APPENDIX 8-1

FLOOD RISK ASSESSMNENT

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PEAT EXTRACTION AT BALLYDERMOT, CO. KILDARE & CO. OFFALY

FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

BORD NA MÓNA BIOMASS LTD.

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

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Signed:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

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This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site specific and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO Ireland (MKO), on behalf of Bord Na Móna Biomass Ltd, to undertake a Flood Risk Assessment (FRA) for the peat extraction and ancillary activities at Ballydermot, located in Counties Kildare and Offaly. This FRA has been completed with respect to the following conditions:

- The current baseline hydrology of the Application Site; and,
- The implementation of the BnM Draft Cutaway Bog Decommissioning and Rehabilitation plans for the bogs which comprise the Application Site.

The Application Site forms part of the larger Allen Bog Group and covers an area of 5,448 hectares (ha). The Application Site comprises 14. no. bogs located on the Offaly-Kildare County border. The bogs include: Ticknevin, Glashabaun North, Glashabaun South, Codd 1, Codd 2, Ballydermot North, Ballydermot South, Blackriver, Lullymore, Lullybeg, Barnaran, Killina, Derrybrennan and Lodge. The Application Site is located 2.2 km southeast of Edenderry, 3.3 km west of Allenwood, 2.4 km north of Rathangan and 1.7 km east of Clonbullogue Village.

The Application Site has been extensively modified, cutover and drained as a result of the historic peat extraction activities dating back to 1935. Peat extraction formally ceased at the Application Site in June 2020.

The FRA is intended to support the remedial Environmental Impact Assessment (rEIAR) submitted as part of the substitute consent application. The Project is described in full in Chapter 4 of the rEIAR. For the purposes of this FRA, and consistent with the rEIAR, the various components are described and assessed using the following references: the 'Project', 'Peat Extraction Phase', 'Current Phase' and the 'Remedial Phase'.

This FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). This FRA is also completed in accordance with the flood policies and objectives as detailed in the local county development plans:

- Flood Risk Management policies (CAEP-53 to CAEP-63) and the policies in relation to Peatlands (CAEP-16 to CAEP20) detailed in the Offaly County Development Plan (2021-2027).
- Flood Risk Management policies and objectives (IN P5 and IN 31 to IN O38) and the policies and objectives in relation to surface water drainage (IN P4; IN O20 to IN O30) as detailed in the Kildare County Development Plan (2023-2029).

1.2 STATEMENT OF QUALIFICATIONS

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 area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

This FRA report was prepared by Nitesh Dalal, Conor McGettigan and Michael Gill.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India and over 1 year environmental consultancy experience in Ireland. Nitesh holds a M.Sc. in Environmental Science from University College Dublin (2024), a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 5 years' experience in environmental consultancy in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor has prepared the Land, Soils and Geology and Hydrology and Hydrogeology Chapters for substitute consent applications for historic peat extraction activities at BnM sites. Conor routinely completes Flood Risk Assessments for a wide variety of projects including wind farms, quarries and proposed residential developments. Conor has prepared FRA's for 20 no. wind farm developments on peatlands including Ballivor WF, Lemanaghan WF and Littleton WF. Conor has also prepared FRA's for the substitute consent applications for the historic peat extraction at these bogs.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 23 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects on peatlands in Ireland. He has substantial experience in surface water drainage design and SUDs design, flood modelling, and surface water/groundwater interactions. Michael has also worked on rEIARs for Cleanrath WF, 41 no. BnM bogs, the Ballivor Bog Group, and also for a number of quarry sites.

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the location and background details of the Application Site;
- Section 3 outlines the hydrological and geological characteristics of the Application Site and downstream surface water catchments and the existing site drainage;
- Section 4 presents the current site-specific flood risk conditions across the Application Site;
- Section 5 assesses the potential change in flood risk conditions (from the baseline) at the Application Site, and downstream of the bogs, as a result of the Cutaway Bog Decommissioning and Rehabilitation Plans, and also cumulatively with the proposed Ballydermot Wind Farm development; and,
- Section 6 presents the FRA report conclusions.

2. BACKGROUND INFORMATION

2.1 SITE LOCATION

The Application Site is located 2.2 km southeast of Edenderry, 3.3 km west of Allenwood, 2.4 km north of Rathangan and 1.7 km east of Clonbullogue Village. The Application Site comprises 14. no. bogs located on the Offaly-Kildare County border. The bogs include: Ticknevin, Glashabaun North, Glashabaun South, Codd 1, Codd 2, Ballydermot North, Ballydermot South, Blackriver, Lullymore, Lullybeg, Barnaran, Killina, Derrybrennan and Lodge.

The Application Site has a total area of 5,448 hectares (ha) measuring approximately 10 km in length from north to south, and approximately 10.7 km from east to west, at its widest point. The Grid Reference co-ordinates for the approximate centre of the Application Site are E 266159, N 225145 (Irish National Grid Coordinates). The boundaries of the individual bogs are mainly defined by hedgerows, watercourses and laneways.

The Application Site is generally accessible via the local road network branching from the R402 to the north, R403 to the east, the R401 to the west and the R414 to the south, with the latter cutting through the southeast of the site.

2.2 SITE TOPOGRAPHY

The Application Site is located in a low-lying landscape rural in character. The topography of the Application Site has changed through time due to the historic peat extraction. The topography of the Application Site was estimated to range between 75 and 88 mOD prior to the onset of any peat extraction or associated site preparation works (i.e. drainage and acrotelm removal). The topography has subsequently been lowered due to drainage related subsidence and in the historic peat extraction areas due to the removal of peat. The topography today ranges between 84 mOD at its highest point to approximately 68 mOD at its lowest point.

2.3 HISTORIC LAND USE CHANGES

The primary land-use change associated with peat extraction and ancillary activities occurs during the initial drainage of the bog and the removal of vegetation in advance of peat extraction. Drainage ditches were constructed in the surface of the bog and drained 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). After the Application Site was drained, vegetation was removed from the bog surface, leaving only bare peat fields between the drains. Around this time and in the years that followed, ancillary features were also constructed including railway infrastructure, workshops, works offices, welfare facilities, fuel storage, machine storage sheds, storage containers, local holding areas, a tiphead, peat loading bay and bagging plant, internal machine passes/tracks and drainage infrastructure (drains, silt ponds and pumps).

During the Peat Extraction Phase of the Project, only minimal land use change occurred which was predominantly related to minor annual topographic changes caused by ongoing peat extraction and ancillary activities. Peat extraction and ancillary activities also prevented the revegetation and rehabilitation of the bog at that time, with the bog only beginning to rehabilitate once peat extraction ceased. Any land changes at the Application Site have been investigated using available aerial imagery dating from 1973 to 2020 (i.e. the year of the cessation of peat extraction). Bord na Móna Annual Reports were also consulted to help develop the timeline of changes across the Application Site.

The timing of the initial site preparation works (vegetation clearance and drainage insertion) varied across the Application Site. Site preparation works were first commenced at the Application Site in 1935 at Lullymore, Lullybeg and Killina bogs, whilst the last bogs on which

site preparation works commenced were Codd 2 and Ticknevin Bog in 1973 (estimated date based on available aerial imagery). Peat extraction also commenced at Lullymore, Lullybeg and Killina bogs in 1935, with these bogs being the first to be subject to extraction at the Application Site. Ticknevin was the last bog within the Application Site on which peat extraction commenced in 1981 (estimated date based on available aerial imagery). Peat extraction ceased at the Application Site in 2020, though it had ceased prior to this time at Lullymore (1992), Lullybeg (2004), Derrybrennan (2015), Ticknevin and Codd 2 bogs (2019).

Table A presents a summary of the peat extraction timeline at each of the bogs comprising the Application Site.

Table A: Peat Extraction Timeline at the Application Site

Bog Unit	Bog Area (ha)	Commencement of Site Preparation Works (vegetation clearance and drainage insertion)	Extraction Commenced	Extraction Ceased
Ballydermot North	456	1946	1950	2020
Ballydermot South	425	1946	1950	2020
Blackriver	732	1947	1950	2020
Barnaran	486	1954	1959	2020
Lullybeg	267	1935	1935	2004
Lullymore	175	1935	1935	1992
Lodge	407	1947	1953	2020
Killina	257	1935	1935	2020
Derrybrennan	132	1959	1969	2015
Glashabaun North	515	1947	1951	2020
Glashabaun South	601	1947	1951	2020
Ticknevin	456	1973*	1981*	2019
Codd 1	247	1959*	1973*	2020
Codd 2	290	1973*	1981*	2019

