites. These potential impacts existed at the Application Site and the welfare facilities and workshops. However, we understand from review of available Annual Environmental Reports submitted to the EPA under the IPC Licence, no significant pollution events/spills to groundwater have occurred since 2000 (surface water is dealt with separately in this rEIAR). We also deduce that there were no significant peat contamination issues arising prior to 2000 as these would have been mentioned and assessed in the EPA licence Application documentation and we could find no records of such occurrences.

Pathway: Infiltration through pore space in peat, subsoil and bedrock.

Receptor: Peat and subsoil, bedrock.

Control Measures:

Pre-IPC Licence

As detailed in Section 4.3.5 in Chapter 4 of this rEIAR, with the exception of silt control (which from 1974 was subject to a formal management program as discussed in Section 4.3.5.9 in Chapter 4), formal documentation outlining dedicated measures referred to as control measures practised on site from 1948 - July 1988 are not available. However, based on personal communication with a retired Bord na Móna manager, the following measures below were enacted at the Application Site as part of daily, monthly, and annual bog management and operations and were outlined in the 1999 IPC Licence application. The following best practice procedures were implemented at the site pre-2000 in order to prevent the occurrence of hydrocarbon leakages and spillages at the Application Site:

- All peat harvesting machinery were stored at the Ballivor Works at the end of each workday.

- All machinery were regularly inspected, serviced.
- All machinery was regularly cleaned via power steam wash system at a wash bay and drained into an interceptor tank and associated gravel soak pit. The interceptor unit facilitated the removal of any floatable oil/grease components.
- A self-contained machine parts washer was located at the Workshop.
- All refuelling and vehicles maintenance was undertaken at the Ballivor Works depot.
- If on-site refuelling was required it was done so with a mobile fuelling unit.
- In the event of a spill, the General Manager was immediately informed of the incident.
    - The spill was assessed by the General Manager for potential risk to the health and safety of employees and the potential environmental consequences.
    - A spill would be sourced, isolated and contained with polystyrene booms or dry peat (moisture content of 10%).
    - All effort should be made to prevent the spill from entering a storm drain or nearest outfall.
    - Once the spill has been contained, a suitable absorbent (dry peat) is to be used to soak the spillage.
    - All possible ignition sources such as electoral equipment, naked lights, machinery should be removed from the area. Any combustibles in the spill area should be removed.
    - Follow up action measures taken must include the implementation of appropriate remedial work to prevent such a spillage recurring in the future.
    - In the event of a significant spillage, the General Manager must notify the local authority.
- All waste oil and break fluids drained from machinery were collected in drums and emptied into a waste oil storage tank which were transported off-site by a licenced disposal contractor.
- All used oil and fuel filters and used batteries were collected by licenced disposal and battery collection contractors respectively.
- All washing from the self-contained machine parts washer was collected within a sludge tank at the Ballivor Works.

Active IPC Licence

These control measures were upgraded to comply with the IPC Licence conditions in 2000:

- Effective spill/leak management of mobile fuelling units.
- Replacement (and remediation where necessary) of all underground fuel tanks.
- There shall be no other emissions to water of environmental significance.
- All tank and drum storage areas shall be rendered impervious to the materials stored therein. In addition, tank and drum storage areas shall, as a minimum be bunded.
- Drainage from bunded areas shall be diverted for collection and safe disposal.
- The integrity and water tightness of all the bunding structures and their resistance to penetration by water or other materials stored therein shall be tested and demonstrated by the licensee to the satisfaction of the Agency and shall be reported to the Agency within eighteen months from the date of grant of this licence and every two years thereafter.
- The loading and unloading of fuel oils shall be carried out in designated areas protected against spillage and leachate run-off.
- While awaiting disposal, all materials shall be collected and stored in designated areas protected against spillage and leachate run-off.
- With the exception of roof water, all surface water discharges from workshop areas shall, be fitted with oil interceptors.
- An inspection for leaks on all flanges and valves on over-ground pipes used to transport materials other than water shall be carried out weekly.
- Inspections and monitoring of wastewater systems and associated discharges.