**Estimated date indicated by available aerial imagery*

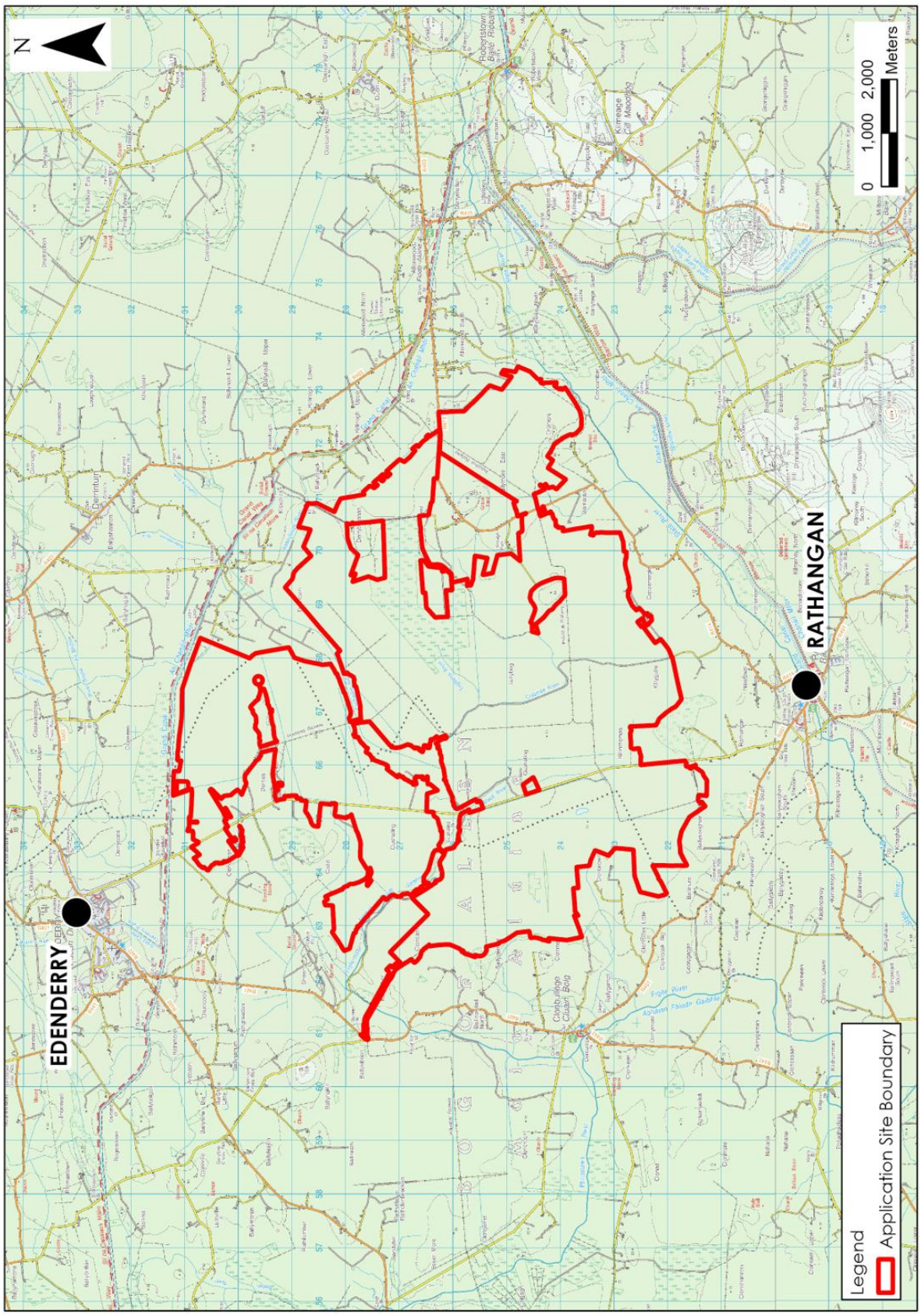

Figure A: Site Location Map

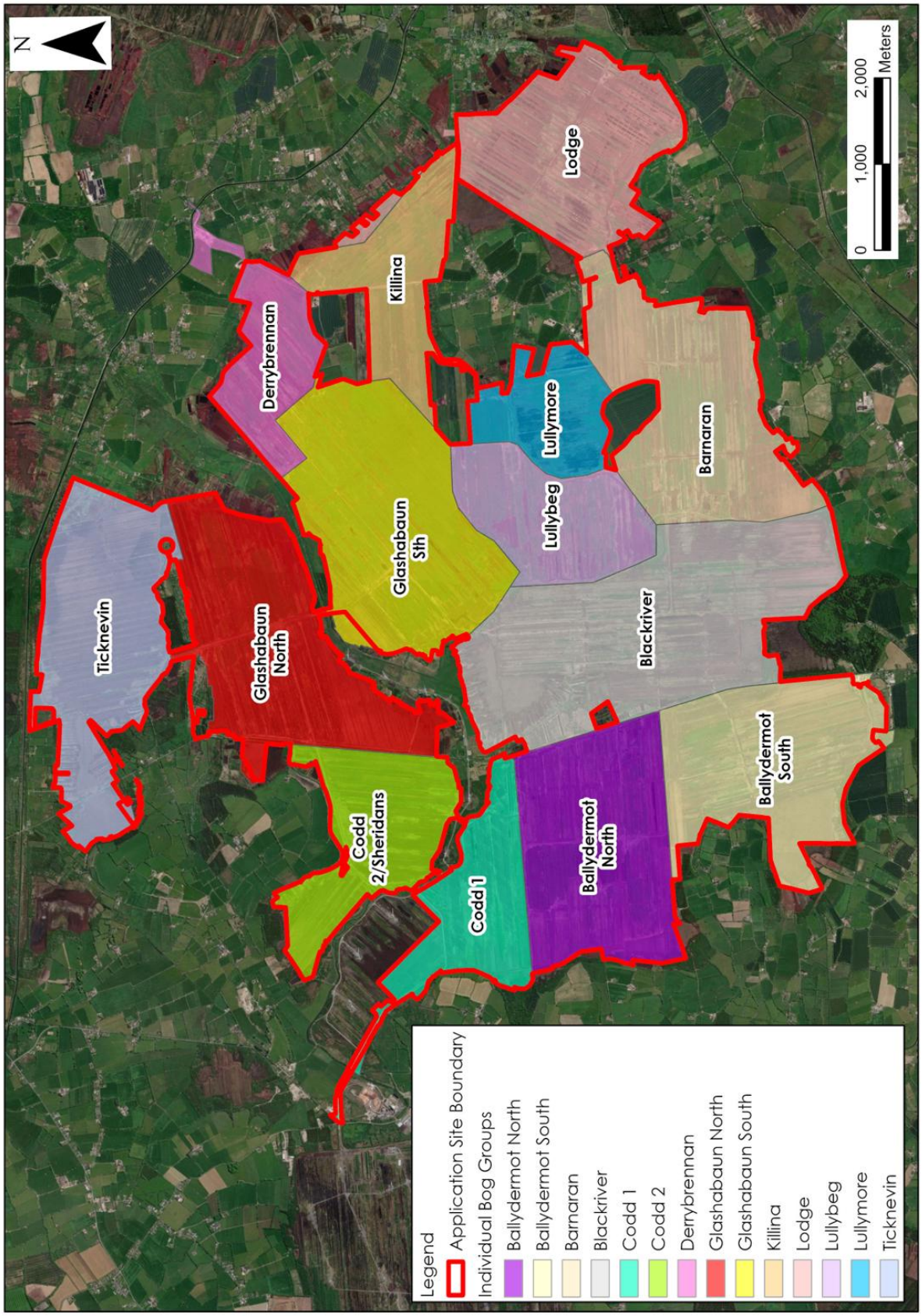

Figure B: Individual Bogs Comprising the Application Site

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

This section gives an overview of the hydrological and geological characteristics in the area of the Application Site.

3.1 HYDROLOGY

3.1.1 Regional and Local Hydrology

Regionally the vast majority of the Application Site is located in the River Barrow surface water catchment within Hydrometric Area 14 of the South Eastern River Basin District. A small area in the north of the Ticknevin Bog located in the River Boyne surface water catchment within Hydrometric Area 07 of the Eastern River Basin District.

Regionally, within the River Barrow surface water catchment, the Application Site is located in 3 no. river sub-catchments. The majority of the Application Site is located within the Figile_SC_010 river sub-catchment, the southwest of the Application Site is located within the Figile_SC_020 river sub-catchment and the south and southeast are located within the Slate_SC_010 river sub-catchment.

Within the Figile_SC_010 river sub-catchment, the Application Site is mapped in 3 no. WFD river sub-basins: the Abbeylough_010, Figile_020 and Figile_030 WFD river sub-basins.

- Within the Abbeylough_010 WFD river sub-basin, the Abbeylough Stream (EPA Code: 14A01) flows to the west along the northern boundary of Derrybrennan Bog where it discharges into the Figile River (EPA Code: 14F01).
- Within the Figile_020 WFD river sub-basin, the Figile River flows to the west, between Glashabaun South and Glashabaun North bogs. A tributary of the Figile River, referred to by the EPA as the Lullymore East Stream (EPA Code: 14L11) is mapped to flow to the west from the western boundary of Lodge Bog. This stream dissects the northern sections of Lullymore and Lullybeg bogs and forms the boundary between Blackriver Bog to the west and Glashabaun South Bog to the east before it discharges into the Figile River. A smaller stream, referred to by the EPA as the Lullybeg Stream (EPA Code: 14L13), flows around the eastern, southern and western perimeter of Lullybeg Bog before it discharges into the Lullymore East Stream. Another stream, assigned the same name (Lullybeg) on the EPA database, flows from south to north through the western section of Blackriver Bog before it discharges into the Figile River.
- Within the Figile_030 WFD river sub-basin, the Figile River flows to the northwest, separating Codd 1 in the south from Codd 2 in the north. A small tributary of the Figile River, the Clonbrown Stream (EPA Code: 14C32) is mapped to flow to the north along the eastern boundary of Ballydermot North Bog before it discharges into the Figile River close to the east of Codd 1 Bog. The EPA also map a stream referred to as the Cloncant Stream (EPA Code: 14C41) to flow to the southwest, dissecting Codd 2 Bog before discharging into the Figile River. Further north, Ticknevin Bog is drained by 2 unnamed no. streams which merge at its southern boundary to form the Codd Stream (EPA Code: 14C44). The Codd Stream flows to the south, along the northwestern boundary of Glashabaun North before it flows to the west and discharges into the Ballyleakin Stream (EPA Code: 14B22). This stream discharges into the Figile River to the northwest of Codd 1 Bog.

Within the Figile_SC_020 river sub-catchment, the Application Site is mapped within the Figile_050 WFD river sub-basin. Within this WFD river sub-basin Figile River is mapped to flow to the south ~1.6 km west of the Application Site. Several streams are mapped to originate at the western boundary of the Application Site. The Clonbulloge Stream (EPA Code: 14C53) to the west of Ballydermot North Bog and the Ballygarrett Stream (EPA Code: 14B30) to the west

of Ballydermot South Bog. These streams merge just upstream of their confluence with the Figile River.

Within the Slate_SC_010 river sub-catchment, the Application Site is mapped within the Slate_050 and Slate_060 WFD river sub-basins. Within the Slate_050 WFD river sub-basin, the Killinagh Upper Stream (EPA Code: 14K17) is mapped to flow along the southeastern boundary of Lodge Bog before it discharges into the Slate River (EPA Code: 14S01). A second tributary of the Slate River is mapped to originate at the western boundary of Lodge Bog, referred to by the EPA as the Drumsru Stream (EPA Code: 14D19). The Slate River flows to the southwest, ~80m from the south of Lodge Bog. Within the Slate_060 WFD river sub-basin, the Slate River is located ~1 km south of Barnaran Bog. There are no watercourses mapped in the immediate vicinity of the Application Site within this WFD river sub-basin.

Further downstream, the Slate River flows through Rathangan and confluences with the Figile River ~6.6 km southwest of the Application Site. The Figile River continues to flow to the south before it discharges into the River Barrow to the north of Monasterevin.

Within the River Boyne surface water catchment, the Application Site is located within the Boyne_SC_010 river sub-catchment and the Boyne_010 WFD river sub-basin. The Clonkeen Stream (EPA Code: 07C36) is mapped to flow along the northern boundary of Ticknevin Bog before it flows to the northwest and discharges into the River Boyne (EPA Code: 07B04) ~2 km north of the Application Site. The River Boyne continues to flow to the northwest before it veers to the northeast close to its confluence with the Yellow River (~7 km northwest of the Application Site).

A regional hydrology map is included as **Figure C**.