7.5.2.1.4 Peat Stability

Peat instability or failure refers to a significant mass movement of a body of peat that would have a negative effect on individual bogs and potentially the surrounding environment. Peat instability could have occurred during development of bog drainage or ancillary activities associated with peat extraction activities and all ancillary works, including e.g. railway lines, machine passes, canteen structures, work sites, welfare facilities, mobile fuel tanks, fixed fuel tanks, peat loading facilities, and end user sites. The significant effects of peat failure at the Application Site could have resulted in:

- Death or injury to personnel;
- Damage to machinery;
- Damage or loss of infrastructure;
- Drainage disruption by blockage of drainage pathway by relocated peat;
- Contamination of watercourses, water supplies by particulates; and,
- Degradation of the peat environment by relocation of peat.

Pathway: Peat slide/Landslide.

Receptor: People, land and infrastructure.

Control Measures:

Generally, the only recorded landslides which relate to peat instability on raised bogs have occurred during the initial stages of bog drainage. The GSI or Bord na Móna records do not document the occurrence of any peat slides within the Application Site. All bogs have active and extensive drainage systems. The residual peat depths across much of the Application Site shallow, and slopes are small, so the risk of large-scale peat failure is negligible. Control and management measures that have been implemented relating to peat stability include:

- All drainage works were completed by experienced and competent operatives;
- All works were designed and overseen by experienced and qualified Bord na Móna personnel;
- The drainage systems around the 5 bog units were maintained and managed by Bord na Móna throughout the duration of the Peat Extraction Phase (1988 – 2020); and,
- Bord na Móna implemented their own best practice drainage maintenance pre-2000 when these were updated to comply with IPC Licence conditions in 2000 (refer to Chapter 4).

7.5.2.1.5 Construction of Supporting Infrastructures and Buildings

From July 1988 to June 2020, activities at the Application Site were not solely limited to peat extraction activities and all ancillary works. During this time period several supporting infrastructures and facilities were constructed to aid the peat extraction activities and all ancillary works operations. These works included the construction of a Welfare Centre (108m^2) in the townland of Grange More (1988), an extension to the pre-existing storage facilities (1990) (510m^2), construction of an ESB sub-station (2005) (23.15m^2) and two grass air strips for model aircraft (2013). In addition, a guyed wind monitoring mast (2015/2016) was erected in Lisclogher Bog for the purpose of assessing the site for a potential future wind energy development. Please note that all of these developments were consented (refer to Chapter 2) and are assessed here for completion due to their association with and/or proximity to the peat extraction activities and all ancillary works at the Application Site.

However, these developments had a very small footprint in the context of the entire Application Site. Additionally, the construction of these infrastructure would have been completed over a relatively short time. Therefore, the potential for these developments to impact on land, soils/land, soils, subsoils and bedrock is much reduced when compared with the potential impacts associated with the peat extraction

activities and all ancillary works which were ongoing during this time period (Section 7.5.2.1.1 to Section 7.5.2.1.4).

Pathway: Excavation of soils/subsoils, infiltration of contaminants through pore space in peat, subsoil and bedrock.

Receptor: Land, soils/land, peat, peat subsoils and bedrock.

Control Measures:

Bord na Móna received planning permission for the above developments and all developments were constructed in accordance with the conditions set out in their respective permissions. For example, the conditions attached to the planning permission for the ESB substation pertain to ensuring the development is constructed in accordance with ESB standards and as per the plans and particulars submitted.

7.5.2.2 Current Phase (2020 – Present)

The Current Phase of the Project encompasses the period of time between the cessation of peat extraction activities and all ancillary works at the Application Site in the June 2020 to the present day.

7.5.2.2.1 *Land and Soils/land*

Following the cessation of peat extraction activities and all ancillary works in June 2020, landuse at the Application Site is no longer classified as commercial peat extraction. The land that was in active peat extraction up to that time (~220 ha) are now available for re-vegetation and natural colonisation. However, given the relatively short time period which has elapsed since the conclusion of peat harvesting operations, there has been no significant change in land cover to date, with much of the Application Site containing bare peat fields or pioneer open cutaway habitats.

Pathway: Extraction of peat and drainage works.

Receptor: Land and Soils/land.

Impact Assessment: Any works during this time period have been completed under licence from the EPA and Bord na Móna's Environmental Management System.

The area of land owned by Bord na Móna remains the same.

Control Measures: No specific control measures.

7.5.2.2.2 *Peat Extraction*

No peat extraction has occurred at the Application Site since the cessation of the Applicants peat extraction activities and all ancillary works in June 2020. Stockpiled peat was removed from the Application Site by the end of 2023.

Therefore, no significant change has occurred in terms of peat depths etc. during this post extraction phase of the Project.

Pathway: Extraction/excavation.

Receptor: Peat.

Control Measures: No control measures were required as peat was not excavated from the Application Site during the Current Phase. The measures outlined in Section 7.5.2.1.2 to prevent the erosion of peat continue to be in operation in accordance with IPC Licence conditions.

7.5.2.2.3 *Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry*

Despite the cessation of peat extraction activities and all ancillary works at the Application Site, there is still some very limited activity at the Application Site involving machinery and plant with which there is always a risk of accidental spillage of hydrocarbons. Similarly, the office buildings at the Applicants depot remain occupied and discharges from wastewater systems (septic tanks) etc. have the potential to cause surface water and groundwater contamination. These risks are the same as those outlined in Section 7.5.2.1.3 but to a lesser extent due to the lower volumes of plant, machinery and workers operating at the Application Site during the Current Phase.

Pathway: Infiltration through pore space in peat, subsoil and bedrock.

Receptor: Peat and subsoil, bedrock.

Control Measures:
Measures that mitigated against contamination of peat, subsoil and bedrock are outlined in Section 7.5.2.1.3 and are currently being adhered to at the Application Site. These control measures significantly decrease the risk of soil contamination. These measures/controls have been implemented as part of compliance with IPC licence conditions across the Application Site. No further control measures, beyond that implemented to date, are deemed necessary. The existing wastewater services at the Application Site have been in operation for years with no reported issues.

7.5.2.2.4 *Peat Stability*

No peat extraction has occurred since the cessation of the Applicant's peat extraction activities and all ancillary works in June 2020. Therefore, no significant change in topography and/or drainage has occurred during the period. Please note that some rehabilitation works including drain blocking have been undertaken at Carranstown Bog, Lisclogher West, and western Bracklin during this period (as part of PCAS, refer to Chapter 4 Section 4.8.2). However this would have no impact on local peat stability due to the low-lying nature of these areas.

The risk of peat failure at the Application Site remained very low with no change observed from Section 7.5.2.1.4.

Pathway: Peat slide/Landslide.

Receptor: People, land and infrastructure.

Control Measures/Monitoring: No further mitigation, beyond that implemented and outlined in Section 7.5.2.1.4 are deemed necessary.

7.5.2.3 Remedial Phase

This section presents an assessment of likely significant effects resulting from the Applicant's proposed rehabilitation plans for the 5 no. bogs comprising the Application Site on the land, soils and geological environment.

7.5.2.3.1 *Soils/Land*

The overall aim of the rehabilitation plans is to put the bogs on a trajectory towards becoming naturally functioning peatlands. One of the main criteria which will be used to define the success of the rehabilitation plans will be the stabilisation of the former peat extraction activities and all ancillary works areas.