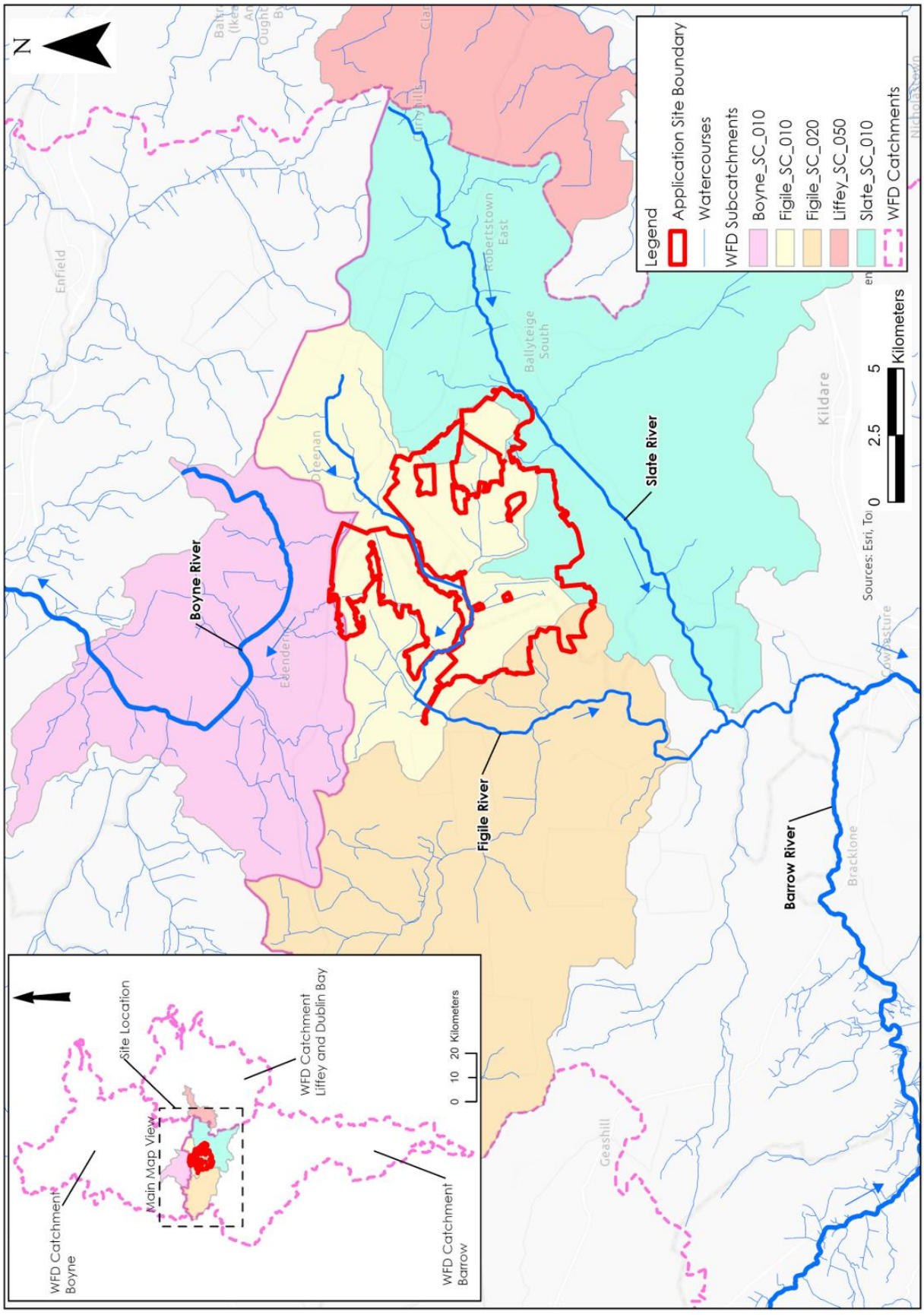

Figure C: Regional Hydrology Map

3.1.2 Rainfall and Evaporation

Long term Average Annual Rainfall (AAR) and evaporation data were sourced Met Éireann (www.met.ie).

The closest rainfall station is located at Lullymore (AGR.RES.STN) situated adjacent to Lullymore Bog. The data from this rainfall station indicates an AAR of 834mm. Met Éireann also provide a grid of AAR for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the 30-year AAR (1991-2020) assigned to location E267000, N226000 (close to the centre of the Application Site) is 880 mm/yr.

The closest synoptic station where the average Potential Evapotranspiration (PE) is recorded is at Mullingar, approximately 30 km northwest of the Application Site. The long-term average PE for this station is 445.8 mm/yr. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the Application Site is estimated as 423.5 mm/yr (which is 0.95 × PE).

The Effective Rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the Application Site is calculated as follows:

Effective rainfall (ER) = Average Annual Rainfall (AAR) – Actual Evaporation (AE)

= 880 mm/yr – 423.5 mm/yr

ER = 456.5 mm/yr

Based on groundwater recharge coefficient estimates from the GSI (www.gsi.ie), the Application Site has a groundwater recharge coefficient of 4%. This means that the hydrology of the Application Site is characterised by very high surface water runoff rates and very low groundwater recharge rates. This is supported by observations made during site walkover surveys with the Application Site and the surrounding area containing a high density of surface water features (field drains and main bog drains within the Application Site and streams in the surrounding lands). Therefore, conservative annual recharge and runoff rates for the Application Site are estimated to be 18.26 mm/yr and 438.24 mm/yr respectively.

The water balance presented above is unlikely to have changed significantly from 1988 to the data period covered by the 1991-2020 Met Éireann data. Raised peat bogs are an excellent store of water. Pre-development when the storage capacity of the peat is reached surface water runoff will occur whereby rainwater would have moved slowly across the bog before discharging to fens and other wetland habitats at the bog margin. In the July 1988 baseline and in the present day, however, drainage channels act as preferential flowpaths which allow surface water to leave the Application Site. These channels generally have a low gradient and the on-site drainage systems have some inherent storage and attenuation, and likely release runoff water at slightly higher rates than that of pre-development times. Meanwhile, the runoff rates between the July 1988 baseline and the present day are unlikely to have changed significantly as drainage had been inserted at the Application Site by July 1998. There may have been a very slight decrease in runoff rates due to the upgrade in silt ponds at the Application Site in the 1990s.

Met Éireann's Translate Project (https://www.met.ie/science/translate) provides projections for a range of future climate change scenarios, as Ireland's future climate will depend on global greenhouse gas emissions reductions. The severity of any future climate change will depend on the degree of future warming. In a 1.5°C world, average winter and summer precipitation rates are projected to be 3.08 mm/day and 2.23 mm/day respectively in Co. Offaly. Meanwhile, in a 4°C world, the average winter and summer precipitation rates in Co. Offaly are projected to be 3.37 mm/day and 2.02 mm/day respectively. In a 1.5°C world, average winter and summer precipitation rates are projected to be 2.78 mm/day and 2.07mm/day respectively in Co. Kildare. Meanwhile, in a 4°C world, the average winter and summer

precipitation rates in Co. Kildare are projected to be 3.03 mm/day and 1.89 mm/day respectively.

Table B below presents return period rainfall depths for the area of the Application Site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year).

Table B: Application Site - Return Period Rainfall Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	4.4	8	14.9	21.9
15 mins	6.4	11.2	19.8	28.3
30 mins	8.1	13.8	23.8	33.3
1 hours	10.3	17	28.5	39.1
6 hours	19.3	29.4	45.4	59.4
12 hours	24.5	36.3	54.3	69.8
24 hours	31.2	44.8	65.1	82
2 days	37.6	52.7	74.5	92.3

**Estimated using growth factors as data not available from (www.met.ie)*

3.2 SOILS AND SUBSOILS

The soils and subsoils present at the Application Site have been verified during site walkover surveys and intrusive site investigations. The results of these site investigations are detailed in Chapter 7 of the rEIAR.

The published Teagasc soils map (www.gsi.ie) for the local area shows that the Application Site (www.gsi.ie) is overlain almost exclusively by cutaway peat (Cut). A small area in the northeast of Derrybrennan Bog which is mapped as mainly basic poorly drained mineral soils (BminPD). Mineral Alluvium (AlluvMIN) is mapped along the major regional rivers including the Slate River to the south of Lodge Bog and the Figile River near Clonbulloge village. Alluvium is also mapped along the Figile River as it flows between Glashabaun North and Derrybrennan bogs.

The GSI subsoils map (www.gsi.ie) for the local area shows that Application Site is underlain almost exclusively by cutover peat. Small areas in the northeast of Derrybrennan Bog mapped to be underlain by till derived from limestones (TLs).

Overall peat depths recorded during the peat probing investigation ranged from 0 to <6m with an average of 1.6m. Approximately 90% of peat depth probes recorded peat depths of less than 3.0m. A number of localised readings were recorded where peat depths were >3.5. Peat is underlain lacustrine clay deposits.

3.3 BEDROCK GEOLOGY

A total of 5 no. bedrock geological formations are mapped to underlie the Application Site (www.gsi.ie). These include the Ballyadams Formation (crinoidal wackestone/packstone limestone), the Lucan Formation (dark limestone and shale (`calp')), Allenwood Formation (thick-bedded limestone, locally peloidal), the Waulsortian Limestones (massive, unbedded lime-mudstone) and the Boston Hill Formation (nodular and muddy limestone and shale).

Further details on the local geology are provided in Chapter 7 of the rEIAR.

3.4 DESIGNATED SITES

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), candidate Special Areas of Conservation (cSAC), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs). No designated sites are mapped within the Application Site boundary.

The Long Derries, Edenderry SAC and pNHA (Site Code: 000925) partially overlaps with the Application Site (i.e. Glashabaun North). The Long Derries, Edenderry SAC/pNHA is located in the lands between the cutover bogs at Glashabaun North and Ticknevin. The SAC/pNHA comprises a gravel (esker) ridge) which is designated for orchid-rich calcareous grasslands and supports several species of conservation interest (refer to Chapter 6). The Long Derries was formerly used as a BnM gravel pit during the construction of the railway network at the Application Site.

The Grand Canal pNHA (Site Code: 002104) is also mapped adjacent to the north of the Ticknevin Bog. The Application Site does not encroach upon the mapped extent of this pNHA.

The River Barrow and River Nore SAC (Site Code: 002162) is located ~9.8 km southwest of the Application Site. This SAC is located downstream and downgradient of the Application Site. The length of the hydrological flowpath between the Application Site and the SAC is ~17 km.

The River Boyne and River Blackwater SAC (Site Code: 002299) and SPA (Site Code: 004232) is located ~14 km to the north of the Application Site. This SAC/SPA is downstream of the Application Site along the River Boyne. The length of the hydrological flowpath between the boundary of the Application Site and the SAC/SPA is ~22 km. However, it is noted that there is no surface water outfall from the bog with this catchment. All water from Ticknevin Bog is directed to the south and discharges via several settlement ponds to the Codd Stream, a tributary of the Figile River.

Other designated sites in the vicinity of the Application Site are identified in Chapter 8 Section 8.4.14 of the rEIAR.

3.5 SITE DRAINAGE

Due to peat extraction activities at the Application Site, the site has been artificially drained in order to lower the peat water table. Drainage ditches were first inserted into the upper surface of each of the bogs comprising the Application Site prior to the commencement of peat extraction. The timing of drainage insertion varied across the Application Site with Killina, Lullybeg and Lullymore being the first bogs on which drainage commenced in 1935. The latest bogs to be drained were Ticknevin and Codd 2 which had been drained by 1973.