Natural colonisation is likely to form the basis for stabilisation of the current bare peat fields. Former peat extraction activities and all ancillary works areas across the Application Site have already re-vegetated naturally so it would be expected that the current bare peat fields present today would develop in a similar manner. Bord na Móna's rehabilitation plans identify two scenarios present at the Application Site which will determine any additional targeted revegetation or rewetting measures to be implemented. Firstly, in the case that significant acid peat remains at the surface there will be an assessment of the area to block drains and promote re-establishment of more typical bog communities. Secondly where alkaline peat is exposed at the surface the land is likely to revert to more alkaline poor fen/wetland or Birch dominated scrub areas.

Both of these scenarios will result in a positive change in land and soils/land across the Application Site. Land cover will change from bare peat fields to an array of scrub, woodland, wetland and peatland communities. However, the Application Site is unlikely to ever revert to the original raised bog which existed prior to the commencement of peat harvesting operations.

Pathway: Natural colonisation, rewetting measures and targeted revegetation.

Receptor: Land and Soils/land

Mitigation Measures: Any works undertaken as part of the rehabilitation plans will be completed in compliance with the licence from the EPA with the Applicant reporting to the EPA until the IPC Licence is surrendered.

The proposed Cutaway Bog Decommissioning and Rehabilitation Plans are bog specific, catering to the requirements of each individual bog given each bogs unique drainage and extraction history. Given that the objectives of the rehabilitation plans are to place the Application Site on a trajectory towards becoming a naturally functioning peatland, no mitigation measures are required except that the bog rehabilitation will be restricted to within the footprint of the Application Site.

7.5.2.3.2 *Peat-Land*

As discussed above, the overall aim of the rehabilitation plans is to put the bogs comprising the Application Site on a trajectory towards becoming naturally functioning peatlands. One of the main criteria which will be used to define the success of the rehabilitation plans will be the stabilisation of the former peat extraction activities and all ancillary works areas.

This stabilisation will be achieved primarily through natural colonisation of the former peat extraction activities and all ancillary works fields. These bare peat fields will likely develop in a similar manner to the areas of the Application Site which have been out of production for some time and are now covered in significant area of vegetation. The revegetation and rewetting of the Application Site will prevent surface erosion of peat which currently occurs in the degraded peatlands which cover the majority of the site.

Despite the best practice measures to be implemented as part of the rehabilitation plans it is very unlikely that the entire site will return to the same level of active peat forming conditions which likely existed at the Application Site prior to commencement of peat extraction activities and all ancillary works operations.

Pathway: Natural colonisation, rewetting measures and targeted revegetation.

Receptor: Peat

Mitigation Measures: Any works undertaken as part of the Remedial Phase will be completed as required by the licence from the EPA with Bord na Móna reporting to the EPA until the IPC Licence is surrendered.

7.5.2.3.3 *Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry*

During the Remedial Phase there will be some activity at the Application Site involving machinery and plant with which there is always a risk of accidental spillage of hydrocarbons. This activity will be greatest during the initial stages of rehabilitation when works associated with rewetting and revegetation such as drain blocking will be completed. Once this work has been completed there will only be very limited activity at the Application Site which will mainly comprise of non-intrusive monitoring and minimal repairs to peat blockages and/or additional fertiliser application to aid the development of successional communities.

Pathway: Infiltration through pore space in peat, subsoil and bedrock.

Receptor: Peat and subsoil, bedrock.

Mitigation Measures: The following environmental control measures will be implemented during the Remedial Phase in order to mitigate against leaks and spills:

- All machinery will be regularly checked and maintained prior to arrival at the site;
- Fuelling and lubrication of equipment will only be completed in designated areas and away from surface water features;
- Vehicles will never be left unattended during refuelling;
- All refuelling will occur in mobile fuel bowsers;
- Only dedicated, trained and competent personnel will complete refuelling operations;
- Fuel bowsers will be bunded to 100% capacity to prevent any spills;
- Storage tanks for bowsers and generators will be double-skinned;
- Waste oil and fluids will be collected in leak proof containers and removed from the site for disposal;
- Spill kits will be kept on site; and,
- All activities will be completed in accordance with current 'best practice' procedures.

7.5.2.3.4 *Peat Stability*

The rehabilitation plans aims to revegetate and rewet the Application Site. No additional peat will be removed from the Application Site, and no drainage will be installed during the Remedial Phase. The risk of peat failure at the Application Site will remain very low with no change observed from Section 7.5.2.1.4.

Pathway: Peat slide/Landslide.

Receptor: People, land and infrastructure.

Mitigation/Monitoring: No further mitigation, beyond that implemented and outlined in Section 7.5.2.1.4 are deemed necessary.

7.5.3 Residual Effect

7.5.3.1 Peat Extraction Phase (July 1988 – June 2020)

7.5.3.1.1 *Soils/land (Land take)*

Following the initial drainage, vegetation removal and clearance which occurred across much of the Application Site prior to 1988, the operations between 1988 and 2020 would not have resulted in any significant changes to land cover and there would have been no significant additional land take. The only effects in these areas postdating 1988 are minor annual topographic changes associated with peat removal for the majority of the Application Site.

Changes to soils/land would have occurred after 1988 where bogs were drained and stripped of vegetation however the change would have been consistent with the emerging trend established by the wider peat extraction activity. Peat extraction activities and all ancillary works first occurred in eastern Carranstown and the northwestern portion of Bracklin after 1988 and any subsequent changes to land and soils/land would have been limited to vegetation removal and slight topographic changes associated with peat extraction activities and all ancillary works. Meanwhile, Lisclogher West was drained by 1995, though never subject to peat extraction, and would have experienced a change in soils/land from remnant bog to a drained peatland.

These changes in soils/land are consistent with the trends associated with peat extraction activities and all ancillary works at the Application Site. By 1988, peat extraction activities and all ancillary works were well established at the Application Site and subsequent soils/land changes within the Application Site, i.e. the encroachment into vegetated (eastern Carranstown and the northwestern portion of Bracklin) and undrained areas (Lisclogher West), are consistent with the overall soils/land of the site.

The residual effect of the drainage and acrotelm removal post 1988 is a Permanent, Moderate , Negative Effect on the soils/land at the Application Site.

7.5.3.1.2 *Peat Extraction – Land*

Peat extraction activities and all ancillary works by their very nature will have a significant effect on peat and subsoils. The operations involve the permanent removal of peat from the Application Site resulting in a loss of peat depth at the Application Site. However, by 1988, peat extraction activities and all ancillary works was already well established at the Application Site, with ~1,626,398 tonnes of peat having been removed from the Application Site before 1988. Therefore, the continued removal of peat during the Peat Extraction Phase (July 1988- June2020) was consistent with the baseline trends which existed in 1988. For these reasons we consider the residual effect to be Permanent, Moderate, Negative Effect on peat subsoils at the Application Site.

7.5.3.1.3 *Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry*

No adverse effect occurred on the identified receptors. From review of the available Annual Environmental Reports (AER) it is understood that no significant fuel spills or wastewater discharges have occurred to groundwater prior to or since 2000, from any of the 5 no. bog units or associated ancillary activities.

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been implemented by the Applicant at the Application Site. These control measures break the pathway between the potential source and the receptor. The residual effect is considered to be - Negative, imperceptible, direct, short-term, unlikely effect on peat and subsoils and bedrock.

7.5.3.1.4 *Peat Stability*

No effect occurred on peat, subsoils and bedrock.

There was no residual effect peat, subsoils and bedrock.

7.5.3.1.5 Construction of Supporting Infrastructures and Buildings

Due to the small scale of the supporting infrastructures within the Application Site, it is considered that the residual effect to be Permanent, Imperceptible, Negative Effect on land, soils/land, peat and peat subsoils.

7.5.3.2 Current Phase (June 2020 – Present Day)

7.5.3.2.1 Land and Soils/land

A significant effect to the land/soil environment occurred following the cessation of the peat extraction activities and all ancillary works. The residual effect on soils/land is considered to be Permanent, Significant, Positive Effect on soils/land at the Application Site.