Currently surface water (or runoff water) is drained from the Application Site via a network of field drains typically spaced at 15 to 20m intervals, piped drains, main drains, headland drains, and silt ponds. Much of the site is drained by gravity however there are 15 no. pumping station located around the Application Site. These include pumping stations in each of the following bogs; Ticknevin Bog, (P37/010), Glashabaun North Bog(P37/008),Codd 1 Bog (P37/014), Ballydermot South (P37/011), Ballydermot North Bog (P37/012), Blackriver Bog (P37/007) and Lodge Bog (P17/013) (the pumps at Lodge Bog have been decommissioned). Following peat extraction activities, drainage by gravity in these areas of the site was no longer feasible as the water level in the surrounding streams were higher than the water level within the site. The field drains discharge to main drains which flow via gravity, or are pumped, towards the perimeter of the site where they discharge to larger headland drains. These headland drains eventually discharge to large silt (settlement) ponds. The silt ponds are used to trap sediment and prevent elevated levels of suspended sediment arising in effluent from the drained peatland. Treated surface water is then discharged at outfall points where the

effluent flows into off-site drainage channels which in turn discharge into the local stream and river network.

The drainage system has been operating in accordance with this existing Integrated Pollution Control (IPC) licence, with all drainage water from the bogs being discharged via an appropriately designed silt pond treatment arrangement. Drainage of the Application Site is currently operating under IPC licence from the EPA (Reg. P0503-01).

A detailed hydrological audit of flowpaths from each bog to its eventual discharge point at the regional catchment scale was completed for each of the bogs comprising the Application Site. The drainage system is summarised on **Figure D** and the flowpaths from each bog to downstream watercourses are shown on **Figure E**.

There are a total of 26 no. surface water discharge locations across the Application Site. These discharge locations are situated downstream of settlement ponds, with the treated and attenuated water from the bog drainage system being discharged to outfall drains which in turn discharge to local watercourses. The vast majority of the bogs comprising the site discharge directly into the Figile River or smaller tributary streams which in turn discharge into the Figile River. Meanwhile, the drainage from Lodge Bog discharges into a local stream which is a tributary of the Slate River. Downstream of the Application Site the Slate River also discharges into the Figile River. Therefore, all surface waters from the Application Site eventually end up in the Figile River, and the River Barrow further downstream.

Table C below presents the respective outfalls and their pipe elevations. Outfalls generally discharge into outfall drains with the flowpaths along these outfall drains to the nearest EPA mapped watercourse ranging from 15m to 1.32 km. Note that SW68, SW69 and SW70 in Ticknevin Bog are located along an unnamed EPA mapped watercourses. These watercourses have been integrated into the existing bog drainage system. Similarly, SW65 and SW65A in Blackriver Bog are located in close proximity (15-20m) to the EPA mapped Lullybeg 14 Stream. Note that this stream is mapped to extend into the bog and has also been integrated into the existing bog drainage system, upstream of these outfall locations.

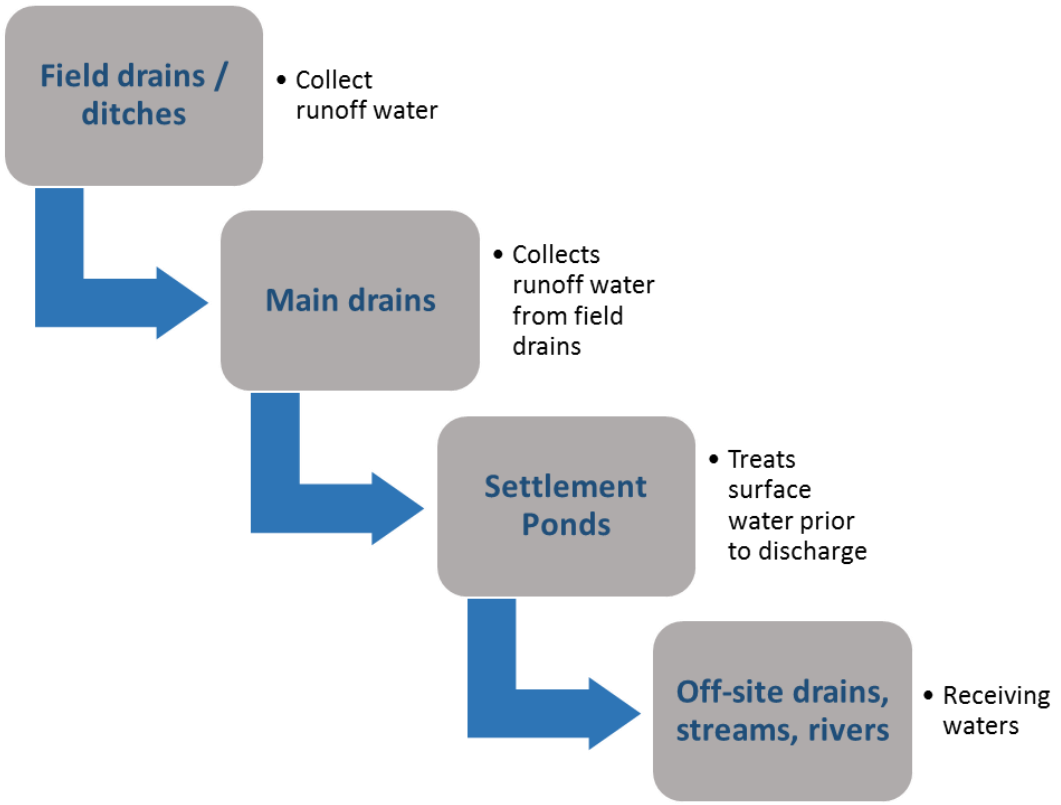

Figure D: Process Flow Diagram for the Existing Site Drainage System

Table C: Bord na Móna Outfall Elevations

Outfall ID	Easting	Northing	Outfall Elevation (mOD)	Bog Name	Receiving EPA Mapped Watercourse	Length of Flowpath from Outfall to Watercourse (m)
SW45	663527.78	726653.71	66.16	Codd South	Figile River	95
SW45A	662256.19	726971.90	68.40	Codd South	Figile River	1,325
SW47	669131.73	728060.14	72.70	Glashabaun South	Figile River	780
SW48	668758.20	728217.78	71.12	Glashabaun South	Figile River	1,040
SW49	668988.62	728084.73	71.94	Glashabaun South	Figile River	1,190
SW50	669212.32	727966.35	72.47	Glashabaun South	Figile River	1,300
SW51	666403.40	726805.68	67.45	Glashabaun South	Figile River	320
SW52	666465.51	726531.67	67.30	Glashabaun South	Lullymore East Stream	380
SW53	666612.12	726351.97	67.63	Glashabaun South	Lullymore East Stream	240
SW56	668389.31	725645.95	68.36	Lullybeg	Lullymore East Stream	20
SW60	673194.35	724739.05	72.46	Lodge	Killinagh Upper Stream	140
SW61	673091.43	724411.58	71.43	Lodge	Killinagh Upper Stream	55
SW62	667936.06	723654.44	67.94	Barnaran	Lullybeg Stream	480
SW65	665875.07	724954.12	67.0	Blackriver	Lullybeg Stream	15
SW65A	665458.68	725293.01	66.54	Blackriver	Lullybeg Stream	20
SW67	664392.87	725678.79	66.91	Codd South	Figile River	450
SW67A	664442.55	723287.69	67.50	Ballydermot South	Ballygarrett Stream	140
SW68	666729.17	729690.42	70.66	Ticknevin	Unnamed Stream	0
SW69	666201.27	729620.71	71.64	Ticknevin	Unnamed Stream	0
SW70	665703.89	729959.63	69.58	Ticknevin	Unnamed Stream	0
SW71	664995.88	728219.88	69.26	Glashabaun North	Cloncant Stream	25
SW72	664234.47	727749.54	68.22	Codd North	Cloncant Stream	20
SW73	663537.72	727291.52	66.42	Codd North	Cloncant Stream	40
SW74	663647.75	726742.12	65.91	Codd North	Figile River	55
SW75	663766.63	726597.55	65.81	Codd North	Figile River	130
SW76	664406.66	726320.81	65.59	Codd North	Figile River	140

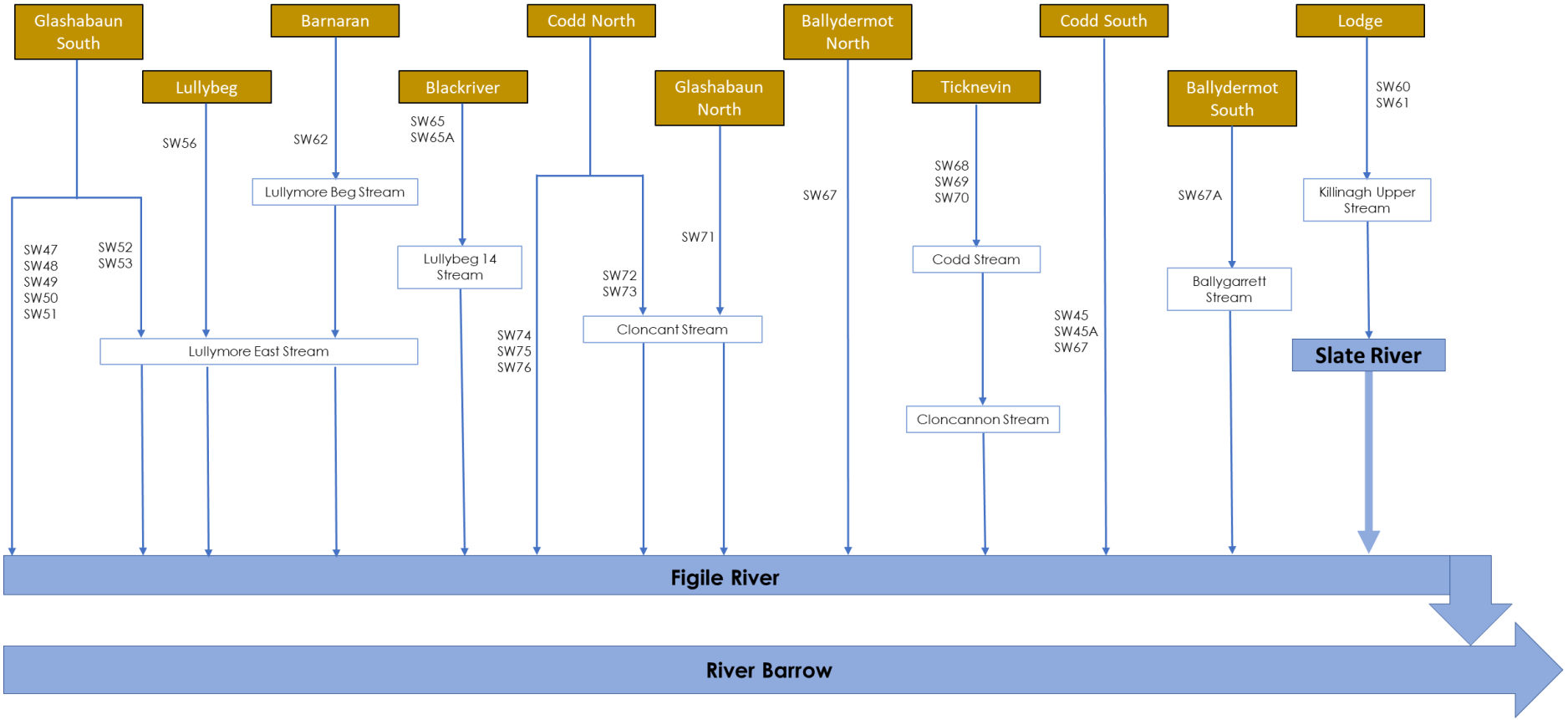

Figure E: Flow Pathways from Bogs Comprising the Application Site

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

4.2 FLOOD RISK ASSESSMENT PROCEDURE

This section of the report details the site-specific flood risk assessment carried out for the site and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the development. As per the relevant guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development; and,
- *Detailed flood risk assessment* – quantitative appraisal of potential risk to a proposed development.