The residual effect on landcover and topography during this time period is considered to be imperceptible.

7.5.3.2.2 Peat Extraction

There was no residual effect on peat/subsoils.

7.5.3.2.3 Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry

No adverse effects were recorded. From review of the available AERs it is understood that no significant fuel spills or wastewater discharges have occurred to groundwater since summer 2020.

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been implemented. The residual effect is considered to be negative, imperceptible, direct, short-term, unlikely effect on peat and subsoils and bedrock.

7.5.3.2.4 Peat Stability

No residual effect on peat, subsoils and bedrock.

7.5.3.3 Remedial Phase

7.5.3.3.1 Land and Soils/land

The likely effect on land and soils/land following the implementation of the rehabilitation plan that is currently proposed is a Moderate, Positive, Direct, Long-Term effect on Land and Soils/land.

7.5.3.3.2 Peat-Land

The likely effect on peat following the implementation of the rehabilitation plan that is currently proposed is a Moderate, Positive, Direct, Permanent effect on peat as it will be wetter and closer to its natural condition with increases in vegetation cover across all bogs.

7.5.3.3.3 Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been

implemented. We consider the residual effect to be Negative, imperceptible, direct, short-term, unlikely effect on peat and subsoils and bedrock.

7.5.3.3.4 *Peat Stability*

No residual effect on existing peat stability.

7.5.4 Significance of Effects

7.5.4.1 Peat Extraction Phase (July 1988 – June 2020)

7.5.4.1.1 *Soils/land (Land take)*

For the reasons outlined above, it is considered that there no significant effects on soils/land as a result of the peat extraction activities and all ancillary works from July 1988 to June 2020 as the activity was consistent with emerging trends at the Application Site.

7.5.4.1.2 *Peat Extraction – Land*

For the reasons outlined above, it is considered that there has been a significant effect on the peat soils and subsoils at the Application Site as a result of the peat extraction activities and all ancillary works.

7.5.4.1.3 *Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry*

For the reasons outlined above, and with the implementation of the control measures it is considered that there has not been significant effects on peat, subsoil and bedrock.

7.5.4.1.4 *Peat Stability*

For the reasons outlined above, and with the application of the control measures outlined above, no significant effects on people, land and infrastructure have occurred.

7.5.4.1.5 *Construction of Supporting Infrastructures and Buildings*

For the reasons outlined above, and with the implementation of the building works in accordance with the planning permissions, it is considered that there has not been a significant effect on the peat soils and subsoils at the Application Site as a result of the construction of the supporting infrastructure.

7.5.4.2 Current Phase (June 2020 – Present Day)

7.5.4.2.1 *Land and Soils/land*

For the reasons outlined above no significant effects on land (to date, but it will change in vegetation cover over time), but there is a significant effect on soils/land, having changed from commercial peat extraction activities to recovering peatland habitats over an area of ~220 Ha.

7.5.4.2.2 *Peat Extraction*

For the reasons outlined above no significant effects on peat has occurred.

7.5.4.2.3 *Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry*

For the reasons outlined above, and with the application of the control measures outlined above, no significant effects on peat, subsoil and bedrock have occurred.

7.5.4.2.4 *Peat Stability*

For the reasons outlined above, and with the application of the control measures outlined above, no significant effects on people, land and infrastructure have occurred.

7.5.4.3 Remedial Phase

7.5.4.3.1 *Land and Soils/land*

For the reasons outlined above, it is considered that there will be a significant positive effect on land and soils/land as a result of the Remedial Phase.

7.5.4.3.2 *Peat-Land*

For the reasons outlined above, it is considered that there will be a significant effect on peat as a result of the Remedial Phase.

7.5.4.3.3 *Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry*

For the reasons outlined above, and with the implementation of the rehabilitation plans it is considered that there will be no significant effects.

7.5.4.3.4 *Peat Stability*

For the reasons outlined above, and with the implementation of the rehabilitation plans it is considered that there will be no significant effects.

7.5.5 Cumulative/In Combination Effects

7.5.5.1 Peat Extraction Phase (July 1988 – June 2020)

The geological impact assessment undertaken above in this chapter outlines those significant effects that have occurred within the Application Site as a result of the Peat Extraction Phase of the Project.

Due to the localised nature of the works associated with the peat extraction activities and all ancillary works within the Application Site boundary, the potential for significant cumulative effects with other local developments (located outside the site, including forestry, agricultural development) on the land, soils and geological environment would have been imperceptible. The only way the peat extraction activities and all ancillary works could have had cumulative effects with other off-site projects and plans is via the drainage and off-site surface water network, and this hydrological pathway is assessed in Chapter 8.

Third party and private sod peat cutting was occurring within the Application Site during this time period (1988 – 2020). However no significant cumulative effects on the land, soils and geological environment will have occurred due to:

- These works were not overlapping with any of the Applicants peat extraction activities and all ancillary works areas;
- The small area of the private peat extraction in comparison to the Applicant's operations;

- The volumes of peat removed by private peat extraction would be very small in comparison to the volumes removed the Applicant; and,
- Any drainage required by the private peat extraction would be of a very small scale when compared with that implemented by the Applicant.

As such no significant cumulative effects have occurred between the Applicant's operations and the third-party private peat cutting at the Application Site.

The Peat Extraction Phase (1988-2020) continued the peat extraction activities and all ancillary works and site preparation works which were completed previously at the Application Site between 1948 and 1988. The cumulative effect of the Peat Extraction Phase with the works completed prior to 1988 was the removal of 4,832,652m^3 of peat from the Application Site (1,951,677m^3 prior to 1988 and 2,880,975m^3 between 1988 and 2020). Therefore, there was a significant cumulative effect on peat within the Application Site.

7.5.5.2 Current Phase (June 2020 – Present Day)

The geological impact assessment undertaken above in this chapter outlines those significant effects have occurred within the Application Site as a result of the Current Phase of the Project.

As outlined in Section 7.5.3.2, the potential for significant cumulative effects with other local developments (located outside the Application Site (i.e. forestry, agriculture, and turbary peat extraction) on the land, soils and geological environment would have been imperceptible.

Due to the activity at the site being limited to stockpile removal and environmental monitoring during the Current Phase, the potential for cumulative effects arising from the Project are significantly decreased in comparison to the Peat Extraction Phase. Furthermore, third party sod peat extraction was terminated in June 2020, eliminating the potential for cumulative effects to arise.

As such no significant cumulative effects on the land, soils and geological environment have arisen during the Current Phase of the Project.

7.5.5.3 Remedial Phase

Due to the localised nature of the proposed works associated with the Remedial Phase within the Application Site boundary, the potential for significant cumulative effects with other local developments on the land, soils and geological environment will be imperceptible. There will be very limited movement of peat during the implementation of the Cutaway Bog Decommissioning and Rehabilitation Plans, and all proposed works will be local to the Application Site.

The only way the rehabilitation plans could have cumulative effects with other off-site projects and plans is via the drainage and off-site surface water network, and this hydrological pathway is assessed in Chapter 8.

The proposed decommissioning and rehabilitation plans for the Application Site will either coincide with or postdate the construction of the proposed Ballivor Wind Farm if this wind energy application is permitted.

7.5.5.4 Overall Cumulative Assessment

Due to the localised nature of the works associated with the peat extraction activities and all ancillary works within the Application Site boundary, the potential for significant cumulative effects with other local developments on the land, soils and geological environment would have been imperceptible. The only way the peat extraction activities and all ancillary works could have had cumulative effects with

other off-site projects and plans is via the drainage and off-site surface water network, and this hydrological pathway is assessed in Chapter 8. In summary:

- Peat extraction works have ceased;
- Any works associated with the Cutaway Bog Decommissioning and Rehabilitation Plan are small and localised within the Applicant's lands;
- The volumes of peat to be moved during the proposed wind farm development will be small in comparison to the large volumes of residual peat remaining on the Application Site; and,
- The permitted Bracklyn Wind Farm development does not overlap with any of the Applicant's lands, and therefore cannot have a cumulative effect on Soils and Geology.