As per the Guidelines, there are essentially two major causes of flooding:

Coastal flooding which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:

- High tide level;
- Storm surges caused by low barometric pressure exacerbated by high winds (the highest surges can develop from hurricanes); and,
- Wave action, which is dependent on wind speed and direction, local topography and exposure.

Coastal Flooding is not applicable to the Application Site.

Inland flooding which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:

- Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows

and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall and eventually enters a piped or natural drainage system.

- River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent low-lying areas (the floodplain). This can occur rapidly in short steep rivers or after some time and some distance from where the rain fell in rivers with a gentler gradient.

- Flooding from artificial drainage systems results when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity and the system becomes blocked, and / or cannot discharge due to a high-water level in the receiving watercourse. This mostly occurs as a rapid response to intense rainfall. Together with overland flow, it is often known as pluvial flooding. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during recent summers.

- Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from interactions of site-specific factors such as tidal variations. While water level may rise slowly, it may be in place for extended periods of time. Hence, such flooding may often result in significant damage to property rather than be a potential risk to life.

- Estuarine flooding may occur due to a combination of tidal and fluvial flows, i.e. interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will prevent water flowing out to sea tending to increase water levels inland, which may flood over river banks.

The Flood Risk Management Guidelines provide direction on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management and the core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for inland and coastal flooding.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined within the guidelines:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and,

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Once a flood zone has been identified for a site, the guidelines set out the different types of development appropriate to each identified zone (pg 25, Table 3.1 of the Guidelines). Exceptions to the restriction of development due to potential flood risks are provided for

through the application of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated by the applicant.

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes.

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. Plan making Justification Tests are made at Plan/Policy development stage such as County Development Plans, or Local Area Plans.

- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land. For example, application of Development Management Justification Test would be required at a site-specific level, such as for this FRA assessment, if a Justification Test is required.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted.

The local 6" base map for the local area states that the Figile River in the vicinity of the Application Site is "liable to flood". The areas identified as liable to flooding are located to the south of Glashabaun North and Codd 2 bogs and to the north of Blackriver and Codd 1 bogs. Downstream of the Application Site, text on the local 6" base maps also record lands which are "liable to flood" along the length of the Figile River.

Lands which are "liable to flood" are also recorded along the EPA mapped Ballygarrett Stream downstream of the Application Site and to the southeast of Clonbullogue.

Meanwhile, lands along the Slate River are also mapped as liable to flooding downstream of Rathangan.

4.3.2 Soils Maps - Fluvial Maps

A review of the soil types in the vicinity of the Application Site was undertaken as soils can be a good indicator of past flooding in an area. Based on the EPA/GSI soil map for the area it appears that the Application Site is predominately underlain by cutover peat. Historically this site would have been prone to high water table levels with poorly draining and waterlogged peaty soils. However, extensive drainage has occurred in the area for peat production and extraction.

Due to past flooding of rivers deposits of transported silts/clays referred to as alluvium build up within the floodplain and hence the presence of these soils is a good indicator of potentially flood-prone areas. Based on the EPA/GSI soil map, alluvium soils (fluvial deposits) are recorded in the northeast of the Figile River corridor, between Glashabaun North and Glashabaun South and Derrybrennan bogs. The mapped extent of the alluvial deposits do not encroach upon the Application Site.

Alluvial soils are also mapped along the Figile River near Clonbulloge and along the Ballyragget and Clonbulloge streams to the west of Ballydermot South and Ballydermot North bogs respectively.

Alluvial soils are also mapped to the south of Lodge Bog on the Slate River. However, no alluvium is mapped within the Application Site.

4.3.3 OPW Past Flood Events Mapping

To identify those areas as being at risk of flooding, the OPW's Past Flood Events Map (www.floodmaps.ie) was consulted.

No recurring or historic flood events are mapped by the OPW within the Application Site. However, there are few recurring flood incidence and past flood event mapped around the Application Site. The flooding events recorded around the Application Site are:

- Recurring flood event (Flood ID: 1486) at Cloncumber Pluckerstown is mapped ~2km south of the Lodge Bog;
- Recurring flood event (Flood ID: 1485) at Slate Cloncurry is mapped ~1.8km south of the Barnaran Bog;
- Recurring flood event (Flood ID: 1484) at Slate Rathangan is mapped ~1.9km south of the Blackriver Bog;
- Recurring flood event (Flood ID: 2772) at Figile Derrygarran is mapped ~1.9km southwest of the Ballydermot South Bog;
- Recurring flood event (Flood ID: 2769) at Figile Clonbulloge is mapped ~1.8km west of the Ballydermot North Bog;
- Past flood event (Flood ID: 10599) at Philipstown Clonbullogue on 16/08/2008 is mapped ~1.6km west of the Ballydermot North Bog;
- Recurring flood event (Flood ID: 2785) at Blundell Aqueduct, Edenderry is mapped ~800m northwest of the Ticknevin Bog;
- Past flood event (Flood ID: 2786) at Grand Canal, Edenderry on 01/01/1989 is mapped ~1km northwest of the Ticknevin Bog; and,
- Recurring flood event (Flood ID: 1280) at Killinagh is mapped ~1.6km east of the Killina Bog.

The closest mapped recurring flood events are located approximately 800m north of Ticknevin Bog at Blundell Aqueduct (Flood ID: 2785). The local area engineers report states that low lying land floods here every year after heavy rain due to inadequate drainage and flat terrain. A recurring flood event is also mapped along the Figile River at Clonbulloge (Flood ID: 2769), where the Figile River is noted to flood most winters. A recurring flood event is also mapped further downstream along the Figile River at Derrygarran (Flood ID: 2772). A recurring flood event is mapped to the east of the Application Site at Killinagh (Flood ID: 1280). The local area engineers report states that this area floods every year after heavy rainfall as a culvert of a stream under the Grand Canal can't take the volume of water. Recurring flood events are also recorded along the Slate River at Cloncurry (Flood ID: 1485) and Rathangan (Flood ID: 1484).

The OPW Past Flood Events Map for the local area is included as **Figure F** below.

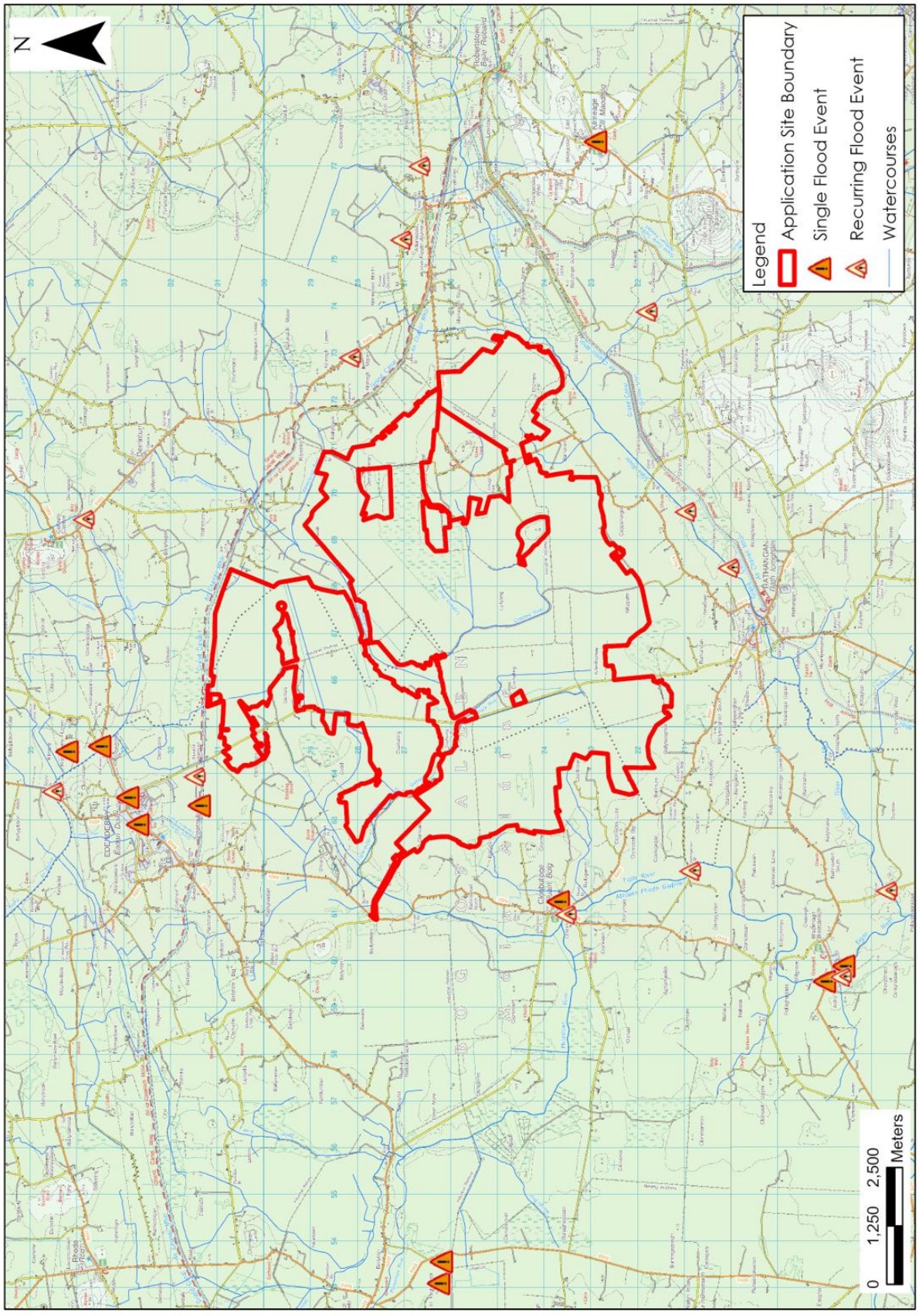

Figure F: OPW Past Flood Events Map (www.floods.ie)

4.3.4 Arterial Drainage Schemes

Arterial Drainage Schemes were carried out under the Arterial Drainage Act, 1945 to improve land for agriculture and to mitigate flooding. Rivers, lakes weirs and bridges were modified to enhance conveyance, embankments were built to control the movement of flood water and various other work was carried out under Part II of the Arterial Drainage Act, 1945. The purpose of the schemes was to improve land for agriculture, to ensure that the 3 – year flood was retained in bank this was achieved by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows. Flood protection in the benefiting lands was increased as a result of the Arterial Drainage Schemes.

According to OPW mapping (www.floodinfo.ie) the northern section of Ticknevin Bog is mapped as "Benefiting Lands" and an ADS channel is located along the northern boundary of the bog.

4.3.5 Drainage Districts

Drainage Districts were carried out by the Commissioners of Public Works under a number of drainage and navigation acts from 1842 to the 1930s to improve land for agriculture and to mitigate flooding. Channels and lakes were deepened and widened, weirs removed, embankments constructed, bridges replaced or modified and various other work was carried out. The purpose of the schemes was to improve land for agriculture, by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows.

According to OPW mapping (www.floodinfo.ie) the Figile River and the Slate River in the vicinity of the Application Site form part of these drainage districts. However, the benefitted land does not include the Application Site.

4.3.6 GSI 2015/2016 Surface Water Flooding

The GSI Winter (2015/2016) Surface Water Flooding map shows areas of fluvial and pluvial flood extents during the Winter 2015/2016 flood event, which was the largest recorded flood event in many areas. This surface water flood map is available to view at www.floodinfo.ie.

The flood map for this event does record some historic surface water flooding within the Application Site. These historic flood zones are located in the west of Glashabaun North, in the north/northeast of Codd South, in the north and east of Ballydermot North and towards the centre of Lodge Bog. Smaller localised flooding is also mapped in Derrybrennan, Blackriver and Lullymore bogs. These historic flood zones correspond with some of the lower lying peat fields in the Application Site.

The GSI Winter (2015/2016) Surface Water Flood Mapping is shown as **Figure G**.

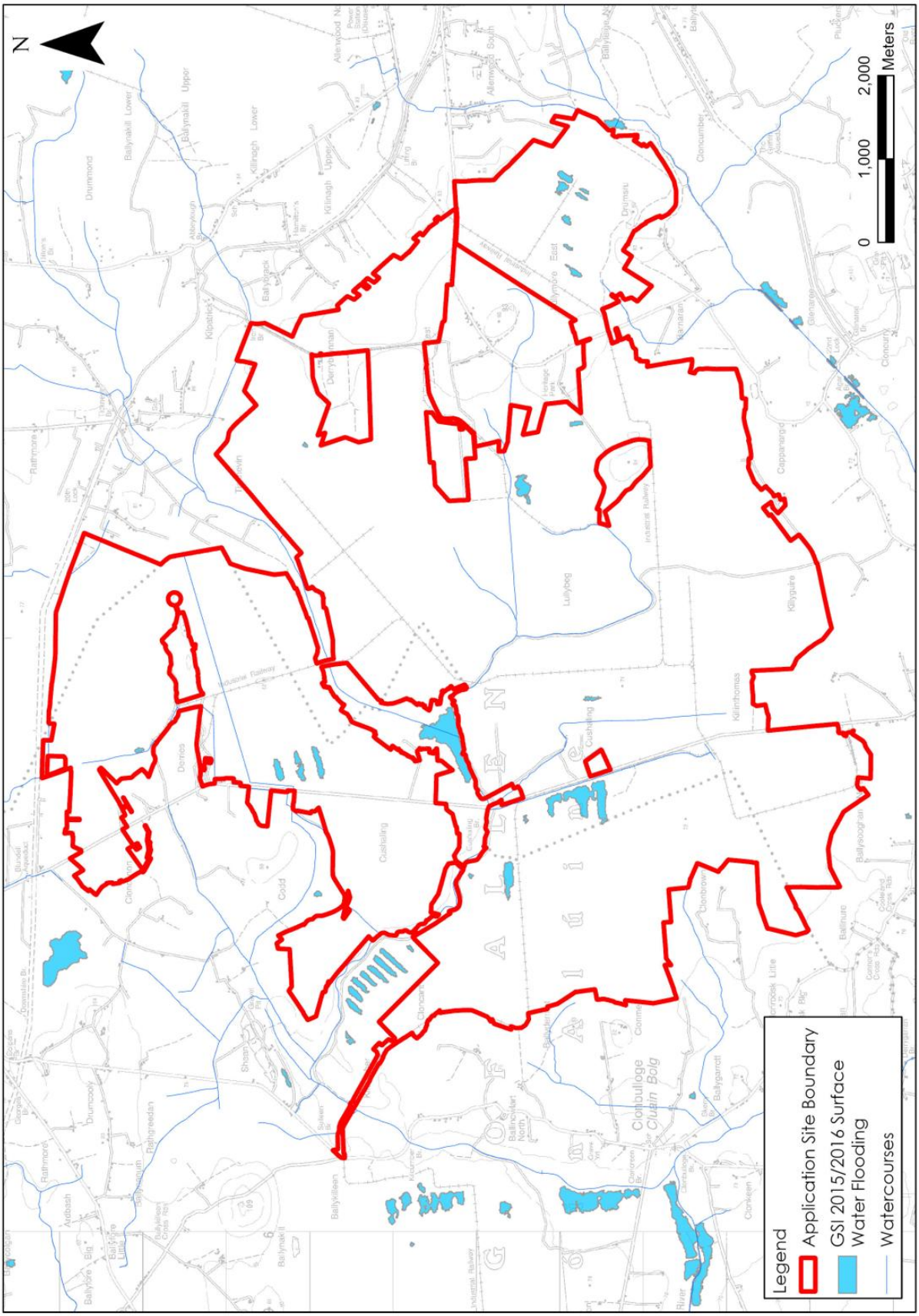

Figure G: GSI Historical Surface Water Flood Map

4.3.7 CFRAM Fluvial Flood Mapping

Catchment Flood Risk Assessment and Management (CFRAM) OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the previous PRFA maps.

CFRAM mapping has been completed for the Figile River to the west of the Application Site and along the Slate River to the south/southeast. The modelled flood extents generally do not extend any significant distance from the river channel and do not encroach upon the Application Site.

The CFRAM flood zones along the Slate River bound the southeastern boundary of Lodge Bog. More widespread flooding is located along the Figile River to the west but these flood zones are distant from the Application Site. Widespread flooding is also located further downstream along the River Barrow.

CFRAM fluvial flood zones are included in **Figure H**.

4.3.8 OPW National Indicative Fluvial Flood Mapping

The National Indicative Fluvial Flood Mapping (NIFM) (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5 km^2 for which flood maps were not produced under the CFRAM Programme.

The Present Day Scenario has been generated using methodologies based on historic flood data and does not consider the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.3.11** below.)

For the present-day scenario, low (1,000-year flood event) and medium (100-year flood event) probability fluvial flood zones are recorded along the Figile River and its tributaries in the immediate vicinity of the Application Site.

The OPW's National Indicative Flood Mapping (NIFM) shows that some of the Application Site to be located in Fluvial Flood Zone A and B, associated with flooding along the Figile River and its tributaries. Flood zones mapped along the Figile River as it flows between Glashabaun North and Codd 2 bogs to the north and Derrybrennan, Glashabaun South, Blackriver and Codd 1 bogs to the south. Flood zones are also mapped along some tributaries of the Figile River including the Lullymore East and Lullybeg Streams. For the most part the medium probability flood zones do not encroach any significant distance from the mapped river/stream channels. However, some of the lower peat fields are mapped to flood in Codd 1 and Derrybrennan bogs. Meanwhile, the low probability flood zones cover large area of Glashabaun North and Blackriver bogs.

However, the vast majority of the Application Site is mapped outside of the 1 in 100-year and 1 in 1,000 year flood zones and is deemed to be at low risk of fluvial flooding (Fluvial Flood Zone C).

The NIFM flood zones are shown on **Figure H** below.

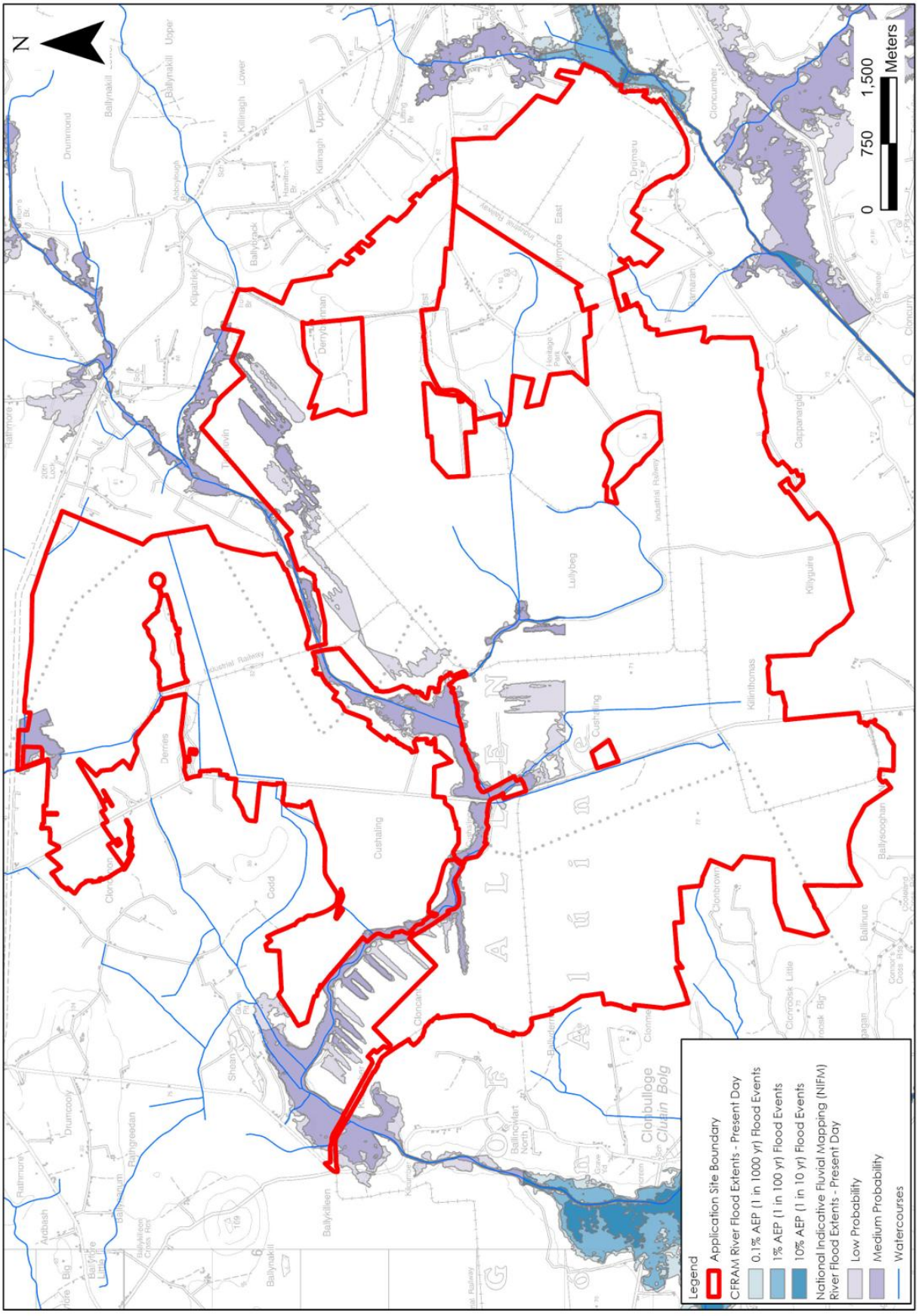

Figure H: CFRAM and NIFM Fluvial Flood Zones

4.3.9 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the Application Site.

The closest historic groundwater flood zones are mapped approximately 6.7 km to the northwest of Ticknevin Bog.

4.3.10 Coastal Flooding

The Application Site is located in the Irish midlands and a significant distance (~47 km) from the coast. There is no risk of coastal flooding.

4.3.11 Climate Change

It is likely that climate change will have significant impacts on flooding and flood risk in Ireland due to rising sea levels, increased winter rainfall and more intense rainfall.

The CFRAM Programme has modelled flooding associated with potential 2 no. future climate change scenarios. The Mid-Range and High-End Future Scenario flood extents were generated using an increase in rainfall of 20% and 30% respectively. The extent of the CFRAM flood zones increase slightly for each future scenario. However, the modelled flood extents are similar to the flood zones described for the Present-Day Scenario in **Section 4.3.7**.

Similarly, NIFM mapping has been modelled for the 2 no. potential future climate change scenarios. Both of these modelled flood extents show similar flood zones to the Present-Day Scenario discussed above in **Section 4.3.8**.

Therefore, flood zones at the Application Site are unlikely to be significantly impacted by future climate change.

4.3.12 Site Walkover Surveys

HES completed site inspections, walkover surveys, drainage mapping, and baseline monitoring/sampling at the Application Site as part of this remedial Environmental Impact Assessment (rEIAR) and to inform the proposed Ballydermot Wind Farm planning application. These site investigations comprised of peat probing and drainage mapping completed by HES on 6th, 15th and 22nd October 2020, 5th, 10th, 12th and 18th November 2020, 1st April 2021, 11th December 2025 and 15th May 2026.

During the site walkover landuse across the Application Site was noted as comprising of cutover bog where peat extraction has previously occurred. Note that peat extraction ceased at the Application Site in June 2020. The Application Site was noted to be drained by regularly spaced field drains which drain towards larger arterial drains. Meanwhile, certain areas of the Application Site have become overgrown, with peat extraction ceasing in these areas some time ago allowing vegetation to recover and recolonise the bare peat fields. At the boundaries of the bog surface water draining from the Application Site is routed via settlement/silt ponds prior to discharge to off-site drainage channels which flow into the local rivers and streams. Where drainage by gravity is not possible, drainage is assisted by pumping.

Several low-lying areas within the Application Site were observed to hold surface water following heavy rainfall, but ponding only occurs to very shallow depths, (<0.2m) and only in certain areas does ponding persist in drier periods. Due to the low lying and relatively flat nature of the Application Site, the flooding is shallow.

4.3.13 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the Application Site can be described using the Source – Pathway – Receptor Model (S-P-R).

Based on the information gained through the flood identification process, it would appear that parts of the Application Site are affected by fluvial flooding. While the majority of the Application Site is located in the Flood Zone C, the GSI historical surface water flood map and the NIFM mapping indicates that some areas of the Application Site are mapped in Fluvial Flood Zones A and B. Flooding in these areas is due to low lying peat fields and overbank flooding of local watercourses.

Due to the permeability of the soils and subsoils at the Application Site, pluvial flooding and surface water ponding may also be an issue.

The potential receptors in the local area include infrastructure and land.

4.3.14 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process it is apparent that flooding is likely to be problematic in some areas of the Application Site. The potential sources of flood risk for the Application Site are outlined and assessed in
Table D**.**

Table D: S-P-R Assessment of Flood Sources for the Application Site

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the Figile and Slate Rivers and smaller tributaries such as the Lullymore Stream.	Land, People, property, infrastructure, River Barrow and River Nore SAC	According to the GSI Historical Surface Water Flood Mapping, areas of the Application Site flooded during the winter of 2015/2016. NIFM flood zones are also mapped along the Figile River and its tributaries. The majority of the Application Site is located in Flood Zone C (Low Risk). However, some areas are mapped in fluvial flood zones.
Pluvial	Ponding of rainwater on site	Land, People, property.	The Application Site is generally low lying and flat in places and given the nature of the soils/subsoils (cutover peat), localised shallow pluvial flood is very likely after heavy or prolonged rainfall.
Surface water	Surface ponding/ Overflow	Land, People, property.	Same as pluvial above.
Groundwater	Rising groundwater levels	Land, People, property	Based on the local hydrogeological regime and GSI groundwater flood mapping, there is no apparent risk of groundwater flooding at the Application Site.
Coastal/tidal	Not applicable	Land, People, property	The Application Site is located in an inland setting and there is no risk of coastal flooding.
Human/ mechanical	Ponding of rainwater on site	Site land	Mechanical error at pumping stations will increase depth of pluvial flooding but will not impact upon downstream fluvial flooding risks.

5. FLOOD RISK ASSESSMENT – REMEDIAL PHASE

5.1 DECOMMISSIONING AND REHABILITATION PLAN DETAILS

It is proposed to implement the Cutaway Bog Rehabilitation and Decommissioning Plans at the Application Site in order to fulfil the requirements of Condition 10.2 of the IPC[1] licence No. P0503.

BnM have devised Draft Cutaway Bog Decommissioning and Rehabilitation Plans to stabilise and rehabilitate the bogs which form the Application Site. The plan uses bespoke interventions designed to first 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. Rehabilitation allows a site to naturally colonise with vegetation to stabilise the bare peat production fields and minimise potential downstream water pollution and increased surface water runoff.

Much of the physical 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 if/as those works are deemed necessary.

The rehabilitation plans for the Allen Bog Group cannot be implemented without mitigation measures. All activities at the Allen Bog Group are required to operate in accordance with IPC Licence (P0503) until the licence is surrendered.

5.1.1 Remedial Phase Site Drainage

The Draft Cutaway Bog Decommissioning and Rehabilitation Plans (2026) outline the proposed rehabilitation for the bogs comprising the Application Site, including proposed site drainage, have been prepared and are summarised in **Table E**.

Table E:Types of and Areas for Rehabilitation measures at the Application Site

Bog	Type	Description	Area (Ha)
Ballydermot	Deep Peat Cutover Bog	Regular drain blocking (3/100 m) + modifying outfalls and managing water levels with overflow pipes	152.6
	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	207.2
	Wetland Cutaway	Turn off or reduce pumping to re-wet cutaway + modifying outfalls and managing water levels with overflow pipes	386.7
	Marginal Land	No work required	38.3
	Rehab Complete	Rehab Complete	68.1
	Silt Ponds	Silt Ponds	2.7
	Constraints	Constraints	20.2
	Total Area		**879.7**
Lodge	Additional Land	Minimal/targeted works required	26.24
	Archaeological Constraint	Known archaeology	0.11
	Constraints	Ballydermot windfarm constraint	41.57
	Dry Cutaway	More intensive drain blocking (7/100 m) + blocking outfalls and managing overflows	55.66
	Deep Peat	More intensive drain blocking (7/100 m) +	6.68

[1] *Integrated Pollution Licence.*

		blocking outfalls and managing overflows with a controlled weir outfall	
		Berms and field re-profiling (45m x 60m cell) + blocking outfalls and managing overflows + drainage channels for excess water + Sphagnum inoculation	90.24
	Marginal Land (MLT1)	No work required	29.29
	Marginal Land (MLT2)	More intensive drain blocking (max 7/100 m)	6.11
	Silt Ponds	No work required	1.59
	Wetland (WLT2)	Turn off or reduce pumping to re-wet cutaway + blocking outfalls and managing water levels with overflow pipes + Targeted blocking of outfalls within a site	60.63
	Wetland (WLT4)	More intensive drain blocking (max 7/100 m), + blocking outfalls and managing overflows + transplanting Reeds and other rhizomes	90.2
	Total Area		**408.3**
Barnaran	Deep Peat Cutover Bog	Regular drain blocking (3/100 m) + modifying outfalls and managing water levels with overflow pipes	893.0
	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	45.1
	Wetland Cutaway	Modifying outfalls and managing water levels with overflow pipes within low lying areas and depressions on shallow peat.	295.2
	Marginal Land	No work required	39.0
	Silt Ponds	Silt Ponds	1.6
	Constraints	Constraints	17.2
	Total Area		**487.4**
Blackriver	Deep Peat Cutover Bog	Regular drain blocking (3/100 m) + modifying outfalls and managing water levels with overflow pipes	79.3
	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	54.9
	Wetland Cutaway	Modifying outfalls and managing water levels with overflow pipes within low lying areas and depressions on shallow peat.	405.12
	Marginal Land	No work required	29.6
	Silt Ponds	Silt Ponds	3.7
	Constraints	Constraints	155.0
	Total Area		**727.7**
Codd	Deep Peat Cutover Bog	Regular drain blocking (3/100 m) + modifying outfalls and managing water levels with overflow pipes	224.6
	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	113.9
	Wetland Cutaway	Turn off or reduce pumping to re-wet cutaway + modifying outfalls and managing water levels with overflow pipes	99.2
	Marginal Land	No work required	8.8
	Silt Ponds	Silt Ponds	6.1
	Constraints	Constraints	104.4
	Total Area		**554.2**
Derrybrennan	Deep Peat Cutover Bog	Regular drain blocking (3/100 m) + modifying outfalls and managing water levels with overflow pipes	3.0
	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	29.4
	Wetland Cutaway	Turn off or reduce pumping to re-wet cutaway + modifying outfalls and managing water levels	70.7

		with overflow pipes	
	Marginal Land	No work required	17.7
	Constraints	Constraint	52.4
	Total Area		**182.2**
Glashabaun	Deep Peat Cutover Bog	Regular drain blocking (3/100 m) + modifying outfalls and managing water levels with overflow pipes	128.7
	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	298.0
	Wetland Cutaway	Turn off or reduce pumping to re-wet cutaway + modifying outfalls and managing water levels with overflow pipes	392.8
	Completed Rehab	Rehabilitation Complete	15.3
	Marginal Land	No work required	37.1
	Silt Ponds	Silt Ponds	3.6
	Constraint	Constraints	189.8
	Total Area		**1055.3**
Killinagh	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	66.7
	Wetland Cutaway	Turn off or reduce pumping to re-wet cutaway + modifying outfalls and managing water levels with overflow pipes	12.4
	Marginal Land	No work required	8.0
	Constraints	Constraint	155.3
	Total Area		**242.33**
	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	0.1
	Wetland Cutaway	Modifying outfalls and managing water levels with overflow pipes	216.4
	Constraints	Constraint Silt Pond	50.4
	Total Area		**266.9**
Lullymore	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	5.1
	Wetland Cutaway	Modifying outfalls and managing water levels with overflow pipes	16.7
	Completed Rehab	Rehabilitation Complete	113.5
	Marginal Land	No work required	0.6
	Constraints	Constraint Silt Pond	38.5
	Total Area		**174.5**
Ticknevin	Deep Peat Cutover Bog	Regular drain blocking (3/100 m) + modifying outfalls and managing water levels with overflow pipes	149.6
	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	3.2
	Wetland Cutaway	Turn off or reduce pumping to re-wet cutaway + modifying outfalls and managing water levels with overflow pipes	154.0
	Marginal Land	No work required	42.0
	Silt Ponds	Silt Ponds	0.7
	Constraints	Constraints	106.6
	Total Area		**456**

5.2 BASELINE HYDROLOGY & FLOOD RISK FOR PROPOSED REHABILITATION PLANS

The Draft Cutaway Bog Decommissioning and Rehabilitation Plans (2026) will be implemented within the Application Site. The baseline hydrology is therefore identical to the existing environment and catchment characteristics outlined in **Section 3** above. Similarly, the flood risk identification and assessment is identical to the flood risk identification and assessment as described above in **Section 4.3**.

5.3 DISCUSSION ON PROPOSED REHABILITATION PLAN FLOOD RISK & FLOOD RISK ASSESSMENT

Improvements in flow and water quality can be achieved through bog rehabilitation and rewetting at the Application Site. The Draft Cutaway Bog Decommissioning and Rehabilitation Plans (2026) will generally involve the rewetting and revegetation of the drained cutover bogs. The greatest hydrological/hydrogeological effects would be experienced in those areas selected for rewetting following ecological surveying. Rewetting would be achieved through measures such as drain blocking. These plans will likely have a positive effect on hydrogeology within the Application Site where groundwater tables in the peat bogs are stabilised and closer to the bog surface. Water storage capacity within the site will therefore improve and reducing the risk of flooding within the vicinity and downstream of the Application Site. Elsewhere, where rewetting is not suitable the drainage regimes will remain relatively unchanged.

In order to be conservative, we have completed a Justification test below in **Section 5.4** for the Draft Cutaway Bog Decommissioning and Rehabilitation Plans (2026) at the Application Site.

5.4 REQUIREMENT FOR A JUSTIFICATION TEST – PROPOSED REHABILITATION PLANS

A matrix of vulnerability versus flood zone is shown in **Table F**. This table is used to illustrate appropriate development types or indicate when a Justification Test[2] is required.

It may be considered that the Draft Cutaway Bog Decommissioning and Rehabilitation Plans can be categorised as a "Water Compatible development". The key rehabilitation plans to be implemented include regular drain blocking, blocking outfalls and managing water levels with overflow pipes which will improve water storage capacity within the Application Site and will therefore reduce the risk of flooding within the vicinity and downstream of the Application Site. Consequently, the Draft Cutaway Bog Decommissioning and Rehabilitation Plans are consistent with the current flood risk for the Application Site (local pluvial ponding and drainage management, that will provide additional attenuation storage and therefore reduce downstream flood risk), and therefore do not require further justification from a planning perspective.

[2] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

Table F: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification test	Justification test	Appropriate
Less vulnerable development	Justification test	Appropriate	Appropriate
Water compatible development	**Appropriate**	**Appropriate**	**Appropriate**

Note: *Taken from Table 3.2 (DoEHLG, 2009)*
Bold: *Applies to this project.*

5.5 FLOOD RISK IMPLICATIONS ASSOCIATED WITH THE PROPOSED BALLYDERMOT WIND FARM

BnM intend to utilise the Application Site for both peatland rehabilitation and wind energy infrastructure in order to facilitate environmental stabilisation of the bog and to optimise climate action benefits.

It is proposed to construct a wind energy development at the Application Site consisting of 47 no. turbines, 20 no. turbines with an overall blade to tip height of 200m and 27 no. turbines with an overall tip height of 220m at the Application Site. The overall footprint of the infrastructure associated with the wind farm is <3% of the total area of the Application Site. The Draft Cutaway Bog Decommissioning and Rehabilitation plans for the Application Site will be updated as required to incorporate the proposed wind farm infrastructure, with the key objectives of the rehabilitation plan i.e. rewetting and revegetation, occurring between and surrounding the proposed wind farm infrastructure. The potential for the localised wind farm drainage to impact the rehab plans is limited due to the scale of the development and the flat topography of the Application Site. The proposed wind farm drainage will not significantly alter the wider bog drainage regime or preclude future rewetting and restoration measures.

A separate EIAR is being undertaken for the proposed Ballydermot Wind Farm development. At the time of writing, the planning application for this development has not yet been submitted to An Coimisiún Pleanála. The FRA for the wind farm development will include a flood risk identification study which identifies existing potential flood risks associated with the proposed Ballydermot wind farm. The FRA for the wind farm will also include an assessment of the risk of the wind farm development contributing to onsite and downstream flooding. The wind farm FRA found that the overall risk of flooding at the wind farm site (i.e. within the Application Site) is low and all proposed infrastructure, including the proposed substation location, will be located at or above Flood Zone C elevations. The FRA also concludes that the risk of the wind farm contributing to downstream flooding is very low.

Furthermore, the proposed Ballydermot wind farm development and the Draft Cutaway Bog Decommissioning and Rehabilitation Plans for the Application Site will not cause a cumulative increase in flood risk due to the following:

- The majority of the proposed wind farm development infrastructures, including the proposed onsite substation are located in Flood Zone C;
- Where wind farm infrastructure is proposed within Flood Zones volumetric analysis has shown that the emplacement of this infrastructure has no potential for significant effects and will only result in minor increases in flood water levels within the Application Site. The cutover bogs comprising the Application Site are flat and

extensive and have sufficient capacity to buffer the effect of any displaced floodwater; and,

- The proposed wind farm drainage system will not significantly alter the existing drainage regime at the Application Site. The wind farm drainage will be localised and has no potential to impact the wider hydrological regime across the Application Site;
- Due to the flat topography of the Application Site, any effects associated with the wind farm drainage will be very localised – note that in order to drain the bogs to facilitate the peat extraction, field drains were inserted at 15m intervals. The ZoI of any drainage feature will not extend a significant distance in this hydrogeological setting;
- The proposed wind farm drainage will be fully integrated into the existing bog drainage system and rehabilitation plans;
- All surface water from the wind farm drainage system will be treated via silt traps and settlement ponds, to ensure there is no deterioration in downstream surface water quality;
- The proposed wind farm drainage system will be designed to provide surface water attenuation with the drainage system limiting discharge from the wind farm site to greenfield runoff rates; and,
- As a result, there will be no increase in surface water discharge from the Application Site as a result of the wind farm development.

Furthermore, the overall aim of the Draft Cutaway Bog Decommissioning and Rehabilitation Plans is to retain and slow down drainage within the Application Site which will result in areas being wetter for longer. Therefore, the proposed rehabilitation works at the Application Site and the wind farm development will not result in any increased downstream flood risk.

6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the Application Site and the potential flood risks associated with the Draft Cutaway Bog Decommissioning and Rehabilitation Plans at the Application Site. From this study:
    - No instances of historical flooding were identified in historic OS maps within the Application Site. The available map text indicates areas along the Figile and the Slate rivers that are liable to flood in the vicinity of the Application Site;
    - No instances of recurring flooding were identified on OPW maps within the Application Site;
    - The GSI Historical 2015/2016 flood map shows that some areas of the Application Site may be affected by surface water flooding;
    - The Application Site is not mapped within any historic or predictive groundwater flood zones;
    - CFRAM maps for the local area do not show any fluvial flood zones within the Application Site; and,
    - The National Indicative Fluvial Flood Mapping (NIFM) do record some fluvial flood zones within the Application Site.
- Whilst CFRAM mapping shows fluvial flood zones on the Figile River downstream of the Application Site and along the Slate River immediately to the south of the Application Site, these flood extents do not encroach upon Application Site;
- The National Indicative Fluvial Flood Mapping records the presence of surface water flooding along the Figile River and its tributaries in the area of the Application Site. Some of these fluvial flood zones encroach upon the Application Site. The flooding is likely to be a combination of fluvial and pluvial flooding due to the flat low-lying nature of the Application Site and the low permeability of the soils and subsoils;
- Site walkover indicates the surface of the cutover bog contains an extensive network of peat drains with surface water outflows from the bogs. This existing drainage network has reduced the risk of pluvial flooding across much of the Application Site. However, following periods of intense and prolonged rainfall events localised surface water ponding is still likely to occur in places. Fluvial flooding may also occur as the land has been lowered due to the previous peat extraction activities;
- The Draft Cutaway Bog Decommissioning and Rehabilitation Plans for the Application Site can be categorised as a "Water Compatible Development" and a justification test is not therefore required. The Draft Cutaway Bog Decommissioning and Rehabilitation Plans are designed to improve the hydrological regime within the Application Site, and these measures will reduce flood risk in the vicinity and downstream of the Application Site; and,
- Cumulatively, the risk of the Cutaway Bog Decommissioning and Rehabilitation Plans and the proposed Ballydermot wind farm development contributing to downstream flooding is also very low, as the long-term plan is to retain and slow down drainage from the bog, and this will result in sections of the Application Site being wetter for longer and therefore promoting more fen like conditions.

* *

7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
Natural Environment Research Council	1975	Flood Studies Report (& maps).
Cunnane & Lynn	1975	Flood Estimated Following the Flood Studies Report
CIRIA	2004	Development and Flood Risk – Guidance for the Construction Industry.
OPW	Not Dated	Construction, Replacement or Alteration of Bridges and Culverts. A Guide to Applying for Consent under Section 50 of the Arterial Act, 1945.
Institute of Hydrology	1994	Flood Estimation in Small Catchments (IH 124).
Fitzgerald & Forrestal	1996	Month and Annual Averages of Rainfall for Ireland 1961 – 1990.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
Kildare County Council	2023	Kildare County Development Plan 2023-2029
Offaly County Council	2021	Offaly County Development Plan 2021-2027
OPW	2025	OPW Flood Hazard Mapping, www.floodmaps.ie
OPW	2012	The National Preliminary Flood Risk Assessment, March 2012.
HES	2026	Ballydermot Wind Farm Co. Kildare and Co. Offaly. Stage II – Site Specific Flood Risk Assessment.
BnM	2026	Ballydermot Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
BnM	2026	Barnaran Draft Cutaway Bog Decommissioning and Rehabilitation Plan
BnM	2026	Blackriver Draft Bog Cutaway Bog Decommissioning and Rehabilitation Plan
BnM	2026	Codd Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
BnM	2026	Derrybrennan Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
BnM	2026	Glashabaun Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
BnM	2026	Killinagh Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
BnM	2026	Lullybeg Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
BnM	2026	Lullymore Bog Draft Cutaway Bog Decommissioning and

		Rehabilitation Plan
BnM	2026	Ticknevin Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
BnM	2022	Lodge Bog Cutaway Bog Decommissioning and Rehabilitation Plan