Likely Residual Effect: No cumulative effects on soils and geology with off-site projects can over as there can be no overlapping outside of the Applicant's land.

There will be a slight cumulative effect with on Land, Soils and Geology for the proposed Ballivor Wind Farm, but the effect is limited by the small footprint of the wind farm relative to the overall Application Site area.

There will be a slight cumulative effect with on Land for the adjacent permitted Bracklyn Wind Farm and the proposed Ballivor Wind Farm, but the effect is limited by the small footprint of both wind farms relative to the overall Ballivor bogs area.

Significance of Effects: For the reasons outlined above, and with the implementation of the Decommissioning and Rehabilitation Plan we consider that there will be no significant cumulative effects on the Land, Soils and Geology environment.

7.5.6 Conclusions

The Application Site comprises 5 no. Bord na Móna bogs situated between the towns of Kinnegad and Delvin, Co. Westmeath. The bogs comprising the Application Site include Ballivor Bog to the south, Carranstown and Bracklin bogs towards the centre and Lisclogher and Lisclogher West bogs at the northern end of the site. The total Application Site area is approximately 2,421ha (24.21km^2). The current topography of the Application Site is relatively flat with an elevation range of between approximately 69 and 86mOD (metres above Ordnance Datum).

The baseline for the assessment of peat extraction activities and all ancillary works at the Application Site is 1988, and the Peat Extraction Phase covers the period between July 1988 and June 2020. The Applicant commenced works at Ballivor Bog Group in 1948. By 1988 peat extraction activities and all ancillary works were well established at Ballivor, Bracklin, Lisclogher and Carranstown bogs.

From a land, soils and geology perspective, the main impacts occurred during the early stages of drainage and peat extraction when the acrotelm (topmost living peat layer) was removed and the extraction of the peat (catotelm) began. These impacts occurred at different times across the Application Site ranging from drainage of Ballivor Bog in 1948 to drainage of Lisclogher West in the early 1990s. These site preparation works had been completed across the majority of the Application Site prior to 1988 and any subsequent activities in these areas would not have resulted in any significant changes, with the only effects resulting from minor annual topographic changes associated with peat removal, and other excavations associated with drainage maintenance. However, some areas of the Application Site have underwent site preparation works including vegetation clearance (eastern Carranstown and the northwestern section of Bracklin) and the installation of drainage (Lisclogher West) since 1988. These areas of the site would have experienced a change in soils/land with this change being consistent with the emerging trend established by the wider peat extraction activity within the Application Site. The peat extraction activities and all ancillary works are therefore considered to have resulted in a moderate negative effect on the land, soils and geological environment.

The proposed Cutaway Bog and Decommissioning and Rehabilitation Plans for the Application Site have also been assessed. The plans will typically involve the rewetting and revegetation of the drained bogs. These plans will have a positive effect on the soils/land across the Application Site, with rewetting of bare peat areas. The Application Site will never return fully to the original raised bog which was present before commencement of the peat extraction activities and all ancillary works, but the implementation of the Cutaway Bog and Decommissioning and Rehabilitation Plans will have a positive effect of land and soils/land, and on the coverage of vegetation at ground level across each of the bogs when compared to the 1988 baseline condition of the lands.

This assessment confirms that no cumulative effects on land, soil and geology environment have resulted from the Peat Extraction Phase. Similarly, no cumulative effects will result from the implementation of the decommissioning and rehabilitation plans, nor from the proposed wind farm development at the site. Effects on the land and soils environment will only occur as direct effects, local to the point of extraction/excavation, and therefore cannot extend beyond the boundary of the bogs